CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

LIFT STATION 1M ELECTRICAL REHABILITATION, LIFT STATION 12A ELECTRICAL PUMP & VFD REHABILITATION AND LIFT STATION 13A ELECTRICAL REHABILITATION PROJECTS

Prepared for
BOARD OF COUNTY COMMISSIONERS
COUNTY OF MANATEE, FLORIDA
COUNTY PROJECT NOs. 6101380, 6101480, 6101680, 6101580 & 6101581

ISSUE FOR BID

February 2021

Prepared by

McKIM & CREED
1365 Hamlet Ave
Clearwater, Florida 33756
Ph: 727/442-7196
Fax: 727/461-3827

TABLE OF CONTENTS
LIFT STATION 1M ELECTRICAL REHABILITATION, LIFT STATION 12A ELECTRICAL PUMP & VFD REHABILITATION AND LIFT STATION 13A ELECTRICAL REHABILITATION PROJECTS
ISSUE FOR BID
COUNTY PROJECT NOS 6101380, 6101480, 6101680, 6101580 & 6101581

DIVISION 1 - GENERAL REQUIREMENTS

DIVISION 2 - SITE WORK

DIVISION 13 – SPECIAL CONSTRUCTION

DIVISION 15 - MECHANICAL

DIVISION 16 - ELECTRICAL

This specification includes by reference the Manatee County Public Works Standards, Part I Utilities Standards Manual approved February 2020.

END OF TOC

SECTION 00005 - CERTIFICATION PAGES

PROFESSIONAL ENGINEER'S CERTIFICATION FOR DAMIAN CUADRADO, PE

PROJECT NAME: LIFT STATION 1M ELECTRICAL REHABILITATION, LIFT STATION 12A ELECTRICAL PUMP & VFD REHABILITATION AND LIFT STATION 13A ELECTRICAL REHABILITATION PROJECT

The following sections of the Technical Specifications in the Issued for Bid submittal for the above referenced project were prepared under my direction and supervision.

DIVISION 2 - SITE WORK

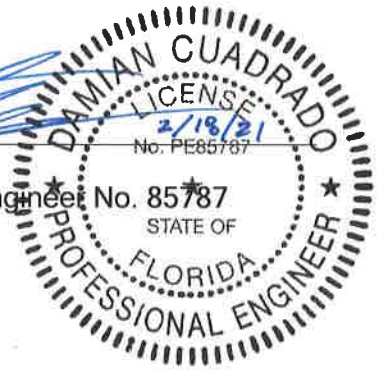
02050 Demolition
02064 Modifications to Existing Structures, Piping and Equipment
02110 Clearing and Grubbing
02220 Excavation, Backfill, Fill and Grading for Structures
02221 Trenching, Bedding and Backfill for Pipe
02223 Excavation Below Grade and Crushed Stone or Shell Refill
02260 Finish Grading
02276 Temporary Erosion and Sedimentation Control
02315 Excavating, Backfilling and Compacting
02485 Seeding and Sodding
02513 Asphalt Concrete Paving
02575 Pavement Repair and Restoration
02615 Ductile Iron Pipe and Fittings
02617 Installation and Testing of Pressure Pipe
02640 Valves and Appurtenances
02720 Sanitary Sewer Bypass Pumping

DIVISION 11 - EQUIPMENT

11310 Submersible Non-Clog Wastewater Pump

DIVISION 15 - MECHANICAL

15051 Pipe and Pipe Fittings - General Statement
15211 Bulkheads
15830 Supply and Exhaust Ventilation Fans



Damian Cuadrado, PE
Florida Professional Engineer No. 85787
McKim & Creed, Inc.
1365 Hamlet Avenue
Clearwater FL 33756

PROFESSIONAL ENGINEER'S CERTIFICATION FOR BILL BAND, PE

PROJECT NAME: LIFT STATION 1M ELECTRICAL REHABILITATION, LIFT STATION 12A ELECTRICAL PUMP & VFD REHABILITATION AND LIFT STATION 13A ELECTRICAL REHABILITATION PROJECT

The following sections of the Technical Specifications in the Issued for Bid submittal for the above referenced project were prepared under my direction and supervision.

DIVISION 3 - CONCRETE

03300	Cast-In-Place Concrete
03350	Concrete Finishes
03600	Grouting

DIVISION 5 - METALS

05500	Metal Fabrications
05521	Pipe and Tube Railings
05530	Gratings
05531	Access Hatches

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

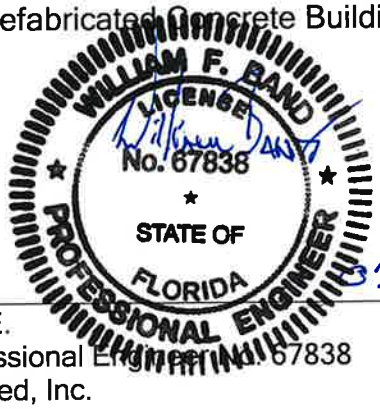
07920	Sealants and Caulking

DIVISION 9 - PAINTING

09865	Surface Preparation and Shop Prime Painting
09900	Painting
09970	Surface Protection Spray System

DIVISION 13 - SPECIAL CONSTRUCTION

13050	Prefabricated Concrete Building



12-22-21

Bill Band, P.E.
Florida Professional Engineer No. 67838
McKim & Creed, Inc.
1730 Varsity Drive
Venture IV Building, Suite 500
Raleigh, NC 27606-2689

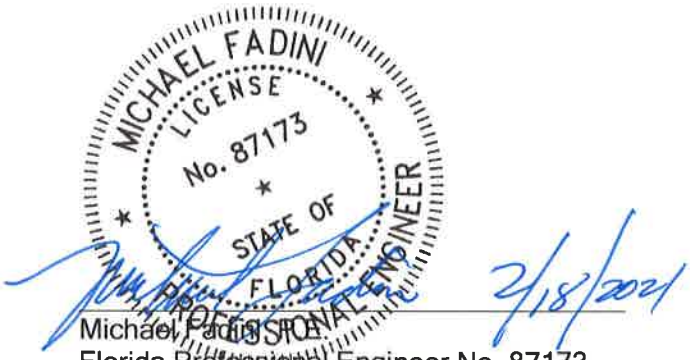
PROFESSIONAL ENGINEER'S CERTIFICATION FOR MICHAEL FADINI, P.E.

PROJECT NAME: LIFT STATION 1M ELECTRICAL REHABILITATION, LIFT STATION 12A ELECTRICAL PUMP & VFD REHABILITATION AND LIFT STATION 13A ELECTRICAL REHABILITATION PROJECT

The following sections of the Technical Specifications in the Issued for Bid submittal for the above referenced project were prepared under my direction and supervision.

DIVISION 13 - SPECIAL CONSTRUCTION

13100 Instrumentation and Controls, General Requirements



Michael Fadini, P.E.
Florida Professional Engineer No. 87173
McKim & Creed, Inc.
1365 Hamlet Avenue
Clearwater, Florida 33756

PROFESSIONAL ENGINEER'S CERTIFICATION FOR AUBREY HAUDRICOURT, P.E.

PROJECT NAME: LIFT STATION 1M ELECTRICAL REHABILITATION, LIFT STATION 12A ELECTRICAL PUMP & VFD REHABILITATION AND LIFT STATION 13A ELECTRICAL REHABILITATION PROJECT

The following sections of the Technical Specifications in the Issued for Bid submittal for the above referenced project were prepared under my direction and supervision.

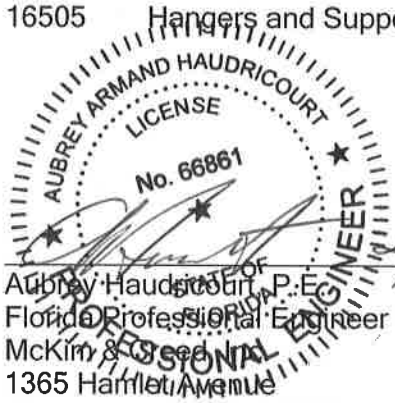
DIVISION 1 - GENERAL REQUIREMENTS

01005 General Requirements
01010 Summary of Work
01015 Control of Work
01030 Special Project Procedures
01045 Cutting and Patching
01050 Field Engineering and Surveying
01090 Reference Standards
01150 Measurement and Payment
01152 Requests for Payment
01153 Change Order Procedures
01200 Project Meetings
01310 Construction Schedule & Project Restraints
01340 Shop Drawings, Project Data and Samples
01370 Schedule of Values
01380 Construction Photographs
01410 Testing & Testing Laboratory Services
01510 Temporary & Permanent Utilities
01570 Traffic Regulation
01580 Project Identification & Signs
01600 Material and Equipment
01620 Storage and Protection
01700 Contract Closeout
01710 Cleaning
01720 Project Record Documents
01730 Operating and Maintenance Data
01740 Warranties and Bonds
01900 Permits

DIVISION 16 - ELECTRICAL

16050 Electrical - General Provisions
16062 Lightning Protection System for Structures
16075 Identification for Electrical Systems
16110 Conduit and Fittings
16120 Low Voltage Conductors and Cables
16134 Expansion Deflection Fittings
16135 Pull Junction and Terminal Boxes

16136 Outlet Boxes
16137 Underground Ductbanks for Electrical Systems
16139 Cable Trays for Electrical Systems
16141 Low Voltage Receptacles
16142 Snap Switches
16143 Disconnect Switches
16160 Panelboards
16271 Dry Type Low Voltage Distribution Transformers
16289 Surge Protective Devices
16370 Variable Frequency Drives
16410 Enclosed Circuit Breakers
16423 Motor Control Centers
16450 Grounding and Bonding for Electrical Systems
16501 Lighting
16505 Hangers and Supports for Electrical Systems



2/19/21

Aubrey Haudricourt, P.E.
Florida Professional Engineer No. 66861
McKim & Creed, Inc.
1365 Hamlet Avenue
Clearwater, Florida 33756

END OF SECTION

DIVISION 1 GENERAL REQUIREMENTS

SECTION 01005 GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE AND INTENT

A. Description

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.

B. Work Included

The Contractor shall furnish all labor, superintendence, materials, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, shop drawings, working drawings and other means of construction necessary or proper for performing and completing the work. He shall obtain and pay for all required permits necessary for the work, other than those permits such as the DEP permit and railroad permit, which may have already been obtained. He 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 County, 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 incidental costs. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the work.

The cost of incidental work described in these General 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.

The Contractor shall be solely responsible for the adequacy of his workmanship, materials and equipment.

C. Public Utility Installations and Structures

Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto.

The Contractor shall protect all installations and structures from damage during the work. Access across any buried public utility installation or structure shall be made only in such locations and by means approved by the County. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities damaged by the Contractor, which are shown on the Plans or have been located in the field by the utility, shall be repaired by the Contractor, at his expense, as approved by the County. No separate payment shall be made for such protection or repairs to public utility installations or structures.

Public utility installations or structures owned or controlled by the County or other governmental body, which are required by this contract to be removed, relocated, replaced or rebuilt by the Contractor not identified in any separate bid item 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.

Where public utility installations or structures owned or controlled by the County or other governmental body are encountered during the course of the work, and are not indicated on the Plans or in the Specifications, and when, in the opinion of the County, 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 County, 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 in accordance with the General and Supplemental General Conditions.

The Contractor shall give written notice to County and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of the work. This can be accomplished by making the appropriate contact with the "Sunshine State One-Call of Florida, Inc. Call Center ("Call Sunshine") and per all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

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 County.

1.02 PLANS AND SPECIFICATIONS

A. Plans

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

B. Copies Furnished to Contractor

The Contractor shall furnish each of the subcontractors, manufacturers, and material men such copies of the Contract Documents as may be required for their work. Additional copies of the Plans and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

C. Supplementary Drawings

When, in the opinion of the County, it becomes necessary to explain more fully the work to be done or to illustrate the work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications

pertaining thereto, will be prepared by the County and five paper prints thereof will be given to the Contractor.

D. Contractor to Check Plans and Data

The Contractor shall verify all dimensions, quantities and details shown on the Plans, Supplementary Drawings, Schedules, Specifications or other data received from the County, and shall notify him 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 County, should such errors or omissions be discovered. All schedules are given for the convenience of the County and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

E. Specifications

The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements which govern the work. Products and Execution modify and supplement these by detailed requirements for the work and shall always govern whenever there appears to be a conflict.

F. Intent

All work called for in the Specifications applicable to this Contract, but not shown on the Plans 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 Plans 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.

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, and interpretation of these Specifications shall be made upon that basis.

The inclusion of the Related Requirements (or work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor and shall not be interpreted as a complete list of related Specification Sections.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer

All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the County, that the manufacturer or subcontractor deal directly with the County. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

Any two or more pieces or material or equipment of the same kind, type or classification, and being used for identical types of services, shall be made by the same manufacturer.

B. Delivery

The Contractor shall deliver materials in ample quantities to insure the most speedy and uninterrupted progress of the work so as to complete the work within the allotted time. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

C. Tools and Accessories

The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind or size of equipment, one complete set of suitably marked high grade special tools and appliances which 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.

Spare parts shall be furnished as specified.

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 rating data.

D. Installation of Equipment.

The Contractor shall have on hand sufficient proper equipment and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character.

Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Plans, unless directed otherwise by the County during installation. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

The Contractor shall furnish, install and protect all necessary anchor and attachment bolts and all other appurtenances needed for the installation of the devices included in the equipment specified. Anchor bolts shall be as approved by the County and made of ample size and strength for the purpose intended. Substantial templates and working drawings for installation shall be furnished.

The Contractor shall furnish all materials and labor for, and shall properly bed in non-shrink grout, each piece of equipment on its supporting base that rests on masonry foundations.

Grout shall completely fill the space between the equipment base and the foundation. All metal surfaces coming in contact with concrete or grout shall receive a coat of coal tar epoxy equal to Koppers 300M or provide a 1/32-inch neoprene gasket between the metal surface and the concrete or grout.

E. Service of Manufacturer's Engineer

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

1.04 INSPECTION AND TESTING

A. General

Inspection and testing of materials will be performed by the County unless otherwise specified.

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. Three (3) copies of the reports shall be submitted and authoritative certification thereof must be furnished to the County as a prerequisite for the acceptance of any material or equipment.

If, in the making of any test of any material or equipment, it is ascertained by the County that the material or equipment does not comply with the Contract, 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 County.

Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the County formally takes over the operation thereof.

B. Costs

All inspection and testing of materials furnished under this Contract will be performed by the County or duly authorized inspection engineers or inspections bureaus without cost to the Contractor, unless otherwise expressly specified.

The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor and such costs shall be deemed to be included in the Contract price.

Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the County for compliance. The Contractor shall reimburse the County for the expenditures incurred in making such tests on materials and equipment which are rejected for non-compliance.

C. Inspections of Materials

The Contractor shall give notice in writing to the County, at least two weeks in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture of preparation of materials. Upon receipt of such notice, the County will arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials or he will notify the Contractor that the inspection will be made at a point other than the point of manufacture, or he will notify the Contractor that inspection will be waived. The Contractor must comply with these provisions before shipping any material. Such inspection shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

D. Certificate of Manufacture

When inspection is waived or when the County so requires, the Contractor shall furnish to him authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the work have been manufactured and tested in conformity with the Contract Documents. 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.

E. Shop Tests of Operating Equipment

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 which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the work until the County notifies the Contractor, in writing, that the results of such tests are acceptable.

The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

F. Preliminary Field Tests

As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make preliminary field tests of equipment. If the preliminary field tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, prior to the acceptance tests, make all changes, adjustments and replacements required. The furnishing Contractor shall assist in the preliminary field tests as applicable.

G. Final Field Tests

Upon completion of the work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance tests as specified or required to prove compliance with the Contract Documents.

The Contractor shall furnish labor, fuel, energy, water and all other materials, equipment and instruments necessary for all acceptance tests, at no additional cost to the County. The Supplier shall assist in the final field tests as applicable.

H. Failure of Tests

Any defects in the materials and equipment or their failure to meet the tests, guarantees or requirements of the Contract Documents shall be promptly corrected by the Contractor. The decision of the County as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to make these corrections or if the improved materials and equipment, when tested, shall again fail to meet the guarantees of specified requirements, the County, notwithstanding its partial payment for work, and materials and equipment, may reject the materials and equipment and may order the Contractor to remove them from the site at his own expense.

In case the County rejects any materials and equipment, then the Contractor shall replace the rejected materials and equipment within a reasonable time. If he fails to do so, the County may, after the expiration of a period of thirty (30) calendar days after giving him notice in writing, proceed to replace such rejected materials and equipment, and the cost thereof shall be deducted from any compensation due or which may become due the Contractor under his Contract.

I. Final Inspection

During such final inspections, the work shall be clean and free from water. In no case will the final pay application be prepared until the Contractor has complied with all requirements set forth and the County has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Document.

1.05 TEMPORARY STRUCTURES

A. Temporary Fences

If, during the course of the work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall, at his own expense, if so ordered by the County, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The County shall be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.

1.06 TEMPORARY SERVICES

A. First Aid

The Contractor shall keep upon the site, at each location where work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when people are employed on the work.

1.07 LINES AND GRADES

A. Grade

All work under this Contract shall be constructed in accordance with the lines and grades shown on the Plans, or as given by the County. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

B. Safeguarding Marks

The Contractor shall safeguard all points, stakes, grade marks, monuments and bench marks made or established on the work, bear the cost of reestablishing 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.

The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the work and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.

C. Datum Plane

All elevations indicated or specified refer to the Mean Sea Level Datum of the NAVD 1988 and/or NGVD 1929.

1.08 ADJACENT STRUCTURES AND LANDSCAPING

A. Responsibility

The Contractor shall also be entirely responsible and liable for all damage or injury as a result of his operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the work. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the work, whether or not shown on the Plans, and the removal, relocation and reconstruction of such items called for on the Plans or specified shall be included in the various Contract Items and no separate

payments will be made therefore. Where such public and private property, structures of any kind and appurtenances thereto are not shown on the Plans and when, in the opinion of the County, additional work is deemed necessary to avoid interference with the work, payment therefore will be made as provided for in the General Conditions.

Contractor is expressly advised that the protection of buildings, structures, tunnels, tanks, pipelines, etc. and related work adjacent and in the vicinity of his operations, wherever they may be, is solely his responsibility. Conditional inspection of buildings or structures in the immediate vicinity of the project which may reasonably be expected to be affected by the Work shall be performed by and be the responsibility of the Contractor.

Contractor shall, before starting operations, make an examination of the interior and exterior of the adjacent structures, buildings, facilities, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the County. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be given to the County.

Prior to the beginning of any excavations, the Contractor shall advise the County of all buildings or structures on which he intends to perform work or which performance of the project work will affect.

B. Protection of Trees

1. All trees and shrubs shall be adequately protected by the Contractor with boxes and otherwise and in accordance with ordinances governing the protection of trees. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age, at the proper season and at the sole expense of the Contractor.
2. Beneath trees or other surface structures, where possible, pipelines may be built in short tunnels, backfilled with excavated materials, except as otherwise specified, or the trees or structures carefully supported and protected from damage.
3. The County may order the Contractor, for the convenience of the County, to remove trees along the line or trench excavation. If so ordered, the County will obtain any permits required for removal of trees. Such tree removal ordered shall be paid for under the appropriate Contract Items.

C. Lawn Areas

Lawn areas shall be left in as good condition as before the starting of the work. Where sod is to be removed, it shall be carefully removed, and later replaced, or the area where sod has been removed shall be restored with new sod.

D. Restoration of Fences

Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the Contractor and shall be left in as good a condition as before the starting of the work. The manner in which the fence is repaired or replaced and the materials used in such work shall be subject to the approval of the County. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate Contract Item or items, or if no specific Item is provided therefore, as part of the overhead cost of the work, and no additional payment will be made therefore.

1.09 PROTECTION OF WORK AND PUBLIC

A. Barriers and Lights

During the prosecution of the work, the Contractor shall put up and maintain at all times such barriers and lights as will effectually prevent accidents. The Contractor shall provide suitable barricades, red lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the work causes obstructions to the normal traffic or constitutes in any way a hazard to the public, in accordance with state and local requirements.

B. Smoke Prevention

A strict compliance with ordinances regulating the production and emission of smoke will be required. No open fires will be permitted.

C. Noise

The Contractor shall eliminate noise to as great an extent as practicable at all times. Air compressing plants shall be equipped with silencers and the exhaust of all engines or other power equipment shall be provided with mufflers. In the vicinity of hospitals and schools, special care shall be used to avoid noise or other nuisances. The Contractor shall strictly observe all local regulations and ordinances covering noise control.

D. Access to Public Services

Neither the materials excavated nor the materials or plant used in the construction of the work shall be so placed as to prevent free access to all fire hydrants, valves or manholes.

E. Dust prevention

The Contractor shall prevent dust nuisance from his operations or from traffic by keeping the roads and/or construction areas sprinkled with water at all times.

1.10 CUTTING AND PATCHING

The Contractor shall do all cutting, fitting or patching of his portion of the work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the County and in accordance with the Plans and Specifications.

The work must be done by competent workmen skilled in the trade required by the restoration.

1.11 CLEANING

A. During Construction

During construction of the work, the Contractor shall, at all times, keep the site of the work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the County, such material, debris, or rubbish constitutes a nuisance or is objectionable. The Contractor shall remove from the site all of his surplus materials and temporary structures when no further need therefore develops.

B. Final Cleaning

At the conclusion of the work, all equipment, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and he shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.

The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver such materials and equipment undamaged in a bright, clean, polished and new operating condition.

1.12 MISCELLANEOUS

A. Protection Against Siltation and Bank Erosion

1. The Contractor shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed water courses and drainage ditches.
2. The Contractor, at his own expense, shall remove any siltation deposits and correct any erosion problems as directed by the County which results from his construction operations.

B. Protection of Wetland Areas

The Contractor shall properly dispose of all surplus material, including soil, in accordance with Local, State and Federal regulations. Under no circumstances shall surplus material be disposed of in wetland areas as defined by the Florida Department of Environmental Protection or Southwest Florida Water Management District.

C. Existing Facilities

The work shall be so conducted to maintain existing facilities in operation insofar as is possible. Requirements and schedules of operations for maintaining existing facilities in service during construction shall be as described in the Special Provisions.

D. Use of Chemicals

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.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01010 SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS/REQUIREMENTS INCLUDED

A. The work included in this contract consists of three (3) electrical improvement projects at LS-1M, LS 12A and LS 13A.

LS 1M ELECTRIAL REHABILITATON

A. Work on this project will consist of the replacement and relocation of the electrical distribution and pump control equipment in a climate controlled, elevated prefabricated building meeting the requirements of FAC Chapter 62-604.400.3(e), be Category 5 (>160mph) hurricane rated and located adjacent to the existing pump station. Work will consist of but not limited to replacement of the 480V main distribution equipment, along with the 208/120V transformer and distribution panels. Relocation of the existing ATS and, new variable frequency drives (VFD) made by Fuji Incorporated will be installed in the new electrical building. The existing building ventilation system fans will be replaced to mitigate corrosive gasses and adherence to NFPA 820. Existing building lighting shall be remain along with receptacle circuits; however, the receptacles themselves will be replaced with corrosion resistant devices. Proposed upgrades to the telemetry control are described in "Instrumentation and Controls".

Bypass pumping with backup pumping will be provided by the contractor with the duration sufficient to keep the flows of the pump station flowing into the force main until station is functioning at design flows. It will be the contractor's responsibility for the connections, startup, testing and maintaining the bypass pumps system, including fuel or power. System shall have method for alarm and notification to Contractor and County. Responsibility for addressing alarms shall be by Contractor, with response time less than one hour.

Patching and painting of the upper floor interior of the pump station, including floor, is included in this project. Refer to specifications.

Replace floor hatches and doors per contract drawings. Contractor responsible for all finishes and security of premises while work is being performed.

B. The Contractor shall furnish all shop drawings, working drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all work required by these Specifications and as shown on the Contract Drawings.

C. The Contractor shall perform the work complete, in place and ready for continuous service and shall include any repairs, replacements, and/or restoration required as a result of damages caused prior to acceptance by the County.

D. The Contractor shall furnish and install all materials, equipment and labor which is reasonably and properly inferable and necessary for the proper completion of the work, whether specifically indicated in the Contract Documents or not.

LS 12A ELECTRICAL PUMP & VFD REHABILITATION

A. Work on this project will consist of the replacement and relocation of the electrical distribution and pump control equipment. Work will consist of but not limited to placing the electrical equipment in a climate controlled, elevated prefabricated building meeting the requirements of FAC Chapter 62-604.400.3(e), be Category 5 (>160mph) hurricane rated and located adjacent to the existing pump station. Replacement of the 480V main distribution equipment, the 208/120V transformer and distribution panels, relocation of the existing ATS, new variable frequency drives (VFD) made by Fuji Incorporated will replace the old, and be installed in the new electrical building. Existing building lighting shall be updated and fixtures change per allowance, along with receptacle circuits; however, the receptacles themselves will be replaced with corrosion resistant devices. Proposed upgrades to the telemetry control are described in “Instrumentation and Controls”.

In addition, new pumps and header piping are to be replaced along with pump and piping support as shown in specification and on drawings. Patching and painting of the upper and lower floors, including floor of the pump station is included in this project. Refer to specifications.

Bypass pumping with backup pumping will be provided by the contractor with the duration sufficient to keep the flows of the pump station flowing into the force main until station is functioning at design flows. It will be the contractor’s responsibility for the connections, startup, testing and maintaining the bypass pumps system, including fuel or power. System shall have method for alarm and notification to Contractor and County. Responsibility for addressing alarms shall be by Contractor, with response time less than one hour.

Patching and painting of the entire interior of the pump station, including floor, is included in this project. Refer to specifications.

Replace floor hatches and doors per contract drawings. Contractor responsible for all finishes and security of premises while work is being performed.

B. The Contractor shall furnish all shop drawings, working drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all work required by these Specifications and as shown on the Contract Drawings.

C. The Contractor shall perform the work complete, in place and ready for continuous service and shall include any repairs, replacements, and/or restoration required as a result of damages caused prior to acceptance by the County.

D. The Contractor shall furnish and install all materials, equipment and labor which is reasonably and properly inferable and necessary for the proper completion of the work, whether specifically indicated in the Contract Documents or not.

LS 13A ELECTRICAL AND WET WELL REHABILITATION

A. Work on this project will consist of the replacement and relocation of the electrical distribution and pump control equipment. Work will consist of but not limited to placing the electrical equipment in a climate controlled, elevated prefabricated building meeting the requirements of FAC Chapter 62-604.400.3(e), be Category 5 (>160mph) hurricane rated and located adjacent to the existing pump station. Replacement of the 480V main distribution equipment, the 208/120V transformer and distribution panels, relocation of the existing ATS, new variable frequency drives (VFD) made by Fuji Incorporated will replace the old, and be installed in the new electrical building. The existing building ventilation system fans will be replaced to mitigate corrosive gasses and adherence to NFPA 820. Existing building lighting shall be updated and fixtures changed per allowance, along with receptacle circuits; however, the receptacles themselves will be replaced with corrosion resistant devices. Proposed upgrades to the telemetry control are described in “Instrumentation and Controls”.

Bypass pumping with backup pumping will be provided by the contractor with the duration sufficient to keep the flows of the pump station flowing into the force main until station is functioning at design flows. It will be the contractor’s responsibility for the connections, startup, testing and maintaining the bypass pumps system, including fuel or power. System shall have method for alarm and notification to Contractor and County. Responsibility for addressing alarms shall be by Contractor, with response time less than one hour.

Patching and painting of the entire interior of the pump station, including floor, is included in this project. Refer to specifications.

Replace floor hatches and doors per contract drawings. Contractor responsible for all finishes and security of premises while work is being performed.

Wet well rehabilitation shall consist of but not limited to a new wet well liner, hand rails, grating, lighting, new grinder and channel “stop gates” including installation; per the County’s current design.

B. The Contractor shall furnish all shop drawings, working drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all work required by these Specifications and as shown on the Contract Drawings.

C. The Contractor shall perform the work complete, in place and ready for continuous service and shall include any repairs, replacements, and/or restoration required as a result of damages caused prior to acceptance by the County.

D. The Contractor shall furnish and install all materials, equipment and labor which is reasonably and properly inferable and necessary for the proper completion of the work, whether specifically indicated in the Contract Documents or not.

1.02 CONTRACTS

Construct all the Work under a single contract.

1.03 WORK SEQUENCE

A. All work done under this Contract shall be done with a minimum of inconvenience to the users of the system or facility. The Contractor shall coordinate his work with private property owners such that existing utility services are maintained to all users to the maximum extent possible.

B. The Contractor shall, if necessary and feasible, construct the work in stages to accommodate the County's use of the premises during the construction period; coordinate the construction schedule and operations with the County's Representative.

C. The Contractor shall, where feasible, construct the Work in stages to provide for public convenience and not close off public use of any facility until completion of construction to provide alternative usage.

1.04 CONSTRUCTION AREAS

A. The Contractor shall: Limit his use of the construction areas for work and for storage, to allow for:

1. Work by other Contractors.
2. County's Use.
3. Public Use.

B. Coordinate use of work site under direction of County's Representative.

C. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.

D. Move any stored products under the Contractor's control, which interfere with operations of the County or separate contractor.

E. Obtain and pay for the use of additional storage of work areas needed for Contractor operations.

1.05 COUNTY OCCUPANCY

A. It is assumed that portions of the Work will be completed prior to completion of the entire Work. Upon completion of construction of each individual facility, including testing, if the County, 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 County will assume ownership and begin operation of the individual facility on that date and the three-year guaranty period shall commence on that date. The County has the option of not accepting the entire work as a whole until it is completed, tested and approved by the County.

1.06 PARTIAL COUNTY OCCUPANCY

The Contractor shall schedule his operations for completion of portions of the Work, as designated, for the County's occupancy prior to substantial completion of

the entire work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01015 CONTROL OF WORK

PART 1 GENERAL

1.01 WORK PROGRESS

The Contractor shall furnish personnel and equipment which will be efficient, appropriate and adequately sized to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated in the Contract. If at any time such personnel appears to the County to be inefficient, inappropriate, or insufficient for securing the quality of work required for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the personnel and equipment and the Contractor shall conform to such order. Failure of the County to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.02 PRIVATE LAND

The Contractor shall not enter or occupy private land outside of easements, except by permission of the affected property owner.

1.03 WORK LOCATIONS

Work shall be located substantially as indicated on the drawings, but the County reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons.

1.04 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the County may require special construction procedures such as limiting the length of open trench, prohibiting stacking excavated material in the street and requiring that the trench shall not remain open overnight.

B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be barricaded and well lighted at all times when construction is not in progress.

1.05 DISTRIBUTION SYSTEMS AND SERVICES

A. The Contractor shall avoid interruptions to water, telephone, cable TV, sewer, gas, or other related utility services. He shall notify the County and the appropriate agency well in advance of any requirement for dewatering, isolating, or relocating

a section of a utility, so that necessary arrangements may be made.

B. If it appears that utility service will be interrupted for an extended period, the County may order the Contractor to provide temporary service lines at the Contractor's expense. Inconvenience of the users shall be kept to the minimum, consistent with existing conditions. The safety and integrity of the systems are of prime importance in scheduling work.

1.06 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

A. The Contractor shall assume full responsibility for the protection of all buildings, structures and utilities, public or private, including poles, signs, services to building utilities, gas pipes, water pipes, hydrants, sewers, drains and electric and telephone cables and other similar facilities, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operation shall be repaired by the Contractor at his expense.

B. The Contractor shall bear full responsibility for obtaining locations of all underground structures and utilities (including existing water services, drain lines and sewers). Services to buildings shall be maintained and all costs or charges resulting from damage thereto shall be paid by the Contractor.

C. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the unit prices established in the Bid.

D. If, in the opinion of the County, permanent relocation of a utility owned by the County is required, the County may direct the Contractor, in writing, to perform the work. Work so ordered will be paid for at the Contract unit prices, if applicable, or as extra work as classified in the General Conditions. If relocation of a privately owned utility is required, the County will notify the utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the County and utility and shall have no claim for delay due to such relocation. The Contractor shall notify public utility companies in writing at least 48 hours (excluding Saturdays, Sundays and legal holidays) before excavating near their utilities.

1.07 TEST PITS

Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor immediately after the utility location and the surface shall be restored in a manner equal or better than the original condition. No separate payment will be made.

1.08 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the

part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition equal or better to that existing before the damage was done, or he shall make good the damage in another manner acceptable to the County.

B. All sidewalks which are disturbed by the Contractor's operations shall be restored to their original or better condition by the use of similar or comparable materials. All curbing shall be restored in a condition equal to the original construction and in accordance with the best modern practice.

C. Along the location of this work, all fences, walks, bushes, trees, shrubbery and other physical features shall be protected and restored in a thoroughly workmanlike manner unless otherwise shown on the drawings. Fences and other features removed by the Contractor shall be replaced in the location indicated by the County as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be regraded and sodded to equal or exceed original conditions.

D. Trees close to the work which drawings do not specify to be removed, shall be boxed or otherwise protected against injury. The Contractor shall trim all branches that are liable to damage because of his operations, but in no case shall any tree be cut or removed without prior notification to the County. All injuries to bark, trunk, limbs and roots of trees shall be repaired by dressing, cutting and painting according to approved methods, using only approved tools and materials.

E. The protection, removal and replacement of existing physical features along the line of work shall be a part of the work under the Contract and all costs in connection therewith shall be included in the unit and/or lump sum prices established under the items in the Bid.

1.09 MAINTENANCE OF TRAFFIC

A. Open pits, trenches, unpaved streets, debris, or other obstructions due to construction that will prevent the normal flow of traffic during an extended construction stoppage, for any reason, shall be minimized. In the event an extended construction stoppage is found to be necessary, Contractor shall, at his own expense, provide normal traffic flow during extended construction stoppage. Extended stoppage will be defined by the County.

B. All excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary roadways, erect wheel guards or fences, or take other safety measures which are satisfactory to the County.

C. Any changes to the traffic pattern require a Traffic Control Plan as detailed in section 01570 of this specification.

1.10 WATER FOR CONSTRUCTION PURPOSES

A. In locations where public water supply is available, the Contractor may purchase water for all construction purposes.

B. The Contractor shall be responsible for paying for all water tap fees incurred for the purpose of obtaining a potable water service or temporary use meter.

1.11 MAINTENANCE OF FLOW

The Contractor shall at his own cost, provide for the flow of sewers, drains and water courses interrupted during the progress of the work and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the County well in advance of the interruption of any flow.

1.12 CLEANUP

During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction work and at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the work in a neat and orderly condition.

1.13 COOPERATION WITHIN THIS CONTRACT

A. All firms or person authorized to perform any work under this Contract shall cooperate with the General Contractor and his subcontractors or trades and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the County.

1.14 PROTECTION OF CONSTRUCTION AND EQUIPMENT

A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at his own expense.

B. All structures shall be protected in a manner approved by the County. Should any of the floors or other parts of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor, at his own expense and to the satisfaction of the County. If, in the final inspection of the work, any defects, faults, or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the warranty period described in the Contract.

C. Further, the Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the County.

1.15 CONSTRUCTION WITHIN RIGHT-OF-WAY

Where pipe lines are installed within FDOT right-of-way, all excavation backfill and compaction for the purpose of reconstructing roadways and/or adjacent slopes contiguous thereto shall be in accordance with FDOT or Manatee County Standards and Specifications, whichever is applicable. Contractor shall satisfy the authorized representative of the FDOT with respect to proper safety procedures, construction methods, required permitting, etc., within the FDOT right-of-way.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01030 SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 PERMITS.

Upon notice of award, the Contractor shall immediately apply for all applicable permits not previously obtained by the County to do the work from the appropriate governmental agency or agencies. No work shall commence until all applicable permits have been obtained and copies delivered to the County. The costs for obtaining all permits shall be borne by the Contractor.

1.02 CONNECTIONS TO EXISTING SYSTEM

The Contractor shall perform all work necessary to locate, excavate and prepare for connections to the existing systems all as shown on the Drawings or where directed by the County. The cost for this work and for the actual connection shall be included in the price bid for the project and shall not result in any additional cost to the County. The termination point for each contract shall be as shown on the Contract Drawings.

1.03 RELOCATIONS

The Contractor shall be responsible for the coordination of the relocation of structures, including but not limited to light poles, power poles, signs, sign poles, fences, piping, conduits and drains that interfere with the positioning of the work as set out on the Drawings. No relocation of the items under this Contract shall be done without approval from the County.

1.04 EXISTING UNDERGROUND PIPING, STRUCTURES AND UTILITIES

A. The attention of the Contractor is drawn to the fact that during excavation, the possibility exists of the Contractor encountering various utility lines not shown on the Drawings. The Contractor shall exercise extreme care before and during excavation to locate and flag these lines as to avoid damage to the existing lines.

B. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be endangered by the close proximity of excavation, are temporarily stayed in position while work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice.

C. The existing utility locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered. The Contractor shall be responsible for notifying the various utility companies to locate their respective utilities in advance of construction in conformance with all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

D. The existing piping and utilities that interfere with new construction shall be rerouted as shown, specified, or required. Before any piping and utilities not shown

on the Drawings are disturbed, the Contractor shall notify the County and shall provide suggestions on how best to resolve the issue.

E. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities which do not interfere with complete work shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the County.

F. It is intended that wherever existing utilities such as water, sewer, gas, telephone, electrical, or other service lines must be crossed, deflection of the pipe within recommended limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated in the Drawings. However, when in the opinion of the County this procedure is not feasible, he may direct the use of fittings for a utilities crossing as detailed on the Drawings. No deflections will be allowed in gravity sanitary sewer lines or in existing storm sewer lines.

1.08 MAINTENANCE OF OPERATIONS FOR EXISTING FACILITIES

A. Prior to beginning construction, the Contractor shall submit a Construction Sequencing and Phasing Plan for review and approval. The Plan shall include sufficient detail to indicate key activities, durations of key activities, and sequencing/phasing to illustrate the following (at a minimum):

1. How operations of the existing facilities will be maintained during construction;

2. How existing WWTP sewer service will be maintained including collection, transmission and disposal during demolition and construction;

3. Planned shutdowns of existing treatment facility and durations of shutdowns

Other than mobilization, no work will be allowed on the site until the Construction Sequencing and Phasing Plan is approved by the Owner and the Owner's Representative.

B. Any power outage or any work, which requires interruption of the plant flow, shall be scheduled during those times of the day and/or night when potable water demands are low. In such cases, the Contractor shall submit a written request at least 14-calendar days prior to the scheduled work or outage and obtain the written permission from the Owner. The Contractor shall coordinate with the electric utility, as required, regarding the scheduling of the power outages.

C. The Owner's personnel shall be responsible for the day-to-day operations of the existing Lifts Stations, including meter reading, process monitoring, and establishing control system modifications to ensure compliance standards.

D. The Contractor shall consider the following scheduling criteria and constraints to assist with the development of the construction and phasing schedule.

1. Throughout construction, the use of all existing sinks, drains, and toilets shall remain at a level of service existing prior to construction.

2. Prior to the complete LIFT STATION system startup, all equipment required for the operation of the LIFT STATION system shall be started, tested, and be made ready for operation.

3. Testing for the various LIFT STATION system components cannot be performed until the LIFT STATION startup testing plan is approved by the Owner or the Owner's representative.

4. The LIFT STATION system cannot be placed into operation until all components and processes are started, tested, disinfected, and certified to be placed into operation

E. As part of the construction sequence, the Contractor shall provide temporary pumping facilities, temporary piping and temporary power, which could include generation required to completely bypass the flow for LS 1M, LS 12A and LS 13A during the times for the assigned work. These pumping facilities or other means that the Contractor elects for bypass pumping shall be subject to the review and approval of the Owner or Owner's Representative and shall be provided by the Contractor. These pumping facilities shall be part of the Contractor's bid; no additional payment shall be made for temporary pumping or piping needed for Construction.

F. Contractor shall make whatever provisions are necessary to protect existing facilities. Such provisions shall include, but may not be limited to the following.

1. Existing Generator, outdoor manual transfer switch, odor control, exterior above ground piping.

G. All existing electrical underground services and underground piping in the vicinity of the Project shall be located and identified prior to starting any new construction.

H. Other work, including new construction and demolition not mentioned in the above schedule may be performed concurrently with the work as long as the performance of such work will in no way jeopardize the continuity and quality of treatment operations at the existing facility, and as submitted and approved by the Owner and Owner's Representative. Nothing contained herein shall preclude the Contractor from suggesting improved sequences of work. The Contractor shall coordinate his work closely with the ongoing functions of the existing pumping facility, chemical and other deliveries and with the work of all subcontractors.

1.09 OPERATIONS DURING CONSTRUCTION

A. Maintenance of operations of the existing Lift Station is critical. All means, methods and costs to maintain the operations (as specified herein) of said facility shall be included in the Contractor's Base Bid. The following is a general list of some of the construction activities which the Contractor will need to account for in maintaining operations of the facility:

1. Temporary generator and automatic transfer switch.

2. Temporary piping, valves.

3. Temporary flow meter, power wire, signal wire, conduit, etc.

4. New pre-manufactured electrical building.

5. New electrical transformers, drives, MCCs, etc.

6. Connections to existing yard piping.

7. Instrumentation system modifications and integration of new components into the existing facility.

8. Removal and replacement of existing piping and wetwell liner, electrical ductbank, electrical wire and conduit, signal wiring and conduit.

This list does not purport to be all inclusive; the Contractor is responsible for coordinating with plant staff to perform all required construction, while maintaining operations of the existing Lift Stations as Specified herein.

C. In addition to the previous requirements, Table 01030-1 provides information for some of the anticipated electrical shutdowns.

TABLE 01030-1
ELECTRICAL SHUT-DOWN INFORMATION

Shut-down No.	Area	Equipment	Constraints	Maximum Duration
1	Installation of feeder to New Electrical Building	Utility Transformer	Temporary loss of power	2hrs
2	Transfer of individual power to equipment	All equipment connected to existing pump station	Loss of individual pieces of equipment	1-4hrs

1.05 SUSPENSION OF WORK DUE TO WEATHER

Refer to FDOT Standards and Specifications Book, Section 8.

1.06 HURRICANE PREPAREDNESS PLAN

A. Within 30 days of the date of Notice to Proceed, the Contractor shall submit to the County a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the County in case of a hurricane warning.

B. In the event of inclement weather, or whenever County shall direct, Contractor shall insure that he and his Subcontractors shall carefully protect work and materials against damage or injury from the weather. If, in the opinion of the County, any portion of work or materials is damaged due to the failure on the part of the Contractor or Subcontractors to protect the work, such work and materials shall be removed and replaced at the expense of the Contractor.

1.07 POWER SUPPLY

Electricity as may be required for construction and permanent power supply shall be secured and purchased by the Contractor.

1.08 SALVAGE

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 County and if so shall be protected for a reasonable time until picked up by the County. Any equipment or material not worthy of salvaging, as directed by the County, shall be disposed of by the Contractor at no additional cost.

1.09 DEWATERING

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

B. The Contractor shall pump out water and wastewater which may seep or leak into the excavations for the duration of the Contract and with his own equipment. He shall dispose of this water in an appropriate manner.

1.10 ADDITIONAL PROVISIONS

A. Before commencing work on any of the existing pipelines, structures or equipment, the Contractor shall notify the County, in writing, at least 10 calendar days in advance of the date he proposes to commence such work.

B. The Contractor shall provide, at his own expense, all necessary temporary facilities for access to and for protection of, all existing facilities. The County's personnel must have ready access at all times to the existing facilities. The Contractor is responsible for all damage to existing structures, equipment and facilities caused by his construction operations and must repair all such damage when and as ordered by the County.

A. The Contractor shall submit a proposed work sequence plan at the pre-construction meeting showing all critical items of work and anticipated shut down times.

B. Submit a detailed schedule and process description for proposed testing.

1.11 MAINTENANCE OF FLOW PLAN

1. The Contractor shall prepare a Maintenance of Flow Plan that describes in

detail the work that will be performed by the Contractor to maintain continuous operation of the City's existing utility services. Maintenance of Flow Plan shall address the temporary and permanent relocation of gravity sewers and service laterals as shown on the Drawings.

2. Temporary diversion of the gravity sewer flows shall be done using bypass pumps (one duty, one standby) to pump from the upstream manhole to the downstream manhole. Bypass pumps shall have hospital grade sound attenuation. The Contractor shall obtain peak wet weather flow in the gravity sewer from the City and shall demonstrate in the Maintenance of Flow Plan that adequate pumping capacity is provided to accommodate peak wet weather flow. The Contractor and City personnel that are experienced in the collection system shall determine the float levels in the field; pump on, standby or lag pump on, and high-level alarm. The high-level alarm shall be connected to an auto dialer to notify the Contractor of an alarm condition. The bypass pump suction manhole shall use the collection system for a temporary wet well storage; however, surcharging in the existing sewer system shall be limited. Once the high-level float alarm is triggered, it shall allow enough time for emergency Contractor personnel to arrive on scene and resolve the problem prior to any sanitary sewer overflows. The bypass suction and discharge pipes may require the removal of the manhole tops which will result in excess odor escaping from the manholes. The contractor shall provide a means to seal odors within the bypass manholes to minimize odors during the temporary diversion

3. The Maintenance of Flow Plan shall include a sequence of construction with projected time, in days for each step in the sequence.

4. If the work required to maintain utility operation must occur during evening, night or weekend hours, the Contractor shall notify residents in advance of the projected work. The Contractor shall reimburse the City for overtime work, including inspector overtime, in excess of regular working hours.

5. Identify the person(s) responsible for executing the Maintenance of Flow Plan and the systems to be put in place for monitoring the existing utility system's ability to maintain flow.

1.12 CONSTRUCTION CONDITIONS

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

1.13 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, excessive noise or dust.

B. Sound levels must meet Manatee County Ordinance #87-34, (which amends Ordinance 81-3, The Manatee County Noise Control Ordinance). Sound levels in excess of such ordinance are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the County for excessive noise shall not relieve the Contractor of the other portions of this specification.

C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.14 WARRANTIES

A. All material supplied under these Specifications shall be warranted by the Contractor and the manufacturers for a period of three (3) years. Warranty period shall commence on the date of County acceptance.

B. The material shall be warranted to be free from defects in workmanship, design and materials. If any part of the system should fail during the warranty period, it shall be replaced at no expense to the County. All material and installation costs shall be 100% borne by the Contractor.

C. 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 warranties from each of the respective suppliers or manufacturers for all the material specified under these contract specifications,

D. In the event that the manufacturer is unwilling to provide a three-year warranty commencing at the time of County acceptance, the Contractor shall obtain from the manufacturer a four (4) year warranty starting at the time of equipment delivery to the job site. This four-year warranty shall not relieve the Contractor of the three-year warranty starting at the time of County acceptance of the equipment.

1.15 FUEL STORAGE & FILLING

A. If the contractor is storing fuel on site or doing his own fuel filling of portable equipment (other than hand-held equipment), he is responsible for any required response, clean-up or reporting required, at no additional cost to the county.

B. The Contractor shall prepare and submit a fuel storage / spill abatement plan prior to start of construction if required.

1.16 CONTRACTOR'S RESPONSIBILITY FOR AUTOCAD RECORD DRAWINGS

A. Along with the expressed requirements in Section 01720 – Project Record Documents, the Contractor (or other professional hired by the Contractor) shall be entirely responsible and shall be required to perform all work associated with providing complete, updated electronic AutoCAD Drawings that incorporate all modifications from Construction activities associated with this Contract. These modifications include Civil, Mechanical, Electrical, HVAC, Instrumentation, Structural, Details, etc. Contractor shall adhere to the layering used in AutoCAD files provided to the Contractor by the Engineer of Record.

B. AutoCAD Drawings shall be submitted to the Engineer along with documentation specified in Section 01720 – Project Record Documents, for review by the Engineer of Record and Owner.

C. Engineer will review and provide comments to the Contractor. The Contractor shall then address all comments and update AutoCAD Drawings to the satisfaction of the Owner and Engineer prior to issuance of Certificate of Substantial Completion. The Contractor shall note that the layering, line weights, etc. used by the Engineer of Record in preparation of the Contractor Drawings shall be used to develop the Contractor provided and updated, AutoCAD Record Drawings.

D. In addition to the requirements set forth in Section 01720 – Project Record Documents, the Contractor shall provide seven (7) final, complete and approved AutoCAD Drawings, in CD-R format, to the Engineer of Record.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01045 CUTTING AND PATCHING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for all cutting, fitting and patching, including excavation and backfill, required to complete the work or to:

1. Make its 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 Contract Documents.
5. Provide penetrations of non-structural surfaces for installation of piping and electrical conduit.

PART 2 PRODUCTS

2.01 MATERIALS

Comply with specifications and standards for each specific product involved.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of work.

C. Report unsatisfactory or questionable conditions to County. Do not proceed with work until County has provided further instructions.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value to integrity of affected portion of work.

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

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

3.03 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

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

D. Restore work which has been cut or removed; install new products to provide completed work in accordance with the requirements of the Contract Documents.

E. Replace surfaces airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

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

END OF SECTION

SECTION 01050 FIELD ENGINEERING AND SURVEYING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall provide and pay for field surveying service required for the project.

B. The Contractor shall furnish and set all necessary stakes to establish the lines and grades as shown on the Contract Drawings and layout each portion of the Work of the Contract.

1.02 QUALIFICATION OF SURVEYOR AND ENGINEER

All construction staking shall be conducted by or under the supervision of a Florida Registered Professional Surveyor and Mapper. The Contractor shall be responsible for the layout of all such lines and grades, which will be subject to verification by the County.

1.03 SURVEY REFERENCE POINTS

A. Existing basic horizontal and vertical control points for the Project are designated on the Contract Drawings.

B. Locate and protect all survey monumentation, property corners and project control points prior to starting work and preserve all permanent reference points during construction. All costs associated with the replacement of all survey monumentation, property corners and project control points shall be borne by the Contractor.

Make no changes or relocations without prior written notice to County.

Report to County when any reference point is lost, destroyed or requires relocation because of necessary changes in grades or locations.

Require surveyor to replace project control points which may be lost or destroyed.

Establish replacements based on original survey control.

1.04 PROJECT SURVEY REQUIREMENTS

The Contractor shall establish temporary bench marks as needed, referenced to data established by survey control points.

1.05 RECORDS

The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare record drawings per Section 01720.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01090 REFERENCE STANDARDS

PART 1 GENERAL

1.01 REQUIREMENTS

Abbreviations and acronyms used in Contract Documents to identify reference standards.

A. Application: When a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes established stricter standards.

B. Publication Date: The most recent publication in effect on the date of issue of Contract Documents, except when a specific publication date is specified.

1.03 ABBREVIATIONS, NAMES AND ADDRESSES OR ORGANIZATIONS

Obtain copies of reference standards direct from publication source, when needed for proper performance of work, or when required for submittal by Contract Documents.

AA Aluminum Association
818 Connecticut Avenue, N.W.
Washington, DC 20006

AASHTO American Association of State Highway and Transportation Officials
444 North Capital Street, N.W.
Washington, DC 20001

ACI American Concrete Institute
Box 19150
Reford Station
Detroit, MI 48219

AI Asphalt Institute
Asphalt Institute Building
College Park, MD 20740

AISC American Institute of Steel Construction
1221 Avenue of the Americas
New York, NY 10020

AISI American Iron and Steel Institute
1000 16th Street NW
Washington, DC 20036

ANSI American National Standards Institute
1430 Broadway

New York, NY 10018

ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
179l Tullie Circle, N.E.
Atlanta, GA 30329

ASME American Society of Mechanical Engineers
345 East 47th Street
New York, NY 10017

ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

AWS American Welding Society
2501 N.W. 7th Street
Miami, FL 33125

CRSI Concrete Reinforcing Steel Institute
180 North LaSalle Street, Suite 2110
Chicago, IL 60601

FDEP Florida Department of Environmental Protection
3900 Commonwealth Blvd.
Tallahassee, Florida 32399

FDOT Florida Department of Transportation Standards Specifications for Road and Bridge Construction
Maps & Publication Sales - Mail Station 12
605 Suwannee St.
Tallahassee, FL 32399-0450

FS Federal Specification
General Services Administration Specifications and Consumer Information Distribution Section (WFSIS)
Washington Navy Yard, Bldg. 197
Washington, DC 20407

MCPW UTIL STD Manatee County Utility Engineering
1022 26th Ave E
Bradenton, FL 34208

MLSFA Metal Lath/Steel Framing Association
221 North LaSalle Street
Chicago, IL 60601

MMA	Monorail Manufacturer's Association 1326 Freeport Road Pittsburgh, PA 15238
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NEMA	National Electrical Manufacturer's Assoc. 2101 L Street N.W. Washington, DC 20037
OHSA	Occupational Safety and Health Assoc. 5807 Breckenridge Pkwy., Suite A Tampa, FL 33610-4249
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 20076
PCI	Prestressed Concrete Institute 20 North Wacker Drive Chicago, IL 60606
SDI	Steel Door Institute 712 Lakewood Center North Cleveland, OH 44107
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association 8224 Old Court House Road Vienna, VA 22180
SSPC	Steel Structures Painting Council 402 24th Street, Suite 600 Pittsburgh, PA 15213
SWFWMD	Southwest Florida Water Management District 2379 Broad Street Brooksville, FL 34604-6899
UL	Underwriter's Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01150 MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE

A. The scope of this section of the Contract Documents is to further define the items included in each Bid Item in the Bid Form section of the Contract Documents. Payment will be made based on the specified items included in the description in this section for each bid item.

B. All contract prices included in the Bid Form section will be full compensation for all shop drawings, working drawings, labor, materials, tools, equipment and incidentals necessary to complete the construction as shown on the Drawings and/or as specified in the Contract Documents to be performed under this Contract. Actual quantities of each item bid on a unit price basis will be determined upon completion of the construction in the manner set up for each item in this section of the Specifications. Payment for all items listed in the Bid Form will constitute full compensation for all work shown and/or specified to be performed under this Contract.

1.02 ESTIMATED QUANTITIES

The quantities shown are approximate and are given only as a basis of calculation upon which the award of the Contract is to be made. The County does not assume any responsibility for the final quantities, nor shall the Contractor claim misunderstanding because of such estimate of quantities. Final payment will be made only for satisfactorily completed quantity of each item.

1.03 WORK OUTSIDE AUTHORIZED LIMITS

No payment will be made for work constructed outside the authorized limits of work.

1.04 MEASUREMENT STANDARDS

Unless otherwise specified for the particular items involved, all measurements of distance shall be taken horizontally or vertically.

1.05 AREA MEASUREMENTS

In the measurement of items to be paid for on the basis of area of finished work, the lengths and/or widths to be used in the calculations shall be the final dimensions measured along the surface of the completed work within the neat lines shown or designated.

1.06 LUMP SUM ITEMS

Where payment for items is shown to be paid for on a lump sum basis, no separate payment will be made for any item of work required to complete the lump sum items. Lump sum contracts shall be complete, tested and fully operable prior to request for final payment. Contractor may be required to provide a break-down of the lump sum

totals.

1.07 UNIT PRICE ITEM

Separate payment will be made for the items of work described herein and listed on the Bid Form. Any related work not specifically listed, but required for satisfactory completion of the work shall be considered to be included in the scope of the appropriate listed work items.

No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of work. Final payments shall not be requested by the Contractor or made by the County until as-built (record) drawings have been submitted and approved by the County.

1. Project signs and photographs.
2. Removal, repair, replacement or relocation of all signs, walls, private irrigation systems and related items.
3. Rubbish and spoil removal.
4. Shop Drawings, Working Drawings.
5. Clearing, grubbing and grading except as hereinafter specified.
6. Trench excavation, including necessary pavement removal and rock removal, except as otherwise specified.
7. Dewatering and disposal of surplus water.
8. Structural fill, backfill, and grading.
9. Replacement of unpaved roadways, and shrubbery plots.
10. Cleanup & miscellaneous work.
11. Foundation and borrow materials, except as hereinafter specified.
12. Testing and placing system in operation.
13. Any material and equipment required to be installed and utilized for the tests.
14. Pipe, structures, pavement replacement, asphalt and shell driveways and/or appurtenances included within the limits of lump sum work, unless otherwise shown.
15. Maintaining the existing quality of service during construction.
16. Appurtenant work as required for a complete and operable system.
17. Seeding and hydromulching.

(THE BID ITEM SECTION IS TO BE COMPLETED FOR EACH ITEM TO BE BID. EXAMPLES AS FOLLOWS)

BID ITEM NO. 1 – MOBILIZATION AND DEBMOBILIZATOIN

Measurement and payment for this Bid Item shall include full compensation for the required 100 percent (100%) Performance Bond, 100 Percent (100%) Payment Bond, all required insurance for the project and the Contractor's mobilization and demobilization costs as shown in the Bid Form. Mobilization includes, but it not limited to: preparation and movement of personnel, equipment, supplies and incidentals such as safety and sanitary supplies/ facilities

Payment for mobilization shall not exceed 10 percent (10%) of the total Contract cost unless the Contractor can prove to the County that his actual mobilization cost exceeds 10 percent (10%).

Partial payments for this Bid Item will be made in accordance with the following schedule:

Percent of Original Contract Amount:	Percent Allowable Payment of Mobilization/Demobilization Bid Item Price:
5	25
10	35
25	45
50	50
75	75
100	100

These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

LS 1M ELECTRICAL REHABILITATION

BID ITEM 2-1 – MECHANICAL IMPROVEMENTS

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all labor, materials and equipment necessary for the:

- Bypass Pumping with backup, ancillary piping and controls necessary for full bypass of the station during construction.
- Replacement of exhaust and supply ventilation fans, necessary duct work.
- Patch, prime and paint upper floor level of station to match County's painting scheme including floors.

All costs for disposal of all items shall be included in the Contractor's Base Bid for this Bid Item.

BID ITEM NO. 3-1 – SITE WORK

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all labor, materials and equipment necessary to excavation, grading and fill soils to return site to existing grade elevations or modify for new elevations. Refer to drawings and specification.

BID ITEM NO. 4-1 – STRUCTURAL AND ARCHITECTURAL

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all labor, materials and equipment necessary to construct concrete improvements for equipment installation and elevated pre-fabricated concrete building meeting the requirements of FAC Chapter 62-604.400.3(e), be Category 5 (>160mph) hurricane rated, elevated and located adjacent to the existing pump station. Work including, but not limited to, excavation, backfill, material, concrete, and all required appurtenant and ancillary items as indicated on the drawings and the pre-engineered concrete building manufacturer

drawings, specified herein or as otherwise necessary for the completion of the Work associated with this Contract.

Replacement of doors and floor hatches with all demolition and finishing associated with replacement and additions.

BID ITEM NO. 5-1 – INSTRUMENTATION AND CONTROLS

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all plant, labor, materials and equipment necessary for the refurbishment of the lift station. The existing control panel backboard for lift station along with a stand-alone UPS will be relocated into a new control panel enclosure by the CONTRACTOR. The control panel enclosure will be provided by the SYSTEM INTEGRATOR.

BID ITEM NO. 6-1 – ELECTRICAL

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all plant, labor, materials and equipment necessary for the replacement of the electrical distribution and pump control equipment. Replacement of the 480V main distribution equipment, the 208/120V transformer and distribution panels, relocation of the existing ATS, new variable frequency drives (VFD) made by Fuji Incorporated will replace the old, and be installed in the new electrical building. Work will consist of but not limited to placing the electrical equipment in a climate controlled prefabricated building and ancillary items as indicated on the drawings, specified herein or as otherwise necessary for the completion of the Work associated with this Contract. Existing building lighting shall remain along with receptacle circuits; however, the receptacles and switches themselves will be replaced with corrosion resistant devices. All costs for disposal of all items shall be included in the Contractor's Base Bid for this Bid Item.

BID ITEM NO. 7-1 – PERMIT ALLOWANCE

Fees for submitting applications for permits required to complete construction in accordance with the plans and specifications, such as Building Permit, NPDES, and etc. The quantity measured for payment shall be the actual receipt-supported permit fees. Payment will be made at the actual cost to the Contractor for the permits required and acquired. Upon completion of the permitting process, the Contractor will submit receipts for permit fees to the County and Engineer.

LS 12A ELECTRICAL PUMP & VFD REHABILITATION

BID ITEM NO. 2-2 – MECHANICAL IMPROVEMENTS

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all labor, materials and equipment necessary for pump and header piping replacement. Provide all demolition, new pumps and piping, valves and supports specified herein or as otherwise necessary for the completion of the Work associated with this Contract. Refer to drawings and specifications.

- Bypass Pumping with backup, ancillary piping and controls necessary for full bypass of the station during construction.

- Patch, prime and paint all interior levels of station to match County's painting scheme including floors.

BID ITEM NO. 3-2 – SITE WORK

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all labor, materials and equipment necessary to excavation, grading and fill soils to return site to existing grade elevations or modify for new elevations. Refer to drawings and specification.

BID ITEM NO. 4-2 – STRUCTURAL AND ARCHITECTURAL

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all, labor, materials and equipment necessary to construct concrete improvements for equipment installation and elevated pre-fabricated concrete building meeting the requirements of FAC Chapter 62-604.400.3(e), be Category 5 (>160mph) hurricane rated, elevated and located adjacent to the existing pump station. Work including, but not limited to, excavation, backfill, material, concrete, and all required appurtenant and ancillary items as indicated on the drawings and the pre-engineered concrete building manufacturer drawings, specified herein or as otherwise necessary for the completion of the Work associated with this Contract.

Addition of door with all demolition and finishing associated.

BID ITEM NO. 5-2 – INSTRUMENTATION AND CONTROLS

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all plant, labor, materials and equipment necessary for the refurbishment of the lift station. The existing control panel backboard for lift station along with a stand-alone UPS will be relocated into a new control panel enclosure by the CONTRACTOR. The control panel enclosure will be provided by the SYSTEM INTEGRATOR.

BID ITEM NO. 6-2 – ELECTRICAL

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all labor, materials and equipment necessary for the replacement of the electrical distribution and pump control equipment. Work will consist of but not limited to replacement of the 480V main distribution equipment, along with the 208/120V transformer and distribution panels. Relocation of the existing ATS and, new variable frequency drives (VFD) made by Fuji Incorporated will be installed in the new electrical building. Work will consist of but not limited to placing the electrical equipment in a climate controlled prefabricated building and ancillary items as indicated on the drawings, specified herein or as otherwise necessary for the completion of the Work associated with this Contract. Existing building lighting shall be replaced along with receptacle circuits; however, the receptacles and switches themselves will be replaced with corrosion resistant devices. All costs for disposal of all items shall be included in the Contractor's Base Bid for this Bid Item.

BID ITEM NO. 7-2 – LIGHTING ALLOWANCE

As part of the contract documents the contractor is to replace all existing light fixtures bulbs with LED type bulbs, in the drywell and control room areas only. This work is contained in the contract documents. If an existing fixture cannot be retrofitted with LED bulb then the fixture is to be replaced in kind. The allowance for this fixture replacement is $5,000.00 total. The Engineer must be notified before any fixture replacement is performed, and must be approved by the County Project Manager.

BID ITEM NO. 8-2 – PERMIT ALLOWANCE

Fees for submitting applications for permits required to complete construction in accordance with the plans and specifications, such as Building Permit, NPDES, and etc. The quantity measured for payment shall be the actual receipt-supported permit fees. Payment will be made at the actual cost to the Contractor for the permits required and acquired. Upon completion of the permitting process, the Contractor will submit receipts for permit fees to the County and Engineer.

LS 13A ELECTRICAL AND WET WELL REHABILITATION

BID ITEM 2-3 – MECHANICAL IMPROVEMENTS

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all labor, materials and equipment necessary for the replacement of exhaust and supply ventilation fans, necessary duct work. In addition, all labor, materials and equipment necessary for the rehabilitation of the wet well shall consist of but not limited to a new wet well liner, new FRP stairs, hand rails, grating, and lighting. Provide new channel "stop gates" including installation; per the County's current design and as specified herein or as otherwise necessary for the completion of the Work associated with this Contract.

- Bypass Pumping with backup, ancillary piping and controls necessary for full bypass of the station during construction.
- Patch, prime and paint upper floor level of station to match County's painting scheme including floors.

BID ITEM NO. 3-3 – SITE WORK

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all labor, materials and equipment necessary to excavation, grading and fill soils to return site to existing grade elevations or modify for new elevations. Refer to drawings and specification.

BID ITEM NO. 4-3 – STRUCTURAL AND ARCHITECTURAL

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all plant, labor, materials and equipment necessary to construct concrete improvements for equipment installation and elevated pre-fabricated concrete building meeting the requirements of FAC Chapter 62-604.400.3(e), be Category 5 (>160mph) hurricane rated and located near to the

existing pump station. Work including, but not limited to, excavation, backfill, material, concrete, and all required appurtenant and ancillary items as indicated on the drawings and the pre-engineered concrete building manufacturer drawings, specified herein or as otherwise necessary for the completion of the Work associated with this Contract.

Replacement of doors and floor hatches with all demolition and finishing associated with replacement and additions.

BID ITEM NO. 5-3 – INSTRUMENTATION AND CONTROLS

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all plant, labor, materials and equipment necessary for the refurbishment of the lift station. The existing control panel backboard for lift station along with a stand-alone UPS will be relocated into a new control panel enclosure by the CONTRACTOR. The control panel enclosure will be provided by the SYSTEM INTEGRATOR.

BID ITEM NO. 6-3 – ELECTRICAL

Payment of all work included in this Bid Item will be made at the applicable Contract lump sum price for furnishing all plant, labor, materials and equipment necessary for the replacement and relocation of the electrical distribution and pump control equipment. Work will consist of but not limited to replacement of the 480V main distribution equipment, along with the 208/120V transformer and distribution panels. Relocation of the existing ATS and, new variable frequency drives (VFD) made by Fuji Incorporated will be installed in the new electrical building. Work will consist of but not limited to placing the electrical equipment in a climate controlled prefabricated building and ancillary items as indicated on the drawings, specified herein or as otherwise necessary for the completion of the Work associated with this Contract. Existing building lighting shall be replaced along with receptacle circuits; however, the receptacles and switches themselves will be replaced with corrosion resistant devices. All costs for disposal of all items shall be included in the Contractor's Base Bid for this Bid Item.

BID ITEM NO. 7-3 – LIGHTING ALLOWANCE

As part of the contract documents the contractor is to replace all existing light fixtures bulbs with LED type bulbs, in the drywell and control room areas only. This work is contained in the contract documents. If an existing fixture cannot be retrofitted with LED bulb then the fixture is to be replaced in kind. The allowance for this fixture replacement is $5,000.00 total. The Engineer must be notified before any fixture replacement is performed, and must be approved by the County Project Manager.

BID ITEM NO. 8-3 – PERMIT ALLOWANCE

Fees for submitting applications for permits required to complete construction in accordance with the plans and specifications, such as Building Permit, NPDES, and etc. The quantity measured for payment shall be the actual receipt-supported permit fees. Payment will be made at the actual cost to the Contractor for the permits

required and acquired. Upon completion of the permitting process, the Contractor will submit receipts for permit fees to the County and Engineer.

BID ITEM A - RECORD DRAWINGS

Payment for all work included under this Bid Item shall be made at the Contract lump sum price bid listed in the Bid Form and shall represent full compensation for all labor, materials and equipment required to generate and provide record drawings approved and accepted by the County. Record drawings shall be in strict accordance with Section 1.14 of the Manatee County Public Work Utility Standards.

BID ITEM B - CONTRACT CONTINGENCY

Payment for all work under this Bid Item shall be made only at the County's discretion. This Bid Item shall not exceed 10% of the Bidders Total Base Bid. The Bidder shall calculate and enter a dollar amount for this Bid Item.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01152 REQUESTS FOR PAYMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Submit Applications for Payment to the Project Manager or as directed at the preconstruction meeting, in accordance with the schedule established by Conditions of the Contract and Agreement between County and Contractor.

1.02 FORMAT AND DATA REQUIRED

A. Submit payment requests in the form provided by the County with itemized data typed in accordance with the Bid Form.

B. Provide construction photographs in accordance with Contract Documents.

1.03 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. When the County requires substantiating data, Contractor shall submit suitable information with a cover letter.

B. Submit one copy of data and cover letter for each copy of application.

1.04 PREPARATION OF APPLICATION FOR FINAL PAYMENT

Fill in application form as specified for progress payments.

1.05 SUBMITTAL PROCEDURE

A. Submit applications for payment at the times stipulated in the Agreement.

B. Number: Three (3) copies of each application; all signed and certified by the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01153 CHANGE ORDER PROCEDURES

PART 1 GENERAL

1.01 DEFINITION

A. Change Order: A written order signed by the Owner, the Architect/Engineer and the Contractor authorizing a change in the Project Plans and/or Specifications and, if necessary, a corresponding adjustment in the Contract Sum and/or Contract Time, pursuant to Article V of the General Conditions of the Construction Agreement.

B. Administrative Change Adjustment: Minor change order under 10% of project cost or 20% time, does not have to be Board approved.

C. Field Directive: A written order issued by Owner which orders minor changes in the Work not involving a change in Contract Time, to be paid from the Owner's contingency funds.

D. Field Order: Minor change to contract work that does not require adjustment of contract sum or expected date of completion.

1.02 REQUIREMENTS INCLUDED

A. The Contractor shall promptly implement change order procedures:

1. Provide full written data required to evaluate changes.
2. Maintain detailed records of work done on a time-and-material/force account basis.
3. Provide full documentation to County on request.

B. The Contractor shall designate a member of the Contractor's organization who:

1. Is authorized to accept changes to the Work.
2. Is responsible for informing others in the Contractor's employ of the authorized changes into the Work.

1.03 PRELIMINARY PROCEDURES

A. Project Manager may initiate changes by submitting a Request to Contractor. Request will include:

1. Detailed description of the change, products, costs and location of the change in the Project.
2. Supplementary or revised Drawings and Specifications.
3. The projected time extension for making the change.
4. A specified period of time during which the requested price will be considered valid.
5. Such request is for information only and is not an instruction to execute the changes, nor to stop work in progress.

B. Contractor may initiate changes by submitting a written notice to the Project Manager, containing:

1. Description of the proposed changes.
2. Statement of the reason for making the changes.
3. Statement of the effect on the Contract Sum and the Contract Time.
4. Statement of the effect on the work of separate contractors.
5. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.04 FIELD ORDER CHANGE

A. In lieu of a Change Order, the Project Manager may issue a Field Order for the Contractor to proceed with additional work within the original intent of the Project.

B. Field Order will describe changes in the work, with attachments of backup information to define details of the change.

C. Contractor must sign and date the Field Order to indicate agreement with the terms therein.

1.05 DOCUMENTATION OF PROPOSALS AND CLAIMS

A. Support each quotation for a lump sum proposal and for each unit price which has not previously been established, with sufficient substantiating data to allow the County to evaluate the quotation.

B. On request, provide additional data to support time and cost computations:

1. Labor required.
2. Equipment required.
3. Products required.

    a. Recommended source of purchase and unit cost.
    b. Quantities required.

4. Taxes, insurance and bonds.
5. Credit for work deleted from Contract, similarly documented.
6. Overhead and profit.
7. Justification for any change in Contract Time.

C. Support each claim for additional costs and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal.

1. Name of the County's authorized agent who ordered the work and date of the order.
2. Date and time work was performed and by whom.
3. Time record, summary of hours work and hourly rates paid.
4. Receipts and invoices for:

    a. Equipment used, listing dates and time of use.

b. Products used, listing of quantities.
c. Subcontracts.

1.06 PREPARATION OF CHANGE ORDERS

A. Project Manager will prepare each Change Order.

B. Change Order will describe changes in the Work, both additions and deletions, with attachments as necessary to define details of the change.

C. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.

1.07 LUMP SUM/FIXED PRICE CHANGE ORDER

A. Project Manager initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by the Contractor, or requests from the County, or both.

B. Once the form has been completed, all copies should be sent to Contractor for approval. After approval by Contractor, all copies should be sent to County for approval. The County will distribute executed copies after approval by the Board of County Commissioners.

1.08 UNIT PRICE CHANGE ORDER

A. Contents of Change Orders will be based on, either:

1. County's definition of the scope of the required changes.
2. Contractor's Proposal for a change, as approved by the County.
3. Survey of completed work.

B. The amounts of the unit prices to be:

1. Those stated in the Agreement.
2. Those mutually agreed upon between County and Contractor.

1.09 TIME AND MATERIAL/FORCE ACCOUNT CHANGE ORDER/CONSTRUCTION CHANGE AUTHORIZATION

A. Refer to Article V.5.6 of the General Conditions of the Construction Agreement.

1.10 CORRELATION WITH CONTRACTOR'S SUBMITTALS

A. Periodically revise Schedule of Values and Application for Payment forms to record each change as a separate item of work, and to record the adjusted Contract Sum.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time. Revise sub schedules to show changes for other items of work affected by the changes.

C. Upon completion of work under a Change Order, enter pertinent changes in Record

Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01200 PROJECT MEETINGS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The County shall schedule the pre-construction meeting, periodic progress meetings and special meetings, if required, throughout progress of work.

B. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The Contractor shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.02 PRE-CONSTRUCTION MEETING

A. Attendance:

1. County's Engineer.
2. County's Project Manager
3. Contractor.
4. Resident Project Representative.
5. Related Labor Contractor's Superintendent.
6. Major Subcontractors.
7. Major Suppliers.
8. Others as appropriate.

B. Suggested Agenda:

1. Distribution and discussion of:

    a. List of major subcontractors.
    b. Projected Construction Schedules.
    c. Coordination of Utilities

2. Critical work sequencing.
3. Project Coordination.

    a. Designation of responsible personnel.
    b. Emergency contact persons with phone numbers.

4. Procedures and processing of:

    a. Field decisions.
    b. Submittals.
    c. Change Orders.
    d. Applications for Payment.

5. Procedures for maintaining Record Documents.

6. Use of premises:

    a. Office, work and storage areas.
    b. County's REQUIREMENTS.

7. Temporary utilities.
8. Housekeeping procedures.
9. Liquidated damages.
10. Equal Opportunity Requirements.
11. Laboratory testing.
12. Project / Job meetings: Progress meeting, other special topics as needed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01310 CONSTRUCTION SCHEDULE & PROJECT RESTRAINTS

PART 1 GENERAL

1.01 GENERAL

A. Construction under this contract must be coordinated with the County and accomplished in a logical order to maintain utilization and flow through existing facilities and public properties and rights-of-way and to allow construction to be completed within the time allowed by Contract Documents and in the manner set forth in the Contract.

1.02 CONSTRUCTION SCHEDULING GENERAL PROVISIONS

A. No work shall be done between 7:00 p.m. and 7:00 a.m. nor on weekends or legal holidays without written permission of the County. However, emergency work may be done without prior permission.

B. Night work may be established by the Contractor as regular procedure with the written permission of the County. Such permission, however, may be revoked at any time by the County if the Contractor fails to maintain adequate equipment and supervision for the proper execution and control of the work at night.

C. Due to potential health hazards and requirements of the State of Florida and the U.S. Environmental Protection Agency, existing facilities must be maintained in operation.

D. The Contractor shall be fully responsible for providing all temporary piping, plumbing, electrical hook-ups, lighting, temporary structure, or other materials, equipment and systems required to maintain the existing facility's operations. All details of temporary piping and temporary construction are not necessarily shown on the Drawings or covered in the Specifications. However, this does not relieve the Contractor of the responsibility to insure that construction will not interrupt proper facility operations.

E. The Contractor shall designate an authorized representative of his firm who shall be responsible for development and maintenance of the schedule and of progress and payment reports. This representative of the Contractor shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the commitments of the Contractor's schedule.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The Contractor shall submit a critical path schedule as described herein.

B. The planning, scheduling, management and execution of the work is the sole responsibility of the Contractor. The progress schedule requirement is established to allow County to review Contractor's planning, scheduling, management and execution of the work; to assist County in evaluating work progress and make

progress payments and to allow other contractors to cooperate and coordinate their activities with those of the Contractor.

2.02 FORM OF SCHEDULES

A. Prepare schedules using the latest version of Microsoft Project, or other County approved software, in the form of a horizontal bar chart diagram. The diagram shall be time-scaled and sequenced by work areas. Horizontal time scale shall identify the first work day of each week.

B. Activities shall be at least as detailed as the Schedule of Values. Activity durations shall be in whole working days. In addition, man-days shall be shown for each activity or tabulated in an accompanying report.

C. Diagrams shall be neat and legible and submitted on sheets at least 8-1/2 inches by 11 inches suitable for reproduction. Scale and spacing shall allow space for notations and future revisions.

2.03 CONTENT OF SCHEDULES

A. Each monthly schedule shall be based on data as of the last day of the current pay period.

B. Description for each activity shall be brief, but convey the scope of work described.

C. Activities shall identify all items of work that must be accomplished to achieve substantial completion, such as items pertaining to Contractor's installation and testing activities; items pertaining to the approval of regulatory agencies; contractor's time required for submittals, fabrication and deliveries; the time required by County to review all submittals as set forth in the Contract Documents; items of work required of County to support pre-operational, startup and final testing; time required for the relocation of utilities. Activities shall also identify interface milestones with the work of other contractors performing work under separate contracts with County.

D. Schedules shall show the complete sequence of construction by activities. Dates for beginning and completion of each activity shall be indicated as well as projected percentage of completion for each activity as of the first day of each month.

E. Submittal schedule for shop drawing review, product data, and samples shall show the date of Contractor submittal and the date approved submittals will be required by the County, consistent with the time frames established in the Specifications.

F. For Contract change orders granting time extensions, the impact on the Contract date(s) shall equal the calendar-day total time extension specified for the applicable work in the Contract change orders.

G. For actual delays, add activities prior to each delayed activity on the appropriate critical path(s). Data on the added activities of this type shall portray all steps leading to the delay and shall further include the following: separate activity identification, activity description indicating cause of the delay, activity duration consistent with whichever set of dates below applies, the actual start and finish

dates of the delay or, if the delay is not finished, the actual start date and estimated completion date.

H. For potential delays, add an activity prior to each potentially delayed activity on the appropriate critical path(s). Data for added activities of this type shall include alternatives available to mitigate the delay including acceleration alternatives and further show the following: separate activity identification, activity description indicating cause of the potential delay and activity duration equal to zero work days.

2.04 SUPPORTING NARRATIVE

A. Status and scheduling reports identified below shall contain a narrative to document the project status, to explain the basis of Contractor's determination of durations, describe the Contract conditions and restraints incorporated into the schedule and provide an analysis pertaining to potential problems and practical steps to mitigate them.

B. The narrative shall specifically include:

1. Actual completion dates for activities completed during the monthly report period and actual start
   dates for activities commenced during the monthly report period.
2. Anticipated start dates for activities scheduled to commence during the following monthly report period.
3. Changes in the duration of any activity and minor logic changes.
4. The progress along the critical path in terms of days ahead or behind the Contract date.
5. If the Monthly Status Report indicates an avoidable delay to the Contract completion date or interim completion dates as specified in the Agreement, Contractor shall identify the problem, cause and the activities affected and provide an explanation of the proposed corrective action to meet the milestone dates involved or to mitigate further delays.
6. If the delay is thought to be unavoidable, the Contractor shall identify the problem, cause, duration, specific activities affected and restraints of each activity.
7. The narrative shall also discuss all change order activities whether included or not in the revised/current schedule of legal status. Newly introduced change order work activities and the CPM path(s) that they affect, must be specifically identified. All change order work activities added to the schedule shall conform with the sequencing and Contract Time requirements of the applicable Change Order.
8. Original Contract date(s) shall not be changed except by Contract change order. A revision need not be submitted when the foregoing situations arise unless required by County. Review of a report containing added activities will not be construed to be concurrence with the duration or restraints for such added activities; instead the corresponding data as ultimately incorporated into the applicable Contract change order shall govern.
9. Should County require additional data, this information shall be supplied by Contractor within 10 calendar days.

2.05 SUBMITTALS

A. Contractor shall submit estimated and preliminary progress schedules (as identified in the Terms and Conditions of the Contract and the General Conditions), monthly status reports, a start-up schedule and an as-built schedule report all as specified herein.

B. All schedules, including estimated and preliminary schedules, shall be in conformance with the Contract Documents.

C. The finalized progress schedule discussed in the Contract Documents shall be the first monthly status report and as such shall be in conformance with all applicable specifications contained herein.

D. Monthly Status Report submittals shall include a time-scaled (days after notice to proceed) diagram showing all contract activities and supporting narrative. The initial detailed schedule shall use the notice to proceed as the start date. The finalized schedule, if concurred with by County, shall be the work plan to be used by the contractor for planning, scheduling, managing and executing the work.

E. The schedule diagram shall be formatted as above. The diagram shall include (1) all detailed activities included in the preliminary and estimated schedule submittals, (2) calendar days prior to substantial completion, (3) summary activities for the remaining days. The critical path activities shall be identified, including critical paths for interim dates, if possible.

F. The Contractor shall submit progress schedules with each application for payment.

2.06 MONTHLY STATUS REPORTS

A. Contractor shall submit detailed schedule status reports on a monthly basis with the Application for Payment. The first such status report shall be submitted with the first Application for Payment and include data as of the last day of the pay period. The Monthly Report shall include a "marked-up" copy of the latest detailed schedule of legal status and a supporting narrative including updated information as described above. The Monthly Report will be reviewed by County and Contractor at a monthly schedule meeting and Contractor will address County's comments on the subsequent monthly report. Monthly status reports shall be the basis for evaluating Contractor's progress.

B. The "marked-up" diagram shall show, for the latest detailed schedule of legal status, percentages of completion for all activities, actual start and finish dates and remaining durations, as appropriate. Activities not previously included in the latest detailed schedule of legal status shall be added, except that contractual dates will not be changed except by change order. Review of a marked-up diagram by County will not be construed to constitute concurrence with the time frames, duration, or sequencing for such added activities; instead the corresponding data as ultimately incorporated into an appropriate change order shall govern.

2.07 STARTUP SCHEDULE

A. At least 60 calendar days prior to the date of substantial completion, Contractor

shall submit a time-scaled (days after notice to proceed) diagram detailing the work to take place in the period between 60 days prior to substantial completion, together with a supporting narrative. County shall have 10 calendar days after receipt of the submittal to respond. Upon receipt of County's comments, Contractor shall make the necessary revisions and submit the revised schedule within 10 calendar days. The resubmittal, if concurred with by County, shall be the Work Plan to be used by Contractor for planning, managing, scheduling and executing the remaining work leading to substantial completion.

B. The time-scaled diagram shall use the latest schedule of legal status for those activities completed ahead of the last 60 calendar days prior to substantial completion and detailed activities for the remaining 60-day period within the time frames outlined in the latest schedule of legal status.

C. Contractor will be required to continue the requirement for monthly reports, as outlined above. In preparing this report, Contractor must assure that the schedule is consistent with the progress noted in the startup schedule.

2.08 REVISIONS

A. All revised Schedule Submittals shall be made in the same form and detail as the initial submittal and shall be accompanied by an explanation of the reasons for such revisions, all of which shall be subject to review and concurrence by County. The revision shall incorporate all previously made changes to reflect current as-built conditions. Minor changes to the approved submittal may be approved at monthly meetings; a minor change is not considered a revision in the context of this paragraph.

B. A revised schedule submittal shall be submitted for review when required by County.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01340 SHOP DRAWINGS, PROJECT DATA AND SAMPLES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the County for review and approval: working drawings, shop drawings, test reports and data on materials and equipment (hereinafter in this section called data) that have been produced within the last three (3) years, and material samples (hereinafter in this section called samples) as are required for the proper control of work, including, but not limited to those working drawings, shop drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings. Submittals may be done electronically via PDF documents.

B. The Contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the County. The County will provide the initial submittal log in electronic format. The electronic log (excel file) shall be passed back and forth between the Contractor and the County for each submittal package. This log shall include the following items:

1. Submittal description and number assigned.
2. Date to County.
3. Date returned to Contractor (from County).
4. Status of Submittal (No exceptions taken, returned for confirmation or resubmittal, rejected).
5. Date of Resubmittal and Return (as applicable).
6. Date material released (for fabrication).
7. Projected date of fabrication.
8. Projected date of delivery to site.
9. Projected date and required lead time so that product installation does not delay contact.
10. Status of O&M manuals submitted.

1.03 CONTRACTOR'S RESPONSIBILITY

A. It is the duty of the Contractor to check all drawings, data and samples prepared by or for him before submitting them to the County for review. Each and every copy of the Drawings and data shall bear Contractor's stamp showing that they have been so checked. Shop drawings submitted to the County without the Contractor's stamp will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the contract Documents.

B. The Contractor shall ensure that all submitted cut sheets, product sheets, product documentation, etc. are current versions of the product information and are not older than three (3) years. Product certification(s) shall be no older than three (3) years. Any submitted documents found to be beyond the acceptable date ranges shall be rejected.

C. Determine and verify:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with Specifications and indicate all variances from the Specifications.

D. The Contractor shall furnish the County a schedule of Shop Drawing submittals fixing the respective dates for the submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall indicate those that are critical to the progress schedule.

E. The Contractor shall not begin any of the work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the County, with No Exceptions Taken or Approved As Noted.

F. The Contractor shall submit to the County all drawings and schedules sufficiently in advance of construction requirements to provide no less than twenty-one (21) calendar days for checking and appropriate action from the time the County receives them. Submittals are to be scheduled, submitted, reviewed, and approved prior to the acquisition of the material or equipment. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential resubmittal.

G. No delay costs or time extensions will be allowed for time lost in late submittals or resubmittals.

H. All material & product submittals, other than samples, may be transmitted electronically as a pdf file. All returns to the contractor will be as a pdf file only unless specifically requested otherwise.

I. The Contractor shall be responsible for and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of work prior to the completion of the review by County of the necessary Shop Drawings.

1.04 COUNTY'S REVIEW OF SHOP DRAWINGS AND WORKING DRAWINGS

A. The County's review of drawings, data and samples submitted by the Contractor shall cover only general conformity to the Specifications, external connections and dimensions which affect the installation.

B. The review of drawings and schedules shall be general and shall not be construed:

1. As permitting any departure from the Contract requirements.
2. As relieving the Contractor of responsibility for any errors, including details, dimensions and materials.
3. As approving departures from details furnished by the County, except as otherwise provided herein.

C. If the drawings or schedules as submitted describe variations and show a departure from the Contract requirements which the County finds to be in the interest of the County and to be so minor as not to involve a change in Contract Price or time for performance, the County may return the reviewed drawings without noting any exception.

D. When reviewed by the County, each of the Shop and Working Drawings shall be identified as having received such review being so stamped and dated. Shop Drawings stamped "REJECTED" and with required corrections shown shall be returned to the Contractor for correction and resubmittal.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals, the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by the County on previous submissions. The Contractor shall make any corrections required by the County.

F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the County.

G. The County shall review a submittal/resubmittal a maximum of three (3) times after which cost of review shall be borne by the Contractor. The cost of engineering shall be equal to the County's actual payroll cost.

H. When the Shop and Working Drawings have been completed to the satisfaction of the County, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the County.

I. No partial submittals shall be reviewed. Incomplete submittals shall be returned to the Contractor and shall be considered not approved until resubmitted.

1.05 SHOP DRAWINGS

A. When used in the Contract Documents, the term "Shop Drawings" shall be considered to mean Contractor's plans for material and equipment which become an integral part of the Project. These drawings shall be complete and detailed. Shop Drawings shall consist of fabrication, drawings, setting drawings, schedule drawings, manufacturer's scale drawings and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature and performance and test data, shall be considered only as supportive to required Shop Drawings as defined above.

B. Drawings and schedules shall be checked and coordinated with the work of all trades involved, before they are submitted for review by the County and shall bear the Contractor's stamp of approval and original signature as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval and original signature shall be returned to the Contractor for resubmission.

C. Each Shop Drawing shall have a blank area 3-1/2 inches by 3-1/2 inches, located adjacent to the title block. The title block shall display the following:

1. Number and title of the drawing.
2. Date of Drawing or revision.
3. Name of project building or facility.
4. Name of contractor and subcontractor submitting drawing.
5. Clear identification of contents and location of the work.
6. Specification title and number.

D. If drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal. If acceptable, proper adjustment in the contract shall be implemented where appropriate. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility of executing the work in accordance with the Contract, even though such drawings have been reviewed.

E. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material. Materials and equipment lists shall give, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.

F. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.

G. All manufacturers or equipment suppliers who proposed to furnish equipment or products shall submit an installation list to the County along with the required shop drawings. The installation list shall include at least five installations where identical equipment has been installed and have been in operation for a period of at least one (1) year.

H. Only the County will utilize the color "red" in marking shop drawing submittals.

1.06 SUBMITTAL PREPARATION

A. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

B. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.

C. If available product data is incomplete, provide Contractor-prepared documentation to supplement product data and satisfy submittal requirements.

D. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain the excessive amount of irrelevant or unnecessary data will be returned with review.

E. Provide a transmittal form for each submittal with the following information:

1. Project title, location and number.
2. Construction contract number.
3. Date of the drawings and revisions.
4. Name, address, and telephone number of subcontractor, supplier, manufacturer, and any other subcontractor associated with the submittal.
5. List paragraph number of the specification section and page number; and sheet number of the contract drawings by which the submittal is required.
6. When a resubmission, the resubmittal document name shall remain the same, but shall add an alphabetic suffix on submittal description. For example, submittal 18 would become 18A, to indicate resubmission.
7. Product identification and location in project.

F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting to the County for review.

G. Stamp, sign, and date each submittal transmittal form indicating action taken.

H. Stamp used by the Contractor on the submittal transmittal form to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR
(Firm Name)

_____ Approved

_____ Approved with corrections as noted on submittal data and/or attached sheet(s).

I certify that the following document and information has been verified to be is not more than three (3) years old.

SIGNATURE:_____

TITLE:_____

DATE:_____

1.07 WORKING DRAWINGS

A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's fabrication and erection drawings for structures such as roof trusses, steelwork, precast concrete elements, bulkheads, support of open cut excavation, support of utilities, groundwater control systems, forming and false work; underpinning; and for such other work as may be required for construction of the project.

B. Copies of working drawings as noted above, shall be submitted to the County where required by the Contract Documents or requested by the County and shall be submitted at least thirty (30) days (unless otherwise specified by the County) in advance of their being required for work.

C. Working drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the County, which review will be for general conformance and will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the Contractor; the County and Engineer shall not have responsibility therefor.

1.08 SAMPLES

A. The Contractor shall furnish, for the review of the County, samples required by the Contract Documents or requested by the County. Samples shall be delivered to the County as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until reviewed by the County.

B. Samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.
2. Full range of color, texture and pattern.
3. A minimum of two samples of each item shall be submitted.

C. Each sample shall have a label indicating:

1. Name of product.
2. Name of Contractor and Subcontractor.
3. Material or equipment represented.
4. Place of origin.
5. Name of Producer and Brand (if any).
6. Location in project.
   (Samples of finished materials shall have additional markings that will identify them under the finished schedules.)
7. Reference specification paragraph.

D. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required above. He shall enclose a copy of this letter with the shipment and send a copy of this letter to the County. Review of a sample shall be only for the characteristics or use named in such and shall not be construed to change or modify any Contract requirements.

E. Reviewed samples not destroyed in testing shall be sent to the County or stored at the site of the work. Reviewed samples of the hardware in good condition will be marked for identification and may be used in the work. Materials and equipment incorporated in work shall match the reviewed samples. If requested at the time of submission, samples which failed testing or were rejected shall be returned to the Contractor at his expense.

1.09 APPROVED SUBMITTALS

A. County approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

B. County approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

C. After submittals have been approved, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

D. Retain a copy of all approved submittals at project site, including approved samples.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01370 SCHEDULE OF VALUES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the County a Schedule of Values allocated to the various portions of the work, within 10 days after date of Notice to Proceed.

B. Upon request of the County, the Contractor shall support the values with data which will substantiate their correctness.

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

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Schedule of Values will be considered for approval by County upon Contractor's request. Identify schedule with:

1. Title of Project and location.
2. Project number.
3. Name and address of Contractor.
4. Contract designation.
5. Date of submission.

B. Schedule of Values shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Follow the table of contents for the Contract Document as the format for listing component items for structures:

1. Identify each line item with the number and title of the respective major section of the specification.
2. For each line item, list sub values of major products or operations under item.

D. Follow the bid sheets included in this Contract Documents as the format for listing component items for pipe lines.

E. The sum of all values listed in the schedule shall equal the total Contract sum.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01380 CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall employ a competent photographer to take construction record photographs or perform video, recording including furnishing all labor, materials, equipment and incidentals necessary to obtain photographs and/or video recordings of all construction areas.

B. Preconstruction record information shall consist of video recordings on digital video disks (DVD).

C. Construction progress information shall consist of photographs and digital photographs on a recordable compact disc (CD-R).

1.02 QUALIFICATIONS

A. All photography shall be done by a competent camera operator who is fully experienced and qualified with the specified equipment.

B. For the video recording, the audio portion should be done by a person qualified and knowledgeable in the specifics of the Contract, who shall speak with clarity and diction so as to be easily understood.

1.03 PROJECT PHOTOGRAPHS

A. Provide one print of each photograph with each pay application.

B. Provide one recordable compact disc with digital photographs with each pay application.

C. Negatives:

1. All negatives shall remain the property of photographer.
2. The Contractor shall require that photographer maintain negatives or protected digital files for a period of two years from date of substantial completion of the project.
3. Photographer shall agree to furnish additional prints to County at commercial rates applicable at time of purchase. Photographer shall also agree to participate as required in any litigation requiring the photographer as an expert witness.

D. The Contractor shall pay all costs associated with the required photography and prints. Any parties requiring additional photography or prints shall pay the photographer directly.

E. All project photographs shall be a single weight, color image. All finishes shall be smooth surface and glossy and all prints shall be 8 inches x 10 inches.

F. Each print shall have clearly marked on the back, the name of the project, the orientation of view, the date and time of exposure, name and address of the photographer and the photographers numbered identification of exposure.

G. All project photographs shall be taken from locations to adequately illustrate conditions prior to construction, or conditions of construction and state of progress. The Contractor shall consult with the County at each period of photography for instructions concerning views required.

1.04 VIDEO RECORDINGS

A. Video, recording shall be done along all routes that are scheduled for construction. Video, recording shall include full, recording of both sides of all streets and the entire width of easements plus 10 feet on each side on which construction is to be performed. All video recording shall be in full color.

B. A complete view, in sufficient detail with audio description of the exact location shall be provided.

C. The engineering plans shall be used as a reference for stationing in the audio portion of the recordings for easy location identification.

D. Two complete sets of video recordings shall be delivered to the County on digital video disks (DVD) for the permanent and exclusive use of the County prior to the start of any construction on the project.

E. All video recordings shall contain the name of the project, the date and time of the video, recording, the name and address of the photographer and any other identifying information required.

F. Construction shall not start until preconstruction video recordings are completed, submitted and accepted by the County. In addition, no progress payments shall be made until the preconstruction video recordings are accepted by the County.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01410 TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. County shall employ and pay for the services of an independent testing laboratory to perform testing specifically indicated on the Contract Documents or called out in the Specifications. County may elect to have materials and equipment tested for conformity with the Contract Documents at any time.

1. Contractor shall cooperate fully with the laboratory to facilitate the execution of its required services.
2. Employment of the laboratory shall in no way relieve the Contractor's obligations to perform the work of the Contract.

1.02 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

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 Contractor.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel; provide access to Work and/or to Manufacturer's operations.

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes which require control by the testing laboratory.

D. 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 specifications for quality and workmanship are indicated in the Contract Documents. The County may require the Contractor 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 County shall be allowed on account of such testing and certification.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at the project site or at the source of the product to be tested.

3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed due to insufficient notice, Contractor shall reimburse County for laboratory personnel and travel expenses incurred due to Contractor's negligence.

G. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience and as approved by the County.

H. If the test results indicate the material or equipment complies with the Contract Documents, the County shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the contractor shall pay for the laboratory costs directly to the testing firm or the total of such costs shall be deducted from any payments due the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01510 TEMPORARY AND PERMANENT UTILITIES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

The Contractor shall be responsible for furnishing all requisite temporary utilities, i.e., power, water, sanitation, etc. The Contractor shall obtain and pay for all permits required as well as pay for all temporary usages. The Contractor shall remove all temporary facilities upon completion of work.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with National Electric Code.

B. Comply with Federal, State and Local codes and regulations and with utility company requirements.

C. Comply with County Health Department regulations.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

Materials for temporary utilities may be "used". Materials for electrical utilities shall be adequate in capacity for the required usage, shall not create unsafe conditions and shall not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

Arrange with the applicable utility company for temporary power supply. Provide service required for temporary power and lighting and pay all costs for permits, service and for power used.

2.03 TEMPORARY WATER

A. The Contractor shall arrange with Manatee County Utilities Customer Service office to provide water for construction purposes, i.e., meter, pay all costs for installation, maintenance and removal, and service charges for water used.

B. The Contractor shall protect piping and fitting against freezing.

2.04 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide sanitary facilities in compliance with all laws and regulations.

B. The Contractor shall service, clean and maintain facilities and enclosures.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall maintain and operate systems to assure continuous service.

B. The Contractor shall modify and extend systems as work progress requires.

3.02 REMOVAL

A. The Contractor shall completely remove temporary materials and equipment when their use is no longer required.

B. The Contractor shall clean and repair damage caused by temporary installations or use of temporary facilities.

END OF SECTION

SECTION 01570 TRAFFIC REGULATION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for providing safe and expeditious movement of traffic through construction zones. A construction zone is defined as the immediate areas of actual construction and all abutting areas which are used by the Contractor and which interfere with the driving or walking public.

B. The Contractor shall remove temporary equipment and facilities when no longer required, restore grounds to original or to specified conditions.

1.02 TRAFFIC CONTROL

A. The necessary traffic control shall include, but not be limited to, such items as proper construction warning signs, signals, lighting devices, markings, barricades, channelization and hand signaling devices. The Contractor shall be responsible for installation and maintenance of all devices and detour routes and signage for the duration of the construction period. The Contractor shall utilize the appropriate traffic plan from the FDOT Maintenance of Traffic Standards, Series 600 of the FDOT Roadway & Traffic Design Standards, Latest Edition.

B. Should there be the necessity to close any portion of a roadway carrying vehicles or pedestrians the Contractor shall submit a Traffic Control Plan (TCP) at least 5 days before a partial or full day closure, and at least 8 days before a multi-day closure. TCP shall be submitted, along with a copy of their accreditation, by a certified IMSA or ATSA Traffic Control Specialist.

1. At no time will more than one (1) lane of a roadway be closed to vehicles and pedestrians without an approved road closure from the County Transportation Department. With any such closings, adequate provision shall be made for the safe expeditious movement of each.
2. All traffic control signs must be in place and inspected at least 1 day in advance of the closure. Multi-day closures notification signs shall be in place al least 3 days in advance of the closure. All signs must be covered when no in effect, and checked twice a day by the Worksite Traffic Supervisor when they are in effect.

C. The Contractor shall be responsible for removal, relocation, or replacement of any traffic control device in the construction area which exists as part of the normal preconstruction traffic control scheme. Any such actions shall be performed by the Contractor under the supervision and in accordance with the instructions of the applicable highway department unless otherwise specified.

D. The Contractor will consult with the County immediately on any vehicular or pedestrian safety or efficiency problem incurred as a result of construction of the project.

E. The Contractor shall provide ready access to businesses and homes in the project

area during construction. The Contractor shall be responsible for coordinating this work with affected homeowners.

F. When conditions require the temporary installation of signs, pavement markings and traffic barriers for the protection or workers and traffic, the entire array of such devices shall be depicted on working drawings for each separate stage of work. These drawings shall be submitted to the County for review and approval prior to commencement of work on the site.

G. Precast concrete traffic barriers shall be placed adjacent to trenches and other excavations deeper than six inches below the adjacent pavement surface.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01580 PROJECT IDENTIFICATION AND SIGNS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Furnish, install and maintain County project identification signs.

B. Remove signs on completion of construction.

C. Allow no other signs to be displayed except for traffic control and safety.

1.02 PROJECT IDENTIFICATION SIGN (COUNTY)

A. Two painted sign, of not less than 32 square feet (3 square meters) area, with painted graphic content to include:

1. Title of Project.
2. Name of County.
3. Names and titles of authorities as directed by County.
4. Prime Contractor.

B. Graphic design, style of lettering and colors: As approved by the County.

C. Erect on the site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the County

1.03 INFORMATIONAL SIGNS

A. Painted signs with painted lettering, or standard products.

1. Size of signs and lettering: as required by regulatory agencies, or as appropriate to usage.
2. Colors: as required by regulatory agencies, otherwise of uniform colors throughout project.

B. Erect at appropriate locations to provide required information.

1.04 QUALITY ASSURANCE

A. Sign Painter: Professional experience in type of work required.

B. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction period.

1.05 PUBLIC NOTIFICATION

A. Door Hangers: The Contractor shall generate and distribute door hangers to all residents who will be impacted by project construction.

1. Residents impacted include anyone who resides inside, or within 500 feet of project limits of construction.

B. Door Hangers shall be distributed prior to start of construction of the project. Hangers shall be affixed to doors of residents via elastic bands or tape.

EXAMPLE:

PLEASE PARDON THE INCONVENIENCE WHILE THE ROADWAY IS BEING RECONSTRUCTED IN YOUR NEIGHBORHOOD

This project consists of utility improvements and the reconstruction of ??? Boulevard from U.S. ??? to ??? Street West. The project is expected to begin in August, 200X and be completed in July 200X.

Location Map

WE HOPE TO KEEP ANY INCONVENIENCE TO A MINIMUM. HOWEVER, IF YOU HAVE ANY PROBLEMS, PLEASE CONTACT THE FOLLOWING:

A. Contractor
Contractor Address
Contractor Phone (Site Phone)

Project Manager
PM Address
PM Phone No. & Ext.

B. Project Inspector
Inspector Phone Number

AFTER HOURS EMERGENCY NUMBER – (941) 747-HELP
THANK YOU FOR YOUR UNDERSTANDING AND PATIENCE
MANATEE COUNTY GOVERNMENT – PROJECT MANAGEMENT DEPT.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: May be new or used, wood or metal, in sound condition structurally adequate to work and suitable for specified finish.

B. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints.

1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.

C. Rough Hardware: Galvanized.

D. Paint: Exterior quality, as specified in the Contract Documents.

PART 3 EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

A. Paint exposed surface or supports, framing and surface material; one coat of primer and one coat of exterior paint.

B. Paint graphics in styles, size and colors selected.

3.02 MAINTENANCE

The Contractor shall maintain signs and supports in a neat, clean condition; repair damages to structures, framing or sign.

3.03 REMOVAL

The Contractor shall remove signs, framing, supports and foundations at completion of project.

END OF SECTION

SECTION 01600 MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Material and equipment incorporated into the work:

1. Conform to applicable specifications and standards.
2. Comply with size, make, type and quality specified, or as specifically approved in writing by the County.
3. Manufactured and Fabricated Products:

    a. Design, fabricate and assemble in accordance with the best engineering and shop practices.
    b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
    c. Two or more items of the same kind shall be identical and manufactured by the same manufacturer.
    d. Products shall be suitable for service conditions.
    e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

4. Do not use material or equipment for any purpose other than that for which it is specified.
5. All material and equipment incorporated into the project shall be new.

1.02 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to County. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with County prior to proceeding. Do not proceed with work without clear instructions.

1.03 TRANSPORTATION AND HANDLING

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

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals and that

products are properly protected and undamaged.

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

1.04 SUBSTITUTIONS AND PRODUCT OPTIONS

Contractor's Options:

1. For products specified only by reference standard, select any product meeting that standard.
2. For products specified by naming one or more products or manufacturers and "or equal", Contractor must submit a request for substitutions of any product or manufacturer not specifically named in a timely manner so as not to adversely affect the construction schedule.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01620 STORAGE AND PROTECTION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Provide secure storage and protection for products to be incorporated into the work and maintenance and protection for products after installation and until completion of Work.

1.02 STORAGE

A. Store products immediately on delivery and protect until installed in the Work, in accord with manufacturer's instructions, with seals and labels intact and legible.

B. Exterior Storage

1. Provide substantial platform, blocking or skids to support fabricated products above ground to prevent soiling or staining.

    a. Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
    b. Prevent mixing of refuse or chemically injurious materials or liquids.

A. Arrange storage in manner to provide easy access for inspection.

1.03 MAINTENANCE OF STORAGE

A. Maintain periodic system of inspection of stored products on scheduled basis to assure that:

1. State of storage facilities is adequate to provide required conditions.
2. Required environmental conditions are maintained on continuing basis.
3. Surfaces of products exposed to elements are not adversely affected. Any weathering of products, coatings and finishes is not acceptable under requirements of these Contract Documents.

B. Mechanical and electrical equipment which requires servicing during long term storage shall have complete manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.

1. Equipment shall not be shipped until approved by the County. The intent of this requirement is to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the County.
2. All equipment having moving parts such as gears, electric motors, etc. and/or instruments shall be stored in a temperature and humidity controlled building approved by the County until such time as the equipment is to be

installed.

3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.
4. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.
5. Lubricants shall be changed upon completion of installation and as frequently as required, thereafter during the period between installation and acceptance.
6. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.04 PROTECTION AFTER INSTALLATION

A. Provide protection of installed products to prevent damage from subsequent operations. Remove when no longer needed, prior to completion of work.

B. Control traffic to prevent damage to equipment and surfaces.

C. Provide coverings to protect finished surfaces from damage.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01700 CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

1.02 SUBSTANTIAL COMPLETION

A. The Contractor shall submit the following items when the Contractor considers the work to be substantially complete:

1. A written notice that the work, or designated portion thereof, is substantially complete.
2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the County shall make an inspection to determine the status of completion.

C. Project record documents and operations and maintenance manuals must be submitted before the project shall be considered substantially complete.

D. If the County determines that the work is not substantially complete:

1. The County shall notify the Contractor in writing, stating the reasons.
2. The Contractor shall remedy the deficiencies in the work and send a second written notice of substantial completion to the County.
3. The County shall reinspect the work.

E. When the County finds that the work is substantially complete:

1. The Engineer shall prepare and deliver to the County a tentative Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a tentative list of the items to be completed or corrected before final payment.
2. The Engineer shall consider any objections made by the County as provided in Conditions of the Contract. When the Engineer considers the work substantially complete, he will execute and deliver to the County a definite Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a revised tentative list of items to be completed or corrected.

1.03 FINAL INSPECTION

A. When the Contractor considered the work to be complete, he shall submit written certification stating that:

1. The Contract Documents have been reviewed.
2. The work has been inspected for compliance with Contract Documents.

3. The work has been completed in accordance with Contract Documents.
4. The equipment and systems have been tested in the presence of the County's representative and are operational.
5. The work is completed and ready for final inspection.

B. The County shall make an inspection to verify the status of completion after receipt of such certification.

C. If the County determines that the work is incomplete or defective:

1. The County shall promptly notify the Contractor in writing, listing the incomplete or defective work.
2. The Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to County that the work is complete.
3. The County shall reinspect the work.

D. Upon finding the work to be acceptable under the Contract Documents, the County shall request the Contractor to make closeout submittals.

E. For each additional inspection beyond a total of three (3) inspections for substantial and final completion due to the incompleteness of the work, the Contractor shall reimburse the County's fees.

1.04 CONTRACTOR'S CLOSEOUT SUBMITTALS TO COUNTY

A. Project Record Documents (prior to substantial completion).

B. Operation and maintenance manuals (prior to substantial completion).

C. Warranties and Bonds.

D. Evidence of Payment and Release of Liens: In accordance with requirements of General and Supplementary Conditions.

E. Certification letter from Florida Department of Transportation and Manatee County Department of Transportation, as applicable.

F. Certificate of Insurance for Products and Completed Operations.

G. Final Reconciliation, Warranty Period Declaration, and Contractor's Affidavit (Manatee County Project Management Form PMD-9).

1.05 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to the County.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.
2. Additions and deductions resulting from:

a. Previous Change Orders
b. Unit Prices
c. Penalties and Bonuses
d. Deductions for Liquidated Damages
e. Other Adjustments

3. Total Contract Sum, as adjusted.
4. Previous payments.
5. Sum remaining due.

C. Project Management shall prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.06 FINAL APPLICATION FOR PAYMENT

Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01710 CLEANING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Execute cleaning during progress of the work and at completion of the work, as required by the General Conditions.

1.02 DISPOSAL REQUIREMENTS

Conduct cleaning and disposal operations to comply with all Federal, State and Local codes, ordinances, regulations and anti-pollution laws.

PART 2 PRODUCTS

2.01 MATERIALS

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 manufacturer of the surface material to be cleaned.

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

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

A. Execute periodic cleaning to keep the work, the site and adjacent properties free from accumulation of waste materials, rubbish and wind-blown debris, resulting from construction operations.

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 disposal areas away from the site.

3.02 DUST CONTROL

A. Clean interior spaces prior to 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

A. Employ skilled workmen for final cleaning.

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

C. Prior to final completion or County occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas to verify that the entire work is clean.

END OF SECTION

SECTION 01720 PROJECT RECORD DOCUMENTS

PART 1 STANDARDS

1.01 MINIMUM RECORD DRAWING STANDARDS FOR ALL RECORD DRAWINGS SUBMITTED TO MANATEE COUNTY

A. Record drawings shall be submitted to at least the level of detail in the contract documents. It is anticipated that the original contract documents shall serve as at least a background for all record information. Original drawings in CAD format may be requested of the County.

B. Drawings shall meet the criteria of paragraph 2.04 D above and as mentioned in Section 1.14 Record Drawings in the Manatee County Public Works Standards, Part I Utilities Standards Manual approved June 2015.

PART 2 STANDARDS

2.01 REQUIREMENTS INCLUDED

A. Contractor shall maintain at the site for the County one record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. County's field orders or written instructions.
6. Approved shop drawings, working drawings and samples.
7. Field test records.
8. Construction photographs.

2.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI format.

C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the County.

2.03 MARKING DEVICES

A. Provide felt tip marking pens for recording information in the color code designated by the County.

2.04 RECORDING DRAWINGS PREPARATION

A. Record information concurrently with construction progress.

B. Do not conceal any work until required information is recorded.

C. Drawings; Legibly mark to record actual construction:

1. All underground piping with elevations and dimensions. Changes to piping location. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Actual installed pipe material, class, etc. Locations of drainage ditches, swales, water lines and force mains shall be shown every 200 feet (measured along the centerline) or alternate lot lines, whichever is closer. Dimensions at these locations shall indicate distance from centerline of right-of-way to the facility.
2. Field changes of dimension and detail.
3. Changes made by Field Order or by Change Order.
4. Details not on original contract drawings.
5. Equipment and piping relocations.
6. Locations of all valves, fire hydrants, manholes, water and sewer services, water and force main fittings, underdrain cleanouts, catch basins, junction boxes and any other structures located in the right-of-way or easement, shall be located by elevation and by station and offset based on intersection P.I.'s and centerline of right-of-way. For facilities located on private roads, the dimensioning shall be from centerline of paving or another readily visible baseline.
7. Elevations shall be provided for all manhole rim and inverts; junction box rim and inverts; catch basin rim and inverts; and baffle, weir and invert elevations in control structures. Elevations shall also be provided at the PVI's and at every other lot line or 200 feet, whichever is less, of drainage swales and ditches. Bench marks and elevation datum shall be indicated.
8. Slopes for pipes and ditches shall be recalculated, based on actual field measured distances, elevations, pipe sizes, and type shown. Cross section of drainage ditches and swales shall be verified.
9. Centerline of roads shall be tied to right-of-way lines. Elevation of roadway centerline shall be given at PVI's and at all intersections.
10. Record drawings shall show bearings and distances for all right-of-way and easement lines, and property corners.
11. Sidewalks, fences and walls, if installed at the time of initial record drawing submittal, shall be located every 200 feet or alternate lot lines, whichever is closer. Dimensions shall include distance from the right-of-way line and the back of curb and lot line or easement line.
12. Sanitary sewer mainline wyes shall be located from the downstream manhole. These dimensions shall be provided by on-site inspections or televiewing of the sewer following installation.
13. Elevations shall be provided on the top of operating nuts for all water and force main valves.
14. Allowable tolerance shall be ± 6.0 inches for horizontal dimensions. Vertical dimensions such as the difference in elevations between manhole inverts shall have an allowable tolerance of ± 1/8 inch per 50 feet (or part thereof) of horizontal distance up to a maximum tolerance of ± 2 inch.

15. Properly prepared record drawings on mylar, together with two copies, shall be certified by a design professional (Engineer and/or Surveyor registered in the State of Florida), employed by the Contractor, and submitted to the County.

D. Specifications and Addenda; Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
2. Changes made by field order or by change order.

E. Shop Drawings (after final review and approval):

1. Five sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

2.05 SUBMITTAL

A. Prior to substantial completion and prior to starting the bacteria testing of water lines, deliver signed and sealed Record Documents and Record Drawings to the County. These will be reviewed and verified by the inspector. If there are any required changes or additions, these shall be completed and the entire signed and sealed set resubmitted prior to final pay application.

B. The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare record drawings. Record drawings shall be certified by the professional(s) (Engineer or Surveyor licensed in Florida), as stipulated by the Land Development Ordinance and submitted on signed and sealed paper drawings, signed and dated mylar drawings together with an AutoCAD version on a recordable compact disk (CD).

C. The CD shall contain media in AutoCad Version 2004 or later, or in any other CAD program compatible with AutoCad in DWG or DXF form. All fonts, line types, shape files, external references, or other pertinent information used in the drawing and not normally included in AutoCad shall be included on the media with a text file or attached noted as to its relevance and use.

D. Accompany submittal with transmittal letter, containing:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title and number of each Record Document.
5. Signature of Contractor or his authorized representative.

Note: The data required to properly prepare these record drawings shall be obtained at the site, at no cost to the County by the responsible design professional or his/her duly appointed representative. The appointed representative shall be a qualified employee of the responsible design professional or a qualified inspector retained by the responsible design professional on a project-by-project basis.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01730 OPERATING AND MAINTENANCE DATA

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

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

Prepare operating and maintenance data as specified in this and as referenced in other pertinent sections of Specifications.

B. Instruct County's personnel in maintenance of products and equipment and systems.

C. Provide three (3) sets of operating and maintenance manuals for each piece of equipment provided within this Contract.

1.02 FORM OF SUBMITTALS

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

B. Format:

1. Size: 8-1/2 inch x 11 inch
2. Paper: 20 pound minimum, white, for typed pages
3. Text: Manufacturer's printed data or neatly typewritten
4. Drawings:

    a. Provide reinforced punched binder tab, bind in with text.
    b. Fold larger drawings to size of text pages.

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

    a. Provide typed description of product and major component parts of equipment.
    b. Provide indexed tabs.

6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:

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

C. Binders:

1. Commercial quality three-ring binders with durable and cleanable plastic covers.
2. Maximum ring size: 1 inch.

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

1.03 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit three copies of complete manual in final form.

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

1. Description of unit and component parts.
    a. Function, normal operating characteristics and limiting conditions.
    b. Performance curves, engineering data and tests.
    c. Complete nomenclature and commercial number of replaceable parts.
2. Operating Procedures:
    a. Start-up, break-in, routine and normal operating instructions.
    b. Regulation, control, stopping, shut-down and emergency instructions.
    c. Summer and winter operating instructions.
    d. Special operating instructions.
3. Maintenance Procedures:
    a. Routine operations.
    b. Guide to "trouble-shooting".
    c. Disassembly, repair and reassembly.
    d. Alignment, adjusting and checking.
4. Servicing and lubricating schedule.
    a. List of lubricants required.
5. Manufacturer's printed operating and maintenance instructions.
6. Description of sequence of operation by control manufacturer.
7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    a. List of predicted parts subject to wear.
    b. Items recommended to be stocked as spare parts.
8. As installed control diagrams by controls manufacturer.
9. Each contractor's coordination drawings.
    a. As installed color coded piping diagrams.
10. Charts of valve tag numbers, with location and function of each valve.
11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
12. Other data as required under pertinent sections of specifications.

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

1. Description of system and component parts.

    a. Function, normal operating characteristics and limiting conditions.
    b. Performance curves, engineering data and tests.
    c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories of panelboards.

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

3. As-installed color coded wiring diagrams.
4. Operating procedures:

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

5. Maintenance procedures:

    a. Routine operations.
    b. Guide to "trouble-shooting".
    c. Disassembly, repair and reassembly.
    d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.
7. List of original manufacture's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
8. Prepare and include additional data when the need for such data becomes apparent during instruction of County's personnel.

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

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

1.04 SUBMITTAL SCHEDULE

A. Submit one copy of completed data in final form fifteen days prior to substantial completion.

1. Copy will be returned after substantial completion, with comments (if any).

B. Submit two copies of approved data in final form. Final acceptance will not be provided until the completed manual is received and approved.

1.05 INSTRUCTION OF COUNTY'S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct County's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

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

1. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01740 WARRANTIES AND BONDS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to County for review and transmittal.

1.02 SUBMITTAL REQUIREMENTS

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 orderly sequence. Provide complete information for each item.

1. Product or work item.
2. Firm, with name of principal, address and telephone number.
3. Scope.
4. Date of beginning of warranty, bond or service and maintenance contract.
5. Duration of warranty, bond or service maintenance contract.
6. Provide information for County's personnel:

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

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

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 inch x 11 inch punched sheets for standard 3-ring binder. Fold larger sheets to fit into binders.
2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:

    a. Title of Project.
    b. Name of Contractor.

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.04 TIME OF SUBMITTALS

A. Make submittals within ten days after date of substantial completion and prior to final request for payment.

B. For items of work, where acceptance is delayed materially beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.05 SUBMITTALS REQUIRED

A. Submit warranties, bonds, service and maintenance contracts as specified in respective sections of Specifications.

B. Approval by the County of all documents required under this section is a pre-requisite to requesting a final inspection and final payment

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01900 PERMITS

PART 1 GENERAL

1.01 GENERAL

A. The Contractor shall obtain all permits necessary to complete Work under this Contract.

B. Where permits require that certain work is to be performed only in the presence of a representative of the permitting entity, the Contractor shall provide all coordination and notification required to assure the permit conditions are not violated.

1.02 PERMITS

A. The Owner has obtained / will obtain permits from the following agencies where required for the construction of the work included in the project.

1. N/A

B. All other permits and licenses required to perform the work included in the contract are the complete and total responsibility of the CONTRACTOR including but not limited to the following:

1. FDEP – NOI including preparation of SWPPP
2. FDEP - Generic Permit for the Discharge of Produced Groundwater
3. Manatee County Building Permit (Signed and Sealed Drawings will be provided to Contractor by McKim & Creed).

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

DIVISION 2 SITE WORK

SECTION 02050 DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes demolition, debris removal, items to be abandoned in place and items to be salvaged as indicated on the Drawings and as specified herein.

B. Demolition items may include, but may not be limited to the following:

1. Removal of electrical and mechanical equipment, including hatches.
2. Removal of equipment pads.
3. Wall demolition for doorways
4. Outdoor slabs and walls.
5. Demolition required for the Wet Well Rehabilitation
6. Piping, valves, meters, vaults, conduit and duct banks.
7. All other items required, whether or not shown on the Drawings or specified herein.

C. Additional items to be salvaged may be identified during the preconstruction meeting.

1.02 QUALITY ASSURANCE

A. Accomplish all demolition work so there is no injury to any persons and no damage to adjacent structures or property. All demolition methods shall be in full compliance with municipal, county, state, and federal ordinances. Demolition work shall comply with the requirements of the Occupational Safety and Health Administration (OSHA).

B. The Contractor shall comply with all municipal, county, state and federal ordinances regarding the disposal of rubble, scrap metal, and refuse.

C. Demolition procedures shall provide for safe conduct of the work, protection of property which is to remain undisturbed, and coordination with other work in progress.

1.03 JOB CONDITIONS

A. It shall be the responsibility of the Contractor to visit the site and inspect the nature and condition of the items to be removed and salvaged before submitting his bid.

B. Dust Control: Control the amount of dust resulting from demolition to prevent the spread of dust to occupied portions of buildings and to avoid creation of a nuisance in the surrounding area. Do not use water when it will result in, or create, hazardous or objectionable conditions such as flooding and pollution.

C. Protection of Existing Work: Protect existing work. Work damaged by the Contractor shall be repaired to match existing work.

D. No interference with plant operations: Demolition work shall be scheduled and conducted so there is no interference with normal plant operations or deliveries.

PART 2 PRODUCTS

2.01 REPAIR AND REPLACEMENT MATERIALS

A. Materials used in the repair or replacement of existing work to remain shall be the higher cost of: 1) Materials specified or shown in the Contract Documents; or 2) items identical or equal to the materials used in existing work when new.

2.02 PIPE ABANDONMENT GROUT

A. Pipe abandonment grout shall conform to the “Non-Excavatable” flowable fill described in FDOT Specification Section 121.

PART 3 EXECUTION

3.01 STRUCTURES AND BUILDINGS

A. Remove all parts of existing structures to be demolished to a minimum depth of 3-ft below grade unless otherwise shown on the drawings. Structures left below grade shall be punctured to allow water to pass through and prevent flotation.

3.02 EQUIPMENT

A. Completely remove equipment which is designated to be removed.

B. Remove concrete equipment bases if the existing bases are not to be used for new equipment.

C. Completely remove isolated equipment bases and patch flooring as needed.

3.03 PIPING

A. Completely remove piping, conduit, and wiring in structures and buildings which are to be demolished, partially demolished, and where otherwise designated to be removed as shown on the Drawings. When not indicated on the Drawings, the removal of said piping, conduit and wiring shall be a minimum of 5-feet from the outside of the structure or building. The Contractor shall schedule underground pipe removal and new pipe installation in order to minimize disruption of the existing piping system and reduce bypass pumping.

B. Underground piping, conduit, and wiring which are to be abandoned and do not interfere with new work may be left in place, except for wiring which has to be completely removed, unless otherwise shown on the Drawings. Plug and seal ends of underground piping to be abandoned. Grout fill abandoned pipes in accordance with plans. Do not leave abandoned branches of piping and wiring “live”. Isolate abandoned branches by closing branch valve at main or by disconnecting branch at main. Plug, cap, and seal active branch at isolating valve or point of disconnection.

C. Properly disconnect, seal and plug utility services to structures and buildings which are completely demolished. Properly disconnect, seal, and plug utility lines within structures and buildings which are partially demolished.

3.04 DISPOSAL

A. Equipment, piping, and materials which are designated to remain the property of the Owner shall be moved to a location within the project site designated by the Owner.

B. All removed equipment, piping, and materials not specifically designated to remain the property of the Owner shall become the property of the Contractor and shall be removed from the site and properly disposed of.

C. Do not allow debris and rubbish to accumulate on the site. Remove debris and rubbish from the site.

D. If the Contractor uses Manatee County Sanitary Landfill for disposal, the Contractor shall be required to pay a tipping fee when crossing the landfill weighing scales.

3.05 FILLING

A. Backfill excavations resulting from demolition.

B. Backfill excavations which will not be beneath new structures, buildings, piping, or other new work as specified in this paragraph.

C. Backfill excavations more than three feet deep or more than five cubic yards in volume as specified in Section 02200- Earthwork.

D. Place and compact backfill in other excavations to produce an adequate foundation for grassing.

3.06 CLEAN-UP

A. Clean-up in areas where other work is to be done following demolition shall be as specified in the applicable Sections.

B. Clean-up the job site in areas where no other work is to be done under this Contract following demolition. Remove all debris and rubbish, temporary facilities, and equipment. Level surface irregularities to eliminate depressions. Leave the work in a neat and presentable condition.

END OF SECTION

SECTION 02064 MODIFICATIONS TO EXISTING STRUCTURES, PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required to modify, alter and/or convert existing structures as shown or specified and as required for the installation of piping, mechanical equipment and appurtenances. Existing piping and equipment shall be removed and dismantled as necessary for the performance of facility alterations in accordance with the requirements herein specified.

PART 2 PRODUCTS

A. Epoxy mortar shall be fiberglass fiber mixed with an epoxy filler.

B. Non-shrink grout shall be a sand-cement, non-metallic formulation, having a 28-day strength of 4,000 psi and 0.0 percent shrinkage per ASTM C1090.

C. Liners to be installed in existing manholes and wetwells shall be spray-applied, monolithic, reinforced urethane resin. Urethane resin-based manhole liner material shall be resistant to hydrogen sulfide gas, and other common contents found in a sanitary sewer environment.

D. Approved manhole and wet well liner products are Raven 405, Green Monster, or SpectraShield.

PART 3 EXECUTION

3.01 GENERAL

A. Cut, repair, reuse, excavate, demolish or otherwise remove parts of the existing structures or appurtenances, as indicated on the construction drawings, or as necessary to complete the work as required. Dispose of surplus materials resulting from the above work in an approved manner. The work shall include all necessary cutting and bending of reinforcing steel, structural steel, or miscellaneous metal work found embedded in the existing structures.

B. Dismantle and remove all existing equipment, piping, and other appurtenances required for the completion of the work. Where called for or required, cut existing pipelines for the purpose of making connections thereto.

C. Anchor bolts for equipment and structural steel to be removed shall be cut off one inch below the concrete surface. Surfaces shall then be refinished using non-shrink grout or epoxy mortar or as indicated on the construction drawings. Repairs to the interior surfaces of existing concrete structures in sanitary sewers shall be made with epoxy mortar. Repairs to be made on other existing concrete surfaces using non-shrink grout shall be made using a bonding agent such as Acrylbond by Concrete Producers Solutions or an equal approved by the County. Remove all dirt, curing compounds, sealers, paint, rust or other foreign material, and etch with

muriatic acid solution. Flush with clean water and while still damp, apply a coating of the bonding agent. Place the new grout patch onto the treated area immediately.

D. At the time that a new connection is made to an existing pipeline, additional new piping, extending to and including a new valve, shall be installed. Pipe restraint devices, if required, shall also be installed as required. At the time when a new potable or reclaimed water service is installed, a pipe locator tracer wire shall be installed and connected to the tracer wire at the main.

E. No existing structure, equipment, or appurtenance shall be shifted, cut, removed, or otherwise altered except with the express approval of and only to the extent approved by the County. All existing valve boxes, fire hydrants, air release valve cabinets, and manholes shall be relocated to meet the new finished grade elevations after construction.

F. When removing materials or portions of existing utility pipelines or structures or when making openings in walls and partitions, take all precautions and use all necessary barriers and other protective devices so as not to damage the structures beyond the limits necessary for the new work, and not to damage the structures or contents by falling or flying debris. Unless otherwise approved by the County, saw-cutting, rotary core-boring, or line drilling will be required in removing material from existing concrete structures or pipes.

G. Materials and equipment removed in the course of making alterations and additions shall remain the property of the County, except that items not salvageable, as determined by the County, shall be disposed of off the work site.

H. All alterations to existing utility pipes and structures shall be done at such time and in such a manner as to comply with the approved time schedule. Before any part of the work is started, all tools, equipment, and materials shall be assembled and made ready so that the work can be completed without delays.

I. All cutting of existing concrete or other material to provide suitable bonding to new work shall be done in a manner to meet the requirements of the respective section of these Standards covering the new work. When not covered, the work shall be carried on in the manner and to the extent directed by the County or per the construction drawings.

J. Surfaces of seals visible in the completed work shall be made to match as nearly as possible the adjacent surfaces.

K. Non-shrink cementatious grout shall be used for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete and elsewhere as shown on the construction drawings. The surface to which grout is to be applied shall be wetted to facilitate good bonding.

L. Where necessary or required for the purpose of making connections; cut existing pipelines in a manner to provide an approved joint. Where required, use flanges, couplings, or adapters, all as required.

M. Provide flumes, hoses, piping, pumps and well points, and other related items to divert or provide suitable plugs, bulkheads, or other means to hold back the flow of water or other liquids, all as required in the performance of the work.

N. Care shall be taken not to damage any part of existing buildings or foundations or outside structures.

O. Prior to entering confined spaces in sanitary sewer structures, conduct an evaluation of the atmosphere within, in accordance with local, state, and federal regulations. Provide ventilation equipment and other equipment as required to assure safe working conditions.

3.02 CONNECTING TO EXISTING PIPING AND EQUIPMENT

The Contractor shall verify exact location, material, alignment, joint, etc. of existing piping and equipment prior to making the connections called out in the Drawings. The verifications shall be performed with adequate time to correct any potential alignment or other problems prior to the actual time of connection. A County Inspector must be present for all tie-ins for a visual inspection.

3.03 REMOVAL AND ABANDONMENT OF ASBESTOS CEMENT PIPE AND APPURTENANCES

A. All work associated with the removal or abandonment of existing asbestos cement pipe and appurtenances shall be performed by a licensed asbestos removal Contractor registered in the State of Florida.

B. The asbestos Contractor shall contact the appropriate regulatory agencies prior to removal or abandonment of any asbestos material and shall obtain all required permits and licenses and issue all required notices. The cost for all fees associated with permits, licenses and notices to the governing regulatory agencies shall be borne by the asbestos Contractor.

C. All work associated with removal or abandonment of asbestos cement pipe and appurtenances shall be performed in accordance with the standards listed below and all other applicable local, State, or Federal standards.

(1) Florida Administrative Code, Chapter 62-257, ASBESTOS PROGRAM
(2) Title 40 CFR, Part 61, Subpart M, NATIONAL EMISSION STANDARD FOR ASBESTOS
(3) Occupational Safety and Health Act, Title 29 CFR
(4) Title 40 CFR, Part 763, ASBESTOS
(5) Florida Statute Title XXXII, Chapter 469, ASBESTOS ABATEMENT

D. All asbestos cement pipe sections indicated on the construction drawings to be removed, and all related tees, valves, fittings and appurtenances shall be removed in their entirety and disposed of by the asbestos Contractor in accordance with this Section. Asbestos cement nipples between tees and valves shall be replaced. After removal of the pipelines, all excavations shall be backfilled in accordance with the applicable provisions of the Trenching and Excavation Section of these Standards. The cost of disposing of the removed materials shall be borne by the asbestos Contractor.

E. The cutting of existing asbestos-cement (A/C, a.k.a. "Transite") pipe shall be by hand tools only. No powered machine cutting is allowed. Removal of all fragments of pipe shall be double bagged prior to shipment. Longer sections of pipe removed may be shipped without double bagging. An asbestos manifest form must accompany each shipment of such pipe or pipe material waste to the Manatee County Lena Road Landfill. Prior to each shipment, a minimum of 24 hours notice to the Landfill field office (telephone (941) 748-5543) is required.

3.04 IN-PLACE GROUTING OF EXISTING PIPE

A. Where water and wastewater utility pipes are to be abandoned in place, they shall be filled with a nonshrinking sand-cement grout. When such pipes are made of asbestos-cement materials, the abandonment activities shall be performed by a licensed asbestos Contractor. It is completely the Contractor's responsibility to obtain all regulatory clearances and provide documentation in cases where they have determined that an asbestos-cement pipe abandonment activity by in-place grouting does not require a licensed asbestos Contractor.

B. The ends of the pipe sections to be grout-filled shall be capped or plugged with suitable pipe fittings. The grout material shall be of suitable properties and the pumping pressure shall be such that the pipe sections are filled completely with grout. All above ground features shall be removed: hydrants, meters, valve & meter boxes, pads, vaults, etc. Existing tees, crosses, and valves left in service shall be plugged and restrained.

C. The County shall be given timely notice so that the County's representative may be present to monitor all pipe grouting operations. Provide standpipes and/or additional means of visual inspection as required to determine if adequate grout material has filled the entire pipe sections.

D. All tees, crosses, and valves left in service shall be plugged and restrained.

3.05 SPRAY-APPLIED LINERS

A. Use a high-pressure water spray to remove all foreign material from the walls and bench of the structure. Loose or protruding masonry materials shall be removed using a hammer and chisel. Fill any voids, holes or cracks using a hand trowel with epoxy mortar to form a uniform surface. Place covers over all pipe openings to prevent extraneous material from entering the pipes. Block or divert sewer flow from entering the structure. Any infiltration leaks shall be stopped by using such methods as approved by the County.

B. The liner material shall be sprayed onto the invert, bench and wall areas. The sprayed-on material shall be applied such that the entire structure is lined with a structurally enhanced monolithic liner. The thickness of the wall liner material shall be such that it will withstand the hydraulic load generated by the surrounding groundwater table, using a factor of safety of two, and using the assumption that the groundwater table is at the level of the top of the structure. The invert and bench liner material shall be the same thickness as that required for the base of the wall.

C. Special care shall be used to provide a smooth transition between the intersecting pipelines and the manhole inverts such that flow is not impaired. Remove concrete

material from the existing manhole base channel in depth to the required thickness of the new liner material.

D. No active sewer flow shall be allowed in the newly lined structure, nor shall any vacuum tests be performed, until the liner material has had adequate time to cure, as recommended by the liner material manufacturer.

E. Install the coating systems per manufacturer's recommendation and completely protect the structure from corrosion. The liner or coating systems must extend and seal onto manhole ring, onto and around pipe openings and any other protrusions, and completely cover the bench and flow invert. Provide a five (5)-year unlimited warranty on all workmanship and products. The work includes the surface preparation and application of the coating or liner system, and shall protect the structure for at least five (5) years from all leaks and from failure due to corrosion from exposure to corrosive gases such as hydrogen sulfide.

3.06 CONNECTION TO EXSTING MANHOLE

A. Where required or as indicated on the construction drawings, make connection of new pipelines to existing manhole structures. If pipe stub-outs of the correct size and position are not available, make connections by removing a portion of the manhole wall by mechanical rotary core boring. The connection between pipe and concrete manhole shall be complete with resilient seals meeting the requirements of ASTM C923.

B. A new channel shall be formed in the manhole base by removing and reforming or by providing new concrete to convey the new flow into the existing channel in accordance with the standard requirements for new sewer manhole structures. Flow direction shall not change by more than 90 degrees within the manhole base.

C. Repair internal coating of existing manholes cored during connection of new sewers by applying approved coating material as listed above in accordance with the manufacturer's recommendations. If existing manhole has an internal coating other than that listed above, sandblast the interior of the existing manhole and apply an approved coating in accordance with the manufacturer's recommendations.

D. When connecting a force main to an existing manhole, the force main termination manhole and the next two manholes downstream shall be rehabilitated and lined with a currently approved liner. If the existing manholes are lined with a non-conforming liner according to Part 2.D above, the existing liner shall be removed and replaced, unless otherwise noted on the plans or with written approval by the County.

END OF SECTION

SECTION 02110 CLEARING AND GRUBBING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

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

Protection. Provide temporary fences, barricades, coverings, or other protection to preserve existing items indicated to remain and to prevent injury or damage to persons or property. Provide protection for adjacent properties as required.

A. Restore damaged work to condition existing prior to start of Work.

B. Protect existing trees and vegetation that are indicated to remain from physical damage. Do not store materials or equipment within tree drip line. Use licensed arborist for tree damage repair. Replace damaged trees that cannot be restored to full growth, as determined by arborist, unless otherwise acceptable to ENGINEER.

C. Existing Services: Locations indicated are approximate; determine exact location before commencing Work. Coordinate with local utility service requirements and comply with their instructions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

Site Clearing. Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions as indicated or that interfere with new construction. Removal includes digging out stumps and roots, together with subsequent off-site disposal.

A. Strip and stockpile topsoil that will be reused in the Work.

B. Remove existing improvements, both above-grade and below-grade, to extent indicated or as otherwise required to permit new construction.

C. Salvable Items: Carefully remove items indicated to be salvaged and store on OWNER's premises where indicated or directed.

D. Control air pollution caused by dust and dirt; comply with governing regulations.

E. Fill depressions and voids resulting from site-clearing operations. Using satisfactory soil materials, place in maximum 6-inch-deep horizontal layers and compact each layer to density of surrounding original ground.

F. Grade ground surface to conform to required contours and to provide surface drainage.

G. Dispose of waste materials, including trash, debris, and excess topsoil, off OWNER's property.

H. Burning waste materials on site is not permitted.

END OF SECTION

SECTION 02220 EXCAVATION, BACKFILL, FILL AND GRADING FOR STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Structural excavation shall consist of the removal of material for the construction of foundations for structures and other excavation designated on the drawings or in these specifications.

B. Structural excavation and backfill shall consist of furnishing material, if necessary and placing and compacting backfill material around structures to the lines and grades designated on the drawings, as specified or directed by the County.

C. Structural excavation and backfill shall include the furnishing of all materials, equipment and other facilities which may be necessary to perform the excavations, place and compact the backfill, install sheeting and bracing, and carry out any necessary dewatering. It shall also include the wasting or disposal of surplus excavated material in a manner and in locations approved by the County.

D. The Contractor is responsible for the protection of every tree which is scheduled to remain in the project area. This includes trees which may or may not be shown on the plans. Every tree shall be adequately protected in place at no additional cost to the County. This includes, but is not limited to, protecting the root systems and adjusting grades as necessary for tree/root protection.

1.02 QUALITY ASSURANCE

A. Testing Agency:

1. In place soil compaction tests shall be performed by a qualified testing laboratory.
2. Compaction tests shall be taken every 500 feet, except in the road crossings or road shoulders. Tests are to be taken according to current FDOT Standards.

B. Reference Standards:

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

    a. ASTM D1557, Moisture-Density Relations of Soils Using 10-lb. (4.5-kg) Rammer and 18-in. (457-mm) Drop.

1.03 JOB CONDITIONS

A. The Contractor shall provide, operate and maintain all necessary pumps, discharge lines, well points, etc., in sufficient number and capacity to keep all excavation, bases, pits, etc., free from seepage, standing or running water at all times throughout the period of construction.

B. The Contractor shall assume all responsibility for the security of the excavation required, employing bracing, lining or other accepted means necessary to accomplish same.

C. Excavated areas shall be cleared of all debris, water, slush, muck, clay and soft or loose earth and shall be conditioned to the entire satisfaction of the County.

D. All excavated material unsuitable for use or which will not be used shall be disposed of in a manner consistent with State and County regulation.

E. All unsuitable organic materials, roots, logs, etc., found during excavation shall be removed by the Contractor and the trench shall be refilled with suitable material.

PART 2 PRODUCTS

2.01 MATERIAL FOR CONTROLLED FILL

A. Composition: Only approved material free from organic matter and lumps of clay, shall be used for backfill. Excavated earth free from debris or organic material may be used for backfilling foundations or fill.

B. Crushed stone and shell shall meet or exceed current FDOT Standards.

2.02 UNSUITABLE MATERIAL

Unsuitable material shall be defined as highly organic soil per ASTM D2487 Group PT. This includes, but is not limited to, such items as topsoil, roots, vegetable matter, trash, debris, and clays that cannot be dried sufficiently to obtain specified compaction.

PART 3 EXECUTION

3.01 INSPECTION

A. The Contractor shall verify that work preceding the affected work of this Section has been satisfactorily completed.

B. Conditions adversely affecting the work of this Section shall be corrected to the satisfaction of the County.

3.02 REMOVAL OF UNSUITABLE MATERIALS

A. The Contractor shall remove unsuitable material from within the limits of the Work.

B. Materials meeting requirements for controlled fill shall be stockpiled as necessary and in such a manner satisfactory to the County.

C. All material excavated shall be placed so as to minimize interference with public travel and to permit proper access for inspection of the work.

3.03 EXCAVATION

A. When concrete or shell subbase footing is to rest on an excavated surface, care shall be taken not to disturb the natural soil. Final removal and replacement of the foundation material and subbase compaction to grade shall not be made until just before the concrete or masonry is placed.

B. When any structural excavation is completed, the Contractor shall notify the County who will make an inspection of the excavation. No concrete or masonry shall be placed until the excavation has been approved by the County.

C. The elevations of the footing bottom and the base slab as shown on the Drawings, shall be considered as approximate and the County may order in writing, such changes in dimensions or elevations of the footings and slab base as necessary to secure satisfactory foundations.

D. All excavation shall be made within an area bounded by lines five feet outside and parallel to the exterior walls of the structure to allow for correct forming, shoring and inspection of foundation work. Pouring of concrete against earth side walls shall not be permitted.

E. If the ground is excavated below the grade called for by the Drawings or becomes unstable due to the Contractor's carelessness or operations, the ground shall be excavated to undisturbed native soil before continuing concreting operations.

F. If in the opinion of the County, the material at or below the normal grade of the bottom of the trench is unsuitable for pipe or structure foundation, it shall be removed to the depth directed by the County and if so directed, replaced by crushed stone or washed shell.

3.04 STRUCTURAL BACKFILL

A. Structural backfill shall not be placed until the footings or other portions of the structure or facility have been inspected by the County and approved for backfilling.

B. A minimum of 1-1/2" layer of lean concrete shall be placed as a working mat for the concrete base slabs and footings if required by the County.

C. Fill shall be placed in uniform layers not more than 12" thick and compacted to a minimum of 98 percent of the maximum density determined by ASTM D1557, Method A or C, or as directed by the County. The Contractor shall securely tamp the backfill with pneumatic rammer around all wall foundations. The method of compaction shall be satisfactory to the County.

D. Compaction of structural backfill by ponding and jetting may be permitted when, as determined by the County: the backfill material is of such character that it will be self-draining when compacted; foundation materials will not soften or be otherwise damaged by the applied water; no damage from hydrostatic pressure will result to the structure. Ponding and jetting within two feet below finished subgrade shall not be permitted in roadway areas. At the discretion of the County, ponding and jetting may be permitted with compaction layers not to exceed four feet.

E. Surplus material not used on-site shall be removed and disposed of off-site by the Contractor. In no case shall surplus material be deposited on adjacent lands. Fill used for grading shall be placed in layers not to exceed 12 inches in thickness and shall be compacted to a density equal or greater to that of the surrounding natural ground.

3.05 BACKFILLING AROUND STRUCTURES

A. Common fill and structural fill are specified for use as backfill against the exterior walls of the structures. Fill shall be placed in layers having a maximum thickness of eight (8) inches in loose state and shall be compacted sufficiently to prevent settlement. If compaction is by rolling or ramming, material shall be wetted down as required. Where material can be suitably compacted by jetting or puddling, the Contractor may use one of these methods. No boulders shall be allowed to roll down the slopes and hit the walls.

B. Backfilling shall be carried up evenly on all walls of an individual structure simultaneously. A variation of two (2) feet in elevation will be the maximum allowable. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength. Backfilling shall be subjected to approval by the County.

C. In locations where pipes pass through building walls, the Contractor shall take the following precautions to consolidate the refill up to an elevation of at least one foot above the bottom of the pipes:

1. Place structural fill in such areas for a distance of not less than three feet either side of the center line of the pipe in level layers not exceeding 6-inches in depth.
2. Wet each layer to the extent directed and thoroughly compact each layer with a power tamper to the satisfaction of the County.
3. Structural fill shall be of the quality specified under Part 2 of this Section.

D. The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the grading plan. No soft spots or uncompacted areas shall be allowed in the work.

E. Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

3.06 FIELD QUALITY CONTROL

A. The density of soil in place shall be a minimum of 95 percent in accordance with ASTM test 1557-70T, Method A or C.

END OF SECTION

SECTION 02221 TRENCHING, BEDDING AND BACKFILL FOR PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform all dewatering, excavation, backfill, fill, grading, trench protection or other related work required to complete the piping work shown on the Drawings and specified herein. The work shall include, but not be limited to: vaults; duct conduit; pipe; roadways and paving; backfilling; required fill or borrow operations; grading; disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing and dewatering.

B. Prior to commencing work, the Contractor shall examine the site and review test borings if available, or undertake his own subsurface investigations and take into consideration all conditions that may affect his work.

C. The Contractor is responsible for the protection of every tree which is scheduled to remain in the project area. This includes trees which may or may not be shown on the plans. Every tree shall be adequately protected in place at no additional cost to the County. This includes, but is not limited to protecting the root systems and adjusting grades as necessary for tree/root protection.

1.02 PROTECTION

A. Sheeting and Bracing in Excavations:

1. In connection with construction of underground structures, the Contractor shall properly construct and maintain cofferdams. These shall consist of: sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing yard pipe and/or foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.
2. Trench sheeting for pipes: no sheeting is to be withdrawn if driven below, mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by the County. During the progress of the work, the County may direct the Contractor in writing to leave additional wood sheeting in place. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given for an alternate method of removal.
3. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. Unless otherwise approved or indicated on the Drawings or in the Specification, all sheeting and bracing shall be removed after completion of the piping or structure, care being taken not to disturb or otherwise injure the pipeline or finished masonry. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by

ramming with tools specifically made for that purpose, by watering, or as may otherwise be directed.

4. The Contractor shall construct, to the extent he deems it desirable for his method of operation, the cofferdams and sheeting outside the neat lines of the pipeline trench or foundation unless otherwise indicated on the Drawings or directed by the County. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the pipeline or structure will be subjected. Pumping, bracing and other work within the cofferdam shall be done in a manner to avoid disturbing any construction of the pipeline or the enclosed masonry. Any movement or bulging which may occur shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.
5. Drawings of the cofferdams and design computations shall be submitted to the County and approved prior to any construction. However, approval of these drawings shall not relieve the Contractor of the responsibility for the cofferdams. The drawings and computations shall be prepared and stamped by a Registered Professional Engineer in the State of Florida and shall be in sufficient detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the pipeline and substructures.

B. Dewatering, Drainage and Flotation

1. The Contractor shall construct and place all pipelines, concrete work, structural fill, bedding rock and limerock base course, in-the-dry. In addition, the Contractor shall make the final 24" of excavation for this work in-the-dry and not until the water level is a minimum of 18 below proposed bottom of excavation.
2. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavation and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations. At all times during the construction operations, the groundwater levels shall be maintained at an elevation 18 inches below the lowest level where structures are being installed.
3. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
4. Wellpoints may be required for dewatering the soil prior to final excavation for deeper in-ground structures or piping and for maintaining the lowered groundwater level until construction has been completed to avoid the structure, pipeline, or fill from becoming floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from wellpoints shall be continuous and standby pumps shall be provided.
5. The Contractor shall furnish all materials and equipment to perform all work required to install and maintain the proposed drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.

6. Where required, the Contractor shall provide a minimum of two operating groundwater observation wells at each structure to determine the water level during construction of the pipeline or structure. Locations of the observation wells shall be at structures and along pipelines as approved by the County prior to their installation. The observation wells shall be extended to 6 inches above finished grade, capped with screw-on caps protected by 24" x 24" wide concrete base and left in place at the completion of this Project.
7. Prior to excavation, the Contractor shall submit his proposed method of dewatering and maintaining dry conditions to the County for approval. Such approval shall not relieve the Contractor of the responsibility for the satisfactory performance of the system. The Contractor shall be responsible for correcting any disturbance of natural bearing soils for damage to pipeline or structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.
8. As part of his request for approval of a dewatering system, the Contractor shall demonstrate the adequacy of the proposed system and wellpoint filter sand by means of a test installation. Discharge water shall be clear, with no visible soil particles in a one quart sample. Discharge water shall not flow directly into wetlands or Waters of the State as defined by FDEP and SWFWMD.
9. During backfilling and construction, water levels shall be measured in observation wells located as directed by the County.
10. Continuous pumping will be required as long as water levels are required to be below natural levels.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials for use as fill and backfill shall be described below and shall be from an FDOT certified pit. For each material, the Contractor shall notify the County of the source of the material and shall furnish the County, for approval, a representative sample weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.
2. Additional materials shall be furnished as required from off-site sources and hauled to the site.

B. Bedding - shall conform to FDOT Standard Specifications for Road and Bridge Construction, Section 901 Coarse Aggregate, and shall be either coarse aggregate of Size No. 57 or coarse sand of Size No. 9. Washed shell size No.57 may be used as an alternate bedding material.

C. Structural Fill

1. Structural fill in trenches shall be used below spread footing foundations, slab-on-grade floors and other structures as backfill within three feet of the below grade portions of structures.

2. Shall be either soil classification A-1, A-2 or A-3, per AASHTO M-145, and shall be free of organic matter, lumps of clay or marl, muck, compressible materials, and rock exceeding 2.5 inches in diameter. Broken concrete, masonry, rubble or other similar materials shall not be used as backfill. Minimum acceptable density shall be 98 percent of the maximum density as determined by AASHTO T-180.

D. Selected Common Fill - shall have the same material classification and requirements as Structural Fill, as described above.

E. Common Fill

1. Shall be either soil classification A-1, A-2, A-3, A-4, A-5 or A-6, per AASHTO M-145, and shall be free of organic matter, lumps of clay or marl, muck, compressible materials and rock exceeding 2.5 inches in diameter. Broken concrete, masonry, rubble or other similar materials shall not be used as backfill.
2. Material falling within the above specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the County, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials by the Contractor.

E. Unsuitable Material - soil classification A-7 and A-8, per AASHTO M-145, shall not be used as backfill material.

PART 3 EXECUTION

3.01 EXCAVATION

A. Excavate trenches and pits for structures to the elevations indicated on the construction drawings. Take special care to avoid over-excavating or disturbing the bottom of the trench or pit, so that the soil at the bottom of the hole remains in a naturally compacted condition. Excavate to widths sufficient to provide adequate working room to install the required structures. Do not excavate the final layer of soil to the designed grade until just before placing the bedding, foundation, pipe, structure, or masonry work required. Remove boulders, rocks, logs or any unforeseen obstacles encountered.

B. In case the foundation soil found at the bottom of the trench or pit is soft, plastic or mucky, or does not conform to the soils classification specified as suitable foundation material, over-excavation to a greater depth will be required. Soils not meeting the classification required for foundation material shall be removed to a depth at least four inches below the bottom of the pipe, bedding or structure bottom elevation. Rock, boulders or other hard or lumpy material shall be removed to a depth 12 inches below the bottom of the pipe, bedding or structure bottom elevation. Remove muck, clay or other soft material to a depth as needed to establish a firm foundation.

C. Where possible, the sides of trenches should be vertical up to at least the spring line of the installed pipe.

D. Trench excavation shall be performed in accordance with Florida Statute Title XXXIII, Chapter 553, Part III, Trench Safety Act.

3.02 BACKFILLING

A. Backfill materials shall be placed on solid, firm, naturally compacted or compacted to 98 percent of the maximum dry density of the material as determined by AASHTO T-180, dry or dewatered in place soil foundations.

B. Where over-excavation is required due to nonconforming soil classification or rocky, unstable, or otherwise undesirable soil conditions, place Structural Fill or Selected Common Fill in the over-excavated zone up to the base of the bedding material layer. Compact the over-excavated zone to 98 percent of the maximum dry density of the material as determined by AASHTO T-180.

C. When backfilling in an over-excavated zone where moist or watery conditions exist, backfill shall be coarse No. 9 sand or a mixture of No. 57 coarse aggregate with either No. 9 coarse sand, A-1, or A-3 material.

D. After compaction, backfill material in the over-excavation zone shall form a solid and firm foundation on which to build up successive layers of backfill and structures.

E. Bedding materials shall be placed on solid, firm soil foundations and shall be compacted to 98 percent of the maximum dry density of the material as determined by AASHTO T-180.

F. Concrete and masonry structures shall be backfilled using Structural Fill. Backfilling and compaction shall be underneath the structure and carried up evenly on all walls of an individual structure simultaneously. The maximum allowable difference in backfill elevations shall be two feet. No backfilling shall be allowed against concrete or masonry walls until the walls and their supporting slabs have been in place at least seven days or until the specified 28-day strength has been attained. Compaction of Structural Fill underneath the base and along the walls shall be 98 percent of the maximum dry density of the material as determined by AASHTO T-180. The Structural Fill shall be either dried or shall have water added so that the moisture content of the material is within a range that will allow the required density to be achieved.

G. Trenching backfill for pipe installation shall be Selected Common Fill for the pipe bedding zone. The pipe bedding envelope shall begin at the level four inches, six inches, or nine inches, depending on pipe diameter, below the bottom of the pipe, and shall extend vertically up to a level 12 inches above the top of the pipe. Where the in-place soil material within the four inch, six inch, or nine inch pipe bedding zone beneath the bottom of the pipe meets the soil classification for Selected Common Fill, undercutting of the trench below the bottom of the pipe will not be required. In this case, loosen the soil in the bottom of the trench immediately below the middle third of the pipe diameter, and place the pipe upon it. Where the in-place soil material within the pipe bedding zone does not meet the soil classification for Selected Common Fill, undercutting shall be required, and the bedding zone shall be backfilled with Selected Common Fill. In this case, place the pipe bedding material and leave it in a moderately firm uncompacted condition under the middle

third of the pipe diameter, and compact the outer portions of the trench bottom to 98 percent of the maximum dry density. Soils that were over-excavated due to rocky, soft or otherwise unsuitable soil foundation conditions shall also be replaced with Selected Common Fill. Compaction of Selected Common Fill shall be 98 percent of the maximum dry density as determined by AASHTO T-180. Such backfill material shall have an optimized moisture content that will allow the required density to be achieved.

H. Pipe sections for gravity flow systems shall be laid with spigots downstream and bells upstream. Excavate for pipe bells before laying pipe. Lay pipe true to the lines and grades indicated on the construction plans. Place backfill material on both sides of the pipe and compact to 98 percent of the maximum dry density of the material as determined by AASHTO T-180. Take special care to effectively fill and compact the material in the haunch areas under the sides of the pipe.

I. For pipes that are not installed under roadways or driveways, trenching backfill for pipe installation shall be Common Fill above the pipe envelope zone, and shall be compacted to 95 percent of the maximum dry density of the material as determined by AASHTO T-180, and shall have moisture content optimized to allow the required density. For pipes that are installed under roadways or driveways, trenching backfill for pipe installation shall be Selected Common Fill above the pipe envelope zone, and shall be compacted to 98 percent of the maximum dry density of the material as determined by AASHTO T-180, and shall have moisture content optimized to allow the required density. Selected Common Backfill shall be placed in layers not to exceed 6 inches. Common Backfill shall be placed in layers not to exceed 12 inches.

J. Backfill compaction tests shall be performed every 500 feet in pipe line trenches and for every utility structure. Test reports shall be presented to the County Inspector.

3.03 GRADING AND CLEAN UP

A. Surplus and unsuitable soil materials not used on-site shall be removed and disposed of off-site in a manner that is consistent with state and local regulations. In no case shall surplus or unsuitable material be deposited on-site or on adjacent lands.

B. The surface of backfilled areas shall be graded smooth and true to the lines and grades indicated on the construction plans. No soft spots or uncompacted areas shall be allowed in the work.

C. Upon completion of the work, leave the work areas and all adjacent areas in a neat and presentable condition, clear of all temporary structures, rubbish and surplus materials. Pile any salvageable materials that have been removed in neat piles for pickup by County crews, unless otherwise directed.

END OF SECTION

SECTION 02223 EXCAVATION BELOW GRADE AND CRUSHED STONE OR SHELL REFILL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. If in the opinion of the County, the material at or below the normal grade of the bottom of the trench is unsuitable for pipe or structure foundation, it shall be removed to the depth directed by the County and replaced by crushed stone or washed shell.

PART 2 PRODUCTS (NOT USED)

PART 3 MATERIALS

3.01 EXCAVATION AND DRAINAGE

A. Whatever the nature of unstable material encountered or the groundwater conditions, trench stabilization shall be complete and effective.

B. Should the Contractor excavate below the grade shown on the Contract drawings because of negligence or for his own convenience; due to failure in properly dewatering the trench; disturbs the subgrade before dewatering is sufficiently complete; he shall be directed by the County to excavate below grade. The work of excavating below grade and furnishing and placing the approved refill material shall be performed at the Contractor's expense.

3.02 REFILL

A. Soils not meeting the classification required for foundation material shall be removed to a depth at least four inches below the bottom of the pipe, bedding or structure bottom elevation. Rock, boulders or other hard or lumpy material shall be removed to a depth 12 inches below the bottom of the pipe, bedding or structure bottom elevation. Remove muck, clay or other soft material to a depth as needed to establish a firm foundation.

END OF SECTION

SECTION 02260 FINISH GRADING

PART 1 GENERAL

1.01 WORK INCLUDED

A. The Contractor shall finish grade sub-soil.

B. The Contractor shall cut out areas to receive stabilizing base course materials for paving and sidewalks.

C. The Contractor shall place, finish grade and compact top soil.

1.02 PROTECTION

The Contractor shall prevent damage to existing fencing, trees, landscaping, natural features, bench marks, pavement and utility lines. Damage shall be corrected at no cost to the County.

PART 2 PRODUCTS

A. Topsoil: Shall be friable loam free from subsoil, roots, grass, excessive amount of weeds or other organics, stones, and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4 percent and a maximum of 25 percent organic matter. The Contractor may use topsoil stockpiles on site if they conform to these requirements.

PART 3 EXECUTION

3.01 SUB-SOIL PREPARATION

A. The Contractor shall rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Uneven areas and low spots shall be eliminated. Debris, roots, branches or other organics, stones, and sub-soil shall be removed by the Contractor and disposed of in a manner consistent with the latest Manatee County Standards as well as any affected regulatory agency. Should contaminated soil be found, the Contractor shall notify the County.

B. The Contractor shall cut out areas to sub-grade elevation to stabilize base material for paving and sidewalks and shall be compacted to 98 percent of the maximum dry density of the material as determined by AASHTO T-180, and shall have moisture content optimized to allow the required density.

C. The Contractor shall bring sub-soil to required profiles and contour graces gradually; and blend slopes into level areas.

D. The Contractor shall slope the structure grade a minimum of two (2) inches in ten (10) feet unless indicated otherwise on the Drawings.

E. The Contractor shall cultivate sub-grade to a depth of 3 inches where the topsoil is to be placed. He shall repeat cultivation in areas where equipment use has

compacted sub-soil.

F. The Contractor shall not make grade changes which causes water to flow onto adjacent lands.

3.02 PLACING TOPSOIL

A. The Contractor shall place topsoil in areas where seeding, sodding and planting is to be performed. He shall place from the following minimum depths, up to finished grade elevations:

1. 6 inches for seeded areas
2. 4-1/2 inches for sodded areas
3. 24 inches for shrub beds
4. 18 inches for flower beds

B. The Contractor shall use topsoil in a dry state as determined by the County. He shall place the material during dry weather.

C. The Contractor shall use fine grade topsoil eliminating rough and low areas to ensure positive drainage. He shall maintain levels, profiles and contours of the sub-grades.

D. The Contractor shall remove stone, roots, grass, weeds, debris, and other organics or foreign material while spreading the material.

E. The Contractor shall manually spread topsoil around trees, plants and structures to prevent damage which may be caused by grading equipment.

F. The Contractor shall lightly compact and place the topsoil.

3.03 SURPLUS MATERIAL

A. The Contractor shall remove surplus sub-soil and topsoil from site at his expense.

B. The Contractor shall leave stockpile areas and entire job site clean and raked, ready for landscaping operations.

END OF SECTION

SECTION 02276 TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of the design, provision, maintenance and removal of temporary erosion and sedimentation controls as necessary.

B. Temporary erosion controls include, but are not limited to: grassing, mulching, netting, watering, and the reseeding of on-site surfaces and spoil and borrow area surfaces, interceptor ditches at ends of berms and other such work at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the County.

C. Temporary sedimentation controls include, but are not limited to: silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which shall ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the County.

D. The Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

1.02 REFERENCE DOCUMENTS

A. Florida Building Code.

B. FDEP/COE Dredge and Fill Regulations and/or Permit as applicable.

C. SWFWMD Permit Regulations and/or Permit as applicable.

D. Florida Stormwater, Erosion and Sedimentation Control Inspector's Manual.

PART 2 PRODUCTS

2.01 EROSION CONTROL

A. Netting - fabricated of material acceptable to the County.

B. Seed and sod.

2.02 SEDIMENTATION CONTROL

A. Bales - clean, seed free cereal hay type.

B. Netting - fabricated of material acceptable to the County.

C. Filter stone - crushed stone conforming to Florida Dept of Transportation specifications.

D. Concrete block - hollow, non-load-bearing type.

E. Concrete - exterior grade not less than one inch thick.

PART 3 EXECUTION

3.01 EROSION CONTROL

A. Minimum procedures for grassing shall be:

1. Scarify slopes to a depth of not less than six inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.
2. Sow seed within twenty-four (24) hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
3. Apply mulch loosely and to a thickness of between 3/4-inch and 1-1/2 inches.
4. Apply netting over mulched areas on sloped surfaces.
5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.02 SEDIMENTATION CONTROL

A. The Contractor shall install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings. Deteriorated hay bales and dislodged filter stone shall be replaced by the Contractor at his expense.

3.03 PERFORMANCE

A. The Contractor, at his own expense, shall immediately take whatever steps are necessary to correct any deficiencies of the temporary erosion and sediment control measures employed if they fail to produce results or do not comply with the requirements of the State of Florida or any other federal, governmental or regulatory agency.

END OF SECTION

SECTION 02315 EXCAVATING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.01 DESCRIPTION

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

B. Related Work Described Elsewhere:

1. Clearing and Grubbing: Section 02110
2. Excavation, Backfill, Fill and Grading for Structures: Section 02220

C. Definitions:

1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material.
2. Optimum Moisture: Percentage of water in a specific material at maximum density.
3. Rock Excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
4. Suitable: Suitable materials for fills shall be non-cohesive, non-plastic granular local sand and shall be free from vegetation, organic material, marl, silt or muck. The CONTRACTOR shall furnish all additional fill material required.
5. Unsuitable: Unsuitable materials are highly organic soil (peat or muck) classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7 and A-8 in accordance with AASHTO Designation M-145.

D. Plan For Earthwork: The CONTRACTOR shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract. Prior to commencing the excavation, the CONTRACTOR shall submit a plan of his proposed operations to the Owner/Engineer for review. The CONTRACTOR shall consider, and his plan for excavation shall reflect, the equipment and methods to be employed in the excavation. No claims for extras based on substrata or groundwater table conditions will be allowed.

1.02 SUBMITTALS

A. Submit six (6) copies of a report from a testing laboratory verifying that any off-site borrow material conforms to the gradation specified.

1.03 QUALITY ASSURANCE

A. A Testing Laboratory employed by the CONTRACTOR will make such tests as are specified. The CONTRACTOR shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. CONTRACTOR shall keep a complete record and provide a map of all test locations.

B. Determination of laboratory moisture-density relationship and maximum density shall be by modified Proctor method of ASTM D-1557. At least one (1) test per soil type shall be made.

C. Compaction shall be deemed to comply with the Specifications when no tests are below the specified relative compaction.

D. Tests will be made in locations reviewed and approved by the Owner/Engineer. If any tests are unsatisfactory, re-excavate and recompact the fill or backfill until the specific compaction is obtained. CONTRACTOR shall make additional compaction tests on each side of unsatisfactory test, at locations approved by the Owner/Engineer, to determine the extent of re-excavation and recompaction necessary.

1.04 JOB CONDITIONS

A. Site Information: Subsurface exploration and geotechnical engineering evaluation where provided is for the CONTRACTOR'S information only. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil bearings. It is expressly understood that OWNER will not be responsible for interpretations or conclusions drawn therefrom by CONTRACTOR. Data, where provided, are made available for convenience of CONTRACTOR.

1. Test borings and other exploratory operations may be made by CONTRACTOR at no cost to OWNER.

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

1.05 PROTECTION

A. Sheeting and Bracing (if required):

1. Furnish, install in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, power poles, etc. from undermining, and to protect workers from hazardous conditions of other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other methods. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be

immediately filled and rammed. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the OWNER.

2. The CONTRACTOR shall construct the sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems is desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressure to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected by the CONTRACTOR at his own expense so as to provide the necessary clearances and dimensions.
3. Where sheeting and bracing is required to support the sides of excavations of structures, the CONTRACTOR shall engage a Geotechnical Professional Engineer, registered in the State of Florida, to design the sheeting and bracing.
4. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The CONTRACTOR shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures due to sheeting installation.
5. The CONTRACTOR shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings for the purpose of preventing injury to structures, utilities, or property, whether public or private. The Owner/Engineer may direct that timber used for sheeting and bracing be cut off at any specified elevation.
6. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed by the Owner/Engineer.
7. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1 foot above the top of any pipe.

B. Pumping and Drainage:

1. The CONTRACTOR shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed suborder foundation. This condition shall continue until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. The CONTRACTOR shall engage a Geotechnical Professional Engineer registered in the State of Florida, to design the temporary dewatering systems for all structures. The dewatering system installed shall be in conformity with the overall construction plan, and certification of this shall be provided by the Geotechnical Professional Engineer. The CONTRACTOR shall be required to monitor the performance of the dewatering systems during the progress of the work and require such modifications as may be required to assure that the systems are performing satisfactorily.
2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the suborder soils at proposed bottom of excavation and to preserve the integrity of adjacent structures. Well or sump

installation shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.

3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a pit bottom free from standing water.
4. The CONTRACTOR shall take all additional precautions to prevent uplift of any structure during construction.
5. The conveying of water in open ditches or trenches will not be allowed. Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the CONTRACTOR. However, the CONTRACTOR shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the Owner/Engineer or the authority having jurisdiction, at no cost to the OWNER.
6. Flotation shall be prevented by the CONTRACTOR by maintaining a positive and continuous operation of the dewatering system. The CONTRACTOR shall be fully responsible and liable for all damages which may result from failure of this system.
7. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system shall be removed by the CONTRACTOR.
8. The CONTRACTOR shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater quality.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:

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

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

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

U.S. Sieve Size	Percent Passing by Weight
1 inch	100
No. 4	75-100
No. 40	15-80
No. 100	0-30
No. 200	0-12

D. Class I Soils: Manufactured angular, granular material, 3/8 to 3/64 inches (9.5 mm to 1 mm) size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately:

1. Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming with ASTM C-33 stone size No. 89 and with particle size limits as follows:

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

2. Soils defined as Class I materials are not defined in ASTM D-2487.

E. Class II Soils:

1. GW: Well-graded gravels and gravel-sand mixtures, little or no fines. 50 percent or more retained on No. 4 sieve. More than 95 percent (95%) retained on No. 200 sieve. Clean.
2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. 50 percent or more retained on No. 4 sieve. More than 95 percent (95%) retained on No. 200 sieve. Clean.
3. SW: Well-graded sands and gravelly sands, little or no fines. More than 50 percent passes No. 4 sieve. More than 95 percent (95%) retained on No. 200 sieve. Clean.
4. SP: Poorly graded sands and gravelly sands, little or no fines. More than 50 percent passes No. 4 sieve. More than 95 percent (95%) retained on No. 200 sieve. Clean.
5. In accordance with ASTM D-2487, less than 5 percent (5%) pass No. 200 sieve.

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

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

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

PART 3 EXECUTION

3.01 PREPARATION

A. Clearing:

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

3.02 EXCAVATION

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

B. Excavating for Roadways/Structures/Utilities:

1. Excavation shall be made to such dimensions as will give suitable room for building the foundations and the structures, for bracing and supporting, for pumping and draining, and for all other work required.

    a. Excavation for precast or prefabricated structures shall be carried to an elevation 2 feet lower than the proposed outside bottom of the structure to provide space for the select backfill material. Prior to placing the select backfill, the excavation shall be sounded, if not dewatered, using a rigid pole to indicate the satisfaction of the OWNER that excavation has been carried to the proper depth and is reasonably uniform over the area to be occupied by the structure.
    b. Excavation for structures constructed or cast in place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavation shall be replaced with 3,000 psi concrete.
    c. Footings: Cast-in-place concrete footing sides shall be formed immediately after excavation. Forming for footing sides is specified elsewhere.

2. Immediately document the location, elevation, size, material type and function of all new subsurface installation, and utilities encountered during the course of construction.
3. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of work.
4. Encounters with subsurface obstructions shall be hand excavated.
5. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of suborder soils. Suborder soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods shall be removed and replaced by crushed stone as required by the Owner/Engineer at the CONTRACTOR'S expense.
6. The bottom of excavations shall be rendered firm and dry before placing any structure. Excavated material not suitable for backfill shall be removed from the site and disposed of by the CONTRACTOR.
7. All pavements shall be cut for removal, with saws and approved power tools.
8. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.
9. All locations and elevations as required herein must be permanently documented by the CONTRACTOR, on the Record Drawings prior to the Owner/Engineer approval of the Application for Payment for that work.
10. When force main pipe or pipe conveying other than non-potable liquid is less than 10 feet from a potable water main, the depth of cover shall be increased to 5 feet or 18 inches below the water main, whichever is greater.

3.03 DRAINAGE

A. The CONTRACTOR shall at all times during construction provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed suborder foundation condition. The dewatering method used shall prevent disturbance of earth below grade.

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

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

D. The CONTRACTOR will be required at his expense to excavate below grade and refill with approved fill material if the OWNER determines that adequate drainage has not been provided.

3.04 UNDERCUT

A. If the bottom of any excavation is below that shown on the Drawings or specified because of CONTRACTOR error, convenience, or unsuitable suborder due to the

CONTRACTOR'S excavating method, he shall refill to normal grade with fill at his own cost. Fill material and compaction method shall be as directed by the OWNER.

3.05 FILL AND COMPACTION

A. Compact and backfill excavations and construct embankment according to the following schedule:

STRUCTURES AND ROADWORK

Area	Material	Compaction
Utility trenches, backfill beneath structures	Structural Fill	8 inch lifts, compacted backfill beneath to 95 percent (95%) by Modified Proctor Method
Roadways	Common Fill	6 inch lifts, compacted backfill beneath to 98 percent (98%) by Modified Proctor Method.
Around structures	Structural Fill	8 inch lifts, 95 percent (95%) of Modified Proctor Method. Use light rubber-tired or vibratory plate compactors.
From cleared existing surface to subgrade for paved and gravel surfaces	Common Fill	12 inch lifts, 98 percent (98%) of Modified Proctor Method.

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

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

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

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

END OF SECTION

SECTION 02485 SEEDING AND SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials and equipment necessary to satisfactorily return all construction areas to their original conditions or better.

B. Work shall include furnishing and placing seed or sod, fertilizing, planting, watering and maintenance until acceptance by County.

1.02 RELATED WORK NOT INCLUDED

Excavation, filling and grading required to establish elevation shown on the Drawings are included under other sections of these Specifications.

1.03 QUALITY ASSURANCE

A. It is the intent of this Specification that the Contractor is obliged to deliver a satisfactory stand of grass as specified. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering and seeding or sodding at no additional cost to the County until a satisfactory stand is obtained. For purposes of grassing, a satisfactory stand of grass is herein defined as a full lawn cover over areas to be sodded or seeded, with grass free of weeds, alive and growing, leaving no bare spots larger than 3/4 square yard within a radius of 8 feet.

B. All previously grassed areas where pipelines are laid shall be sodded. All sodding and grassing shall be installed in accordance with these Specifications or as directed by the County.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fertilizer: The fertilizer shall be of the slow-release type meeting the following minimum requirements: 12 percent nitrogen, 8 percent phosphorus, 8 percent potassium; 40 percent other available materials derived from organic sources. At least 50 percent of the phosphoric acid shall be from normal super phosphate or an equivalent source which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitive analysis card attached to each bag or other container. Fertilizer shall be uniform in composition, dry and free flowing delivered to sites in original unopened containers bearing manufacturer's statement or guarantee.

B. Seeding/Grassing: The Contractor shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications, Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications, except that no additional payment will be made for mulching, fertilizing and/or watering.

C. Sodding: Sod shall be provided as required on the construction drawings or at locations as directed by the County in accordance with Florida Department of Transportation, Specifications Section 575 and 981. The Contractor shall furnish bahia grass sod or match existing sod. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575, except that no additional payment will be made for placement and/or watering. This cost shall be included in the Contract price bid for sodding.

D. Topsoil: Topsoil stockpiled during excavation may be used as necessary. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the County. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants and grassing specified herein.

E. Water: It is the Contractor's responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The Contractor shall make whatever arrangements that may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 EXECUTION

3.01 INSTALLATION

A. When the trench backfill has stabilized sufficiently, the Contractor shall commence work on lawns and grassed areas, including fine grading as necessary and as directed by the County.

B. Finish Grading: Areas to be seeded or sodded shall be finish graded, raked, and debris removed. Soft spots and uneven grades shall be eliminated. The County shall approve the finish grade of all areas to be seeded or sodded prior to seed or sod application.

C. Areas to be sodded shall be excavated or cut-down to accept the approximate 2” thick sod, so finish grade matches existing. Sod shall not be thrown over top of existing sod or debris.

D. Protection: Seeded and sodded areas shall be protected against traffic or other use by placing warning signs or erecting barricades as necessary. Any areas damaged prior to acceptance by the County shall be repaired by the Contractor as directed by the County.

3.02 CLEANUP

Soil or similar materials spilled onto paved areas shall be removed promptly, keeping those areas as clean as possible at all times. Upon completion of seeding and sodding operations, all excess soil, stones and debris remaining shall be removed from the construction areas.

3.03 LANDSCAPE MAINTENANCE

A. Any existing landscape items damaged or altered during construction by the Contractor shall be restored or replaced as directed by the County.

B. Maintain landscape work for a period of 90 days immediately following complete installation of work or until County accepts project. Watering, weeding, cultivating, restoration of grade, mowing and trimming, protection from insects and diseases, fertilizing and similar operations as needed to ensure normal growth and good health for live plant material shall be included at no additional cost to the County.

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATORS

Lawn areas planted under this Contract and all lawn areas damaged by the Contractor's operation shall be repaired at once by proper soil preparation, fertilizing and sodding, in accordance with these Specifications.

END OF SECTION

SECTION 02513 ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials and equipment necessary to complete all milling asphalt pavement and asphalt concrete paving (including restoration of driveways) as called out on the Contract Documents or as shown on the Drawings.

1.02 QUALITY ASSURANCE

A. Qualifications of Asphalt Concrete Producer: The only materials permitted shall be furnished by a bulk asphalt concrete producer exclusively engaged in the production of hot-mix, hot-laid asphalt concrete.

B. Qualification of Testing Agency: The County may employ a commercial testing laboratory to conduct tests and evaluations of asphalt concrete materials and design. The Contractor shall:

1. Provide asphalt concrete testing and inspection service acceptable to County.
2. Include sampling and testing asphalt concrete materials proposed, and tests and calculations for asphalt concrete mixtures.
3. Provide field testing facilities for quality control testing during paving operations.

C. Requirements of Regulatory Agencies: The Contractor shall comply with the applicable requirements of:

1. Manatee County Utility Operations Department
2. Manatee County Transportation Department
3. State of Florida Dept. of Transportation

1.03 PAVING QUALITY REQUIREMENTS

A. General: In addition to other specified conditions, the Contractor shall comply with the following minimum requirements:

1. In-place asphalt concrete course shall be tested for compliance with requirements for density, thickness and surface smoothness.
2. Final surface shall be provided of uniform texture, conforming to required grades and cross sections.
3. A minimum of four inch diameter pavement specimens for each completed course shall be taken from locations as directed by the County.
4. Holes from test specimens shall be repaved as specified for patching defective work.

B. Density:

1. When subjected to 50 blows of standard Marshall hammer on each side of an in place material specimen, densities shall be comparable to a laboratory specimen of same asphalt concrete mixture.
2. The minimum acceptable density of in-place course material shall be 98% of the recorded laboratory specimen density.

C. Thickness: In-place compacted thicknesses shall not be acceptable if less than the minimum thicknesses shown on the Drawings.

D. Surface Smoothness:

1. Finished surface of each asphalt concrete course shall be tested for smoothness, using a 10 ft. straightedge applied parallel to and at right angles to centerline of paved areas.
2. Surface areas shall be checked at intervals directed by County.
3. Surfaces shall not be acceptable if they exceed the following:

    a. Base Course: 1/4 in. in 10 ft.
    b. Surface Course: 3/16 in. in 10 ft.
    c. Crowned Surfaces:

        (1) Test crowned surfaces with a crown template, centered and at right angles to the crown.
        (2) Surfaces will not be acceptable if varying more than 1/4 in. from the template.

1.04 SUBMITTALS

A. Samples: The Contractor may be required to provide samples of materials for laboratory testing and job-mix design.

B. Test Reports: The Contractor shall submit laboratory reports for following materials tests:

1. Coarse and fine aggregates from each material source and each required grading:

    a. Sieve Analysis: ASTM C 136 (AASHO T 27).
    b. Unit Weight of Slag: ASTM C29 (AASHO T 19).
    c. Soundness: ASTM C 88 (AASHO T 104) for surface course aggregates only.
    d. Sand Equivalent: ASTM D 2419 (AASHO T 176).
    e. Abrasion of Coarse Aggregate: ASTM C131 (AASHO T 96),for surface course aggregates only.

2. Asphalt cement for each penetration grade:

    a. Penetration: ASTM D5 (AASHO T49).
    b. Viscosity (Kinematic): ASTM D2170 (AASHO T 201).
    c. Flash Point: ASTM D92 (AASHO T 48).

d. Ductility: ASTM D 113 (AASHO T 51).
e. Solubility: ASTM D 4 (AASHO T 44).
f. Specific Gravity: ASTM D 70 (AASHO T 43).

3. Job-mix design mixtures for each material or grade:

   a. Bulk Specific Gravity for Coarse Aggregate: ASTM C 117(AASHO T 85).
   b. Bulk Specific Gravity for Fine Aggregate: ASTM C 128(AASHO T 84).

4. Uncompacted asphalt concrete mix: Maximum Specific Gravity: ASTM D 2041 (AASHO T 209).
5. Compacted asphalt concrete mix:

   a. Bulk Density: ASTM D 1188 (AASHO T 166).
   b. Marshall Stability and Flow: ASTM D 1559.

6. Density and voids analysis:

   a. Provide each series of asphalt concrete mixture text specimens, in accordance with A.I. MS-2 "Mix Design Methods for Asphalt Concrete".
   b. Use Marshall method of mix design unless otherwise directed or acceptable to the County.
   c. Report the quantity of absorbed asphalt cement in pounds of dry aggregate, percent air voids, and percent voids in mineral aggregate.

7. Sampling and testing of asphalt concrete mixtures for quality control during paving operations:

   a. Uncompacted asphalt concrete mix.

      (1) Asphalt Cement Content: ASTM D 2172 (AASHO T 164).
      (2) Penetration of Recovered Asphalt Cement: ASTM D 5(AASHO T 49).
      (3) Ductibility of Recovered Asphalt Cement: ASTM D 113(AASHO T 51).

   b. Compacted asphalt concrete mix:

      (1) Bulk Density: ASTM D 1188 (AASHO T 166).
      Marshall Stability and Flow: ASTM D1559).

   c. Perform at least one test for each day's paving.

8. Asphalt plant inspection: ASTM D 290.
9. Additional testing:

   a. Retesting shall be required if previous tests indicate insufficient values, or if directed by the County.

b. Testing shall continue until specified values have been attained.

10. Asphalt concrete materials which do not comply with specified requirements shall not be permitted in the work.

1.05 JOB CONDITIONS

A. Weather Limitations:

1. Apply bituminous prime and tack coats only when the ambient temperature in the shade is 50 degrees F. and when the temperature has not been below 35 degrees F. for 12 hours immediately prior to application.
2. Do not apply when the base surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.
3. Construct asphalt concrete surface course only when atmospheric temperature is above 40 degrees F., when the underlying base is dry, and when weather is not rainy.
4. Base course may be placed when air temperature is not below 30 degrees F. and rising, when acceptable to the County.

B. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.

C. Traffic Control: Maintain vehicular and pedestrian traffic during paving operations, as required for other construction activities.

PART 2 PRODUCTS

2.01 MATERIALS

A. Soil Cement or Shell Base Course: as specified in FDOT Section 270, "Material for Base and Stabilized Base", and as called for in the Contract Documents.

B. Aggregate for Asphalt Concrete, General:

1. Sound, angular crushed stone, crushed gravel, or crushed slag: ASTM D 692.
2. Sand, stone, or slag screening: ASTM D 1073.
3. Provide aggregate in gradations for various courses to comply with local highway standards.

C. Surface Course Aggregates:

1. Provide natural sand, unless sand prepared from stone, slag, or gravel or combinations are required to suit local conditions.

D. Asphalt Cement: Comply with ASTM D 946 for 85-100 penetration grade.

E. Prime Coat:

1. Cut-back liquid asphalt.

2. Medium-Curing type: ASTM D 2027, Grade MC-70.

2.02 ASPHALT-AGGREGATE MIXTURES

A. Job-mix criteria:

1. Provide job-mix formulas for each required asphalt-aggregate mixture.
2. Establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to aggregate, and a single temperature at which asphalt concrete is to be produced.
3. Comply with the mix requirements of local governing highway standards.
4. Maintain material quantities within allowable tolerances of the governing standards.

2.03 TRAFFIC AND PARKING MARKING MATERIALS

A. Traffic lane marking paint with chlorinated rubber base.

B. Factory mixed, quick drying and non bleeding, FS TT-P-115C, Type III.

C. Color: Driving Lane Dividers - White
No Parking Zone - Yellow
Parking Dividers - White

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Subbase Preparation:

1. The Contractor shall remove from the area all organic substance encountered to a depth of six or eight inches (6" or 8"), or to such depth and width as directed by the County. The entire area shall be plowed and dragged prior to placing a stabilizing additive, if required to meet minimum bearing value.
2. Subbase shall be compacted to a minimum density of 98 percent of the maximum as determined by the Modified Proctor Density AASHTO T180, and shall have a minimum bearing value of 40 pounds per square inch as determined by the Florida Bearing Test.

B. Base Course:

1. Check subgrade for conformity with elevations and section immediately before placing base material.
2. Place base material in compacted layers not more than 6 inches thick, unless continuing tests indicate the required results are being obtained with thicker layers.
3. In no case will more than 8-inches of compacted base be placed in one lift.
4. Spread, shape, and compact all base material deposited on the subgrade during the same day.
5. Compact base course material to be not less than 98% of maximum density: ASTM D 1557, Method D (98 percent maximum density: AASHTO

T-180).

6. Test density of compacted base course: ASTM D 2167.
7 Conduct one test for each 250 sq. yds. of in-place material, but in no case not less than one daily for each layer.

C. Loose and Foreign Material:

1. Remove loose and foreign material from compacted subbase surface immediately before application of paving.
2. Use power brooms or blowers, and brooming as required.
3. Do not displace subbase material.

D. Prime Coat:

1. Uniformly apply at rate of 0.20 to 0.5 gal. per sq. yd. over compacted and cleaned subbase surface.
2. Apply enough material to penetrate and seal, but not flood the surface.
3. Allow to cure and dry as long as required to attain penetration and evaporation of volatile, and in no case less than 24 hours unless otherwise acceptable to the County.
4. Blot excess asphalt with just enough sand to prevent pick-up under traffic.
5. Remove loose sand before paving.

E. Tack Coat:

1. Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphalt concrete or portland cement concrete and similar surfaces.
2. Apply at rate of 0.05 to 0.15 gal. per sq. yd. of surface.
3. Apply tack coat by brush to contact surfaces of structures projecting into or abutting asphalt concrete pavement.
4. Allow surfaces to dry until material is at condition of tackiness to receive pavement.

3.02 MANHOLE FRAME / VALVE BOX ADJUSTMENTS (IF APPLICABLE)

A. Placing Manhole frames:

1. Surround manhole frames set to elevation with a ring of compacted asphalt concrete base prior to paving.
2. Place asphalt concrete mixture up to 1 in. below top of frame, slope to grade, and compact by hand tamping.

B. Adjust manhole frames to proper position to meet paving.

C. If permanent covers are not in place, provide temporary covers over openings until completion of rolling operations.

D. Set cover manhole frames to grade, flush with surface of adjacent pavement.

3.03 PREPARING THE MIXTURE

A. Comply with ASTM D 995 for material storage, control, and mixing, and for plant equipment and operation.

B. Stockpiles:

1. Keep each component of the various-sized combined aggregates in separate stockpiles.
2. Maintain stockpiles so that separate aggregate sizes shall not be intermixed.

C. Heating:

1. Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture
2. Use lowest possible temperature to suit temperature-viscosity characteristics of asphalt.
3. Do not exceed 350 degrees F. (176.6 degrees C.).

D. Aggregate:

1. Heat-dry aggregates to reduce moisture content to not more than 2.0%.
2. Deliver dry aggregate to mixer at recommended temperature to suit penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture.
3. Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements.

E. Mix aggregate and asphalt cement to achieve 90-95% of coated particles for base mixtures and 85-90% of coated particles for surface mixture, when tested in accordance with ASTM D 2489.

F. Transporting:

1. Transport asphalt concrete mixtures from mixing site in trucks having tight, clean compartments.
2. Coat hauling compartments with a lime-water mixture to prevent asphalt concrete mixture from sticking.
3. Elevate and drain compartment of excess solution before loading mix.
4. Provide covers over asphalt concrete mixture when transporting to protect from weather and to prevent loss of heat.
5. During periods of cold weather or for long-distance deliveries, provide insulation around entire truck bed surfaces.

3.04 EQUIPMENT

A. Provide size and quantity of equipment to complete the work specified within project time schedule.

B. Bituminous Pavers: Self-propelled that spread hot asphalt concrete mixtures without tearing, shoving or gouging surfaces, and control pavement edges to true lines without use of stationary forms.

C. Rolling Equipment:

1. Self-propelled, steel-wheeled and pneumatic-tired rollers that can reverse direction without backlash.
2. Other type rollers may be used if acceptable to the County.

D. Hand Tools: Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools to complete the work specified.

3.05 PLACING THE MIX

A. Place asphalt concrete mixture on prepared surface, spread and strike-off using paving machine.

B. Spread mixture at a minimum temperature of 225 degrees F. (107.2 degrees C.).
C. Inaccessible and small areas may be placed by hand.

D. Place each course at thickness so that when compacted, it will conform to the indicated grade, cross-section, finish thickness, and density indicated.

E. Paver Placing:

1. Unless otherwise directed, begin placing along centerline of areas to be paved on crowned section, and at high side of sections on one-way slope, and in direction of traffic flow.
2. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
3. Complete base courses for a section before placing surface courses.
4. Place mixture in continuous operation as practicable.

F. Hand Placing:

1. Spread, tamp, and finish mixture using hand tools in areas where machine spreading is not possible, as acceptable to County.
2. Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperature.

G. Joints:

1. Carefully make joints between old and new pavements, or between successive days' work, to ensure a continuous bond between adjoining work.
2. Construct joints to have same texture, density and smoothness as adjacent sections of asphalt concrete course.
3. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat.
4. Offset transverse joints in succeeding courses not less than 24 inches.
5. Cut back edge of previously placed course to expose an even, vertical surface for full course thickness.
6. Offset longitudinal joints in succeeding courses not less than 6 inches.
7. When the edges of longitudinal joints are irregular, honeycombed, or

inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness.

3.06 COMPACTING THE MIX

A. Provide sufficient rollers to obtain the required pavement density.

B. Begin rolling operations as soon after placing when the mixture will bear weight of roller without excessive displacement.

C. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set.

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

E. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs.

F. Do not roll centers of sections first under any circumstances.

G. Breakdown Rolling:

1. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.
2. Operate rollers as close as possible to paver without causing pavement displacement.
3. Check crown, grade, and smoothness after breakdown rolling.
4. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.

A. Second Rolling:

1. Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction.
2. Continue second rolling until mixture has been thoroughly compacted.

I. Finish Rolling:

1. Perform finish rolling while mixture is still warm enough for removal of roller marks.
2. Continue rolling until roller marks are eliminated and course has attained specified density.

J. Patching:

1. Remove and replace defective areas.
2. Cut-out and fill with fresh, hot asphalt concrete.
3. Compact by rolling to specified surface density and smoothness.
4. Remove deficient areas for full depth of course.
5. Cut sides perpendicular and parallel to direction of traffic with edges vertical.

6. Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

3.07 MARKING ASPHALT CONCRETE PAVEMENT

A. Cleaning:

1. Sweep surface with power broom supplemented by hand brooms to remove loose material and dirt.
2. Do not begin marking asphalt concrete pavement until acceptable to the County.

B. Apply paint with mechanical equipment.

1. Provide uniform straight edges.
2. Not less than two separate coats in accordance with manufacturer's recommended rates.

3.08 CLEANING AND PROTECTION

A. Cleaning: After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of the County.

B. Protection:

1. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case sooner than 6 hours.
2. Provide barricades and warning devices as required to protect pavement.
3. Cover openings of structures in the area of paving until permanent coverings are placed (if applicable).

END OF SECTION

SECTION 02575 PAVEMENT REPAIR AND RESTORATION

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials, equipment, obtain County or State right-of-way permits and incidentals required and remove and replace pavements over trenches excavated for installation of water or sewer lines and appurtenances as shown on the Contract Drawings.

1.02 GENERAL

A. The Contractor shall take before and after photographs.

B. The Contractor shall repair in a manner satisfactory to the County or State, all damage done to existing structures, pavement, driveways, paved areas, curbs and gutters, sidewalks, shrubbery, grass, trees, utility poles, utility pipe lines, conduits, drains, catch basin, flagstones, or stabilized areas or driveways and including all obstructions not specifically named herein, which results from this Project.

C. The Contractor shall keep the surface of the backfilled area of excavation in a safe traffic bearing condition and firm and level with the remaining pavement until the pavement is restored in the manner specified herein. All surface irregularities that are dangerous or obstructive to traffic are to be removed. The repair shall conform to applicable requirements of Manatee County Transportation Department requirements for pavement repair and as described herein, including all base, subbase and asphalt replacement.

D. All materials and workmanship shall meet or exceed the County requirements and as called for in the Contract Documents and nothing herein shall be construed as to relieve the Contractor from this responsibility.

E. All street, road and highway repair shall be made in accordance with the FDOT and County details indicated on the Drawings and in accordance with the applicable requirements and approval of affected County and State agencies.

PART 2 PRODUCTS

2.01 PAVEMENT SECTION

A. Asphaltic concrete shall consist of asphalt cement, coarse aggregate, fine aggregate and mineral filler conforming to FDOT Type S-III Asphalt. Pavement replacement thickness shall match that removed but in no case shall be less than 1-1/2” compacted thickness. All asphalt concrete pavement shall be furnished, installed and tested in accordance with FDOT Specifications for Road and Bridge Construction.

B. Asphalt or crushed concrete or approved equal base material shall be furnished and installed under all pavement sections restored under this Contract. Asphalt base shall have a minimum 6” compacted thickness, meet requirements for FDOT

ABC III (Minimum Marshall Stability of 1000) and be furnished, installed and tested in accordance with the requirements of the FDOT Standards. Crushed concrete base shall be 10" minimum compacted thickness. Crushed concrete aggregate material shall have a minimum LBR of 140 compacted to 98% T-180 AASHTO density. Asphalt base and crushed concrete base are acceptable. Other bases shall be submitted for approval.

C. Prime and tack will be required and applied in accordance with Section 300 - FDOT Specifications: Prime and Tack Coat for Base Courses.

PART 3 EXECUTION

3.01 CUTTING PAVEMENT

A. The Contractor shall saw cut in straight lines and remove pavement as necessary to install the new pipelines and appurtenances and for making connections to existing pipelines.

B. Prior to pavement removal, the Contractor shall mark the pavement for cuts nearly paralleling pipe lines and existing street lines. Asphalt pavement shall be cut along the markings with a rotary saw or other suitable tool. Concrete pavement shall be scored to a depth of approximately two (2) inches below the surface of the concrete along the marked cuts. Scoring shall be done by use of a rotary saw, after which the pavement may be broken below the scoring with a jackhammer or other suitable equipment.

C. The Contractor shall not machine pull the pavement until it is completely broken and separated along the marked cuts.

D. The pavement adjacent to pipe line trenches shall neither be disturbed nor damaged. If the adjacent pavement is disturbed or damaged, irrespective of cause, the Contractor shall remove and replace the pavement. In addition, the base and sub-base shall be restored in accordance with these Specifications, Florida Dept. of Transportation Standard Specifications and as directed by the County.

3.02 PAVEMENT REPAIR AND REPLACEMENT

A. The Contractor shall repair, to meet or exceed original surface material, all existing concrete or asphaltic pavement, driveways, or sidewalks cut or damaged by construction under this Contract. He shall match the original grade unless otherwise specified or shown on the Drawings. Materials and construction procedures for base course and pavement repair shall conform to those of the Florida Dept. of Transportation.

B. The Contractor's repair shall include the preparation of the subbase and base, place and maintain the roadway surface, any special requirements whether specifically called for or implied and all work necessary for a satisfactory completion of this work. Stabilized roads and drives shall be finished to match the existing grade. Dirt roads and drives shall have the required depth of backfill material as shown on the Contract Drawings.

C. The asphaltic concrete repairs shall be in accordance with the Manatee County Public Works Standards, Part I Utilities Standards Manual, Detail UG-12. The asphaltic concrete repairs shall extend the full width and length of the excavation or to the limits of any damaged section. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other approved method so as to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities. The existing asphalt beyond the excavation or damaged section shall be milled 25' back from the saw cut. Final overlay shall match existing with no discernable "bump" at joint.

3.03 MISCELLANEOUS RESTORATION

Sidewalks or driveways cut or damaged by construction shall be restored in full sections or blocks to a minimum thickness of four inches. Concrete curb or curb and gutter shall be restored to the existing height and cross section in full sections or lengths between joints. RCP pipe shall be repaired or installed in accordance with manufacturer's specifications. Grassed yards, shoulders and parkways shall be restored to match the existing sections with grass sod of a type matching the existing grass.

3.04 SPECIAL REQUIREMENTS

The restoration of all surfaces, as described herein, disturbed by the installation of pipelines shall be completed as soon as is reasonable and practical. The complete and final restoration of both paved and shell stabilized roads within a reasonable time frame is of paramount importance. To this end, the Contractor shall, as part of his work schedule, complete the restoration of any area of road within five weeks after removing the original surface. Successful leak testing shall be performed prior to restoring any area of road. All restoration and replacement or repairs are the responsibility of the Contractor.

3.05 CLEANUP

After all repair and restoration or paving has been completed, all excess asphalt, dirt and other debris shall be removed from the roadways. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

3.06 MAINTENANCE OR REPAIR

All wearing surfaces shall be maintained by the Contractor in good order suitable for traffic prior to completion and acceptance of the work.

END OF SECTION

SECTION 02615 DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install ductile iron pipe and restrained joint ductile iron pipe and cast iron or ductile iron restrained joint fittings, complete, as shown on the Drawings and specified in these Standards.

B. Fittings are noted on the drawings for the Contractor's convenience and do not relieve him from laying and jointing different or additional items where required.

C. The Contractor shall furnish all labor, materials, equipment and incidentals required to install push-on joint, restrained mechanical joint, or flanged-joint ductile iron pipe, complete as shown on the Drawings and Specifications.

D. Newly installed pipe shall be kept clean and free of all foreign matter. All DI pipe installed underground shall be poly wrapped unless noted otherwise on the plans.

1.02 SUBMITTALS

A. The Contractor shall submit to the County, within ten days after receipt of Notice to Proceed, a list of materials to be furnished, the names of the suppliers and the appropriate shop drawings for all ductile iron pipe and fittings.

B. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

C. Shop Drawings including layout drawings shall be submitted to the Engineer for approval and shall include dimensioning, methods and locations of supports and all other pertinent technical specifications for all piping to be furnished. Layout Drawings shall be to scale and shall clearly indicate the amount of pipe to be restrained from each fitting.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ductile iron pipe shall conform to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, current editions. Thickness of pipe shall be Class 50 or pressure Class 350. All pipe not buried shall be Class 53. All ductile iron pipe shall be clearly marked on the outside of the barrel to readily identify it from cast iron.

B. Unrestrained joint pipe shall be supplied in lengths not to exceed 21 feet. Unless otherwise called for in the Contract Documents, unrestrained joint pipe shall be either the rubber-ring compression-type push-on joint or standard mechanical joint pipe as manufactured by the American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, or approved equal.

C. All mechanical joint fittings shall be pressure rated for 350 psi for sizes 4-24 inches and 250 psi for sizes 30 inches and larger. All flanged fittings shall be pressure rated for 250 psi for all sizes. All fittings shall meet the requirements of AWWA C110 or AWWA C153.

D. Rubber gaskets shall conform to AWWA C111 for mechanical and push-on type joints and shall be Ethylene Propylene Diene Monomer (EPDM) rubber for potable water, sanitary sewage, and reclaimed water pipelines. Standard gaskets shall be such as Fastite as manufactured by American Cast Iron Pipe Company, or an approved equal. Acrylonitrile butadiene (NBR) gaskets shall be used for potable water mains that are located in soil that is contaminated with low molecular-weight petroleum products or non-chlorinated organic solvents or non-aromatic organic solvents. Fluorocarbon (FKM) gaskets shall be used for potable water mains that are located in soil that is contaminated with aromatic hydrocarbons or chlorinated hydrocarbons. Fluorocarbon (FKM) gaskets shall be used where both classes of contaminates are found.

E. Water Main and Reclaimed Water Main Coatings: All ductile iron pipe used in water and reclaimed water systems shall have a standard thickness cement lining on the inside in accordance with AWWA C104 and a standard 1-mil asphaltic exterior coating per AWWA C151. All ductile iron or gray iron fittings used in water and reclaimed water systems shall have standard thickness cement linings on the inside per AWWA C104 and an asphaltic exterior coating or they shall have factory-applied fusion bonded epoxy coatings both inside and outside in accordance with AWWA C550.

F. Wastewater Main Coatings: All ductile iron pipe and fittings used in wastewater sewer systems shall have a factory applied minimum dry film thickness 40-mils of Tnemec 431 Perma-Shield PL or Permox CTF on the inside. The interior lining application is to be based on the manufacturer's recommendation for long-term exposure to raw sewage. To ensure a holiday-free lining, documentation must be provided, prior to shipment, showing each section of lined pipe has passed holiday testing at the time of production per ASTM G62. The lining shall have a minimum one-year warranty covering failure of the lining and bond failure between liner and pipe.

   Exterior coatings for ductile iron pipe and fittings used in wastewater systems shall be either an asphaltic coating per AWWA C151 or a factory-applied epoxy coating per AWWA C550.

G. Lubricant furnished for lubricating the push-on joints in potable water pipes shall be nontoxic, water soluble, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material, and shall not impart color, taste, or odor to the water, and shall be an approved substance per NSF 61.

H. Thrust restraint devices shall be provided at all horizontal and vertical bends and fittings, in casings under roads and railroads and at other locations specifically indicated on the construction drawings. Thrust restraint devices shall be either concrete thrust blocks or restraining glands as manufactured by Star Pipe Products, Stargrip 3000 and 3100, Allgrip 3600, or as manufactured by EBAA Iron Sales, Megaflange, 2000 PV, or other approved equal restraining gland products.

Restrained joints, where used, shall be installed at bend and fitting locations and at pipe joint locations both upstream and downstream from the bends or fittings at distances as required by these Standards. . Restraint devices shall have the following factory applied high performance coatings: Star Pipe Products: Starbond System; Sigma Corp. Products: CORRSAFE System; EBBA Iron Products: MEGA-BOND System. Restrained joint pipe fittings shall be designed and rated for the following pressures:

350 psi for pipe sizes up to and including 24" diameter
250 psi for pipe sizes 30" diameter and above

I. All gaskets and restraining gasket shall be EPDM rubber and shall have color inherent with the rubber. Color shall not be attained by surface coating. The word “EPDM” shall be embossed or formed into the gasket. Stamped or stickers shall be prohibited. All gaskets not clearly identified to be EPDM shall be rejected and removed from the job site.

J. Restrained joints shall be provided at all horizontal and vertical bends and fittings, at casings under roads and railroads and at other locations shown on the Contract Drawings. Restrained joint pipe fittings shall be designed and rated for the following pressures: 350 psi for pipe sizes up to and including 24" diameter; 250 psi for pipe sizes 30" diameter and above. Offsite forcemain shall be restrained as shown on the civil detail sheets, unless otherwise indicated.

K. Flanged ductile-iron pipe for above ground piping shall conform to current ANSI/AWWA C115/A21.15 with factory applied screwed long hub flanges except as otherwise specified hereinafter. Flanges shall be faced and drilled after being screwed on the pipe with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe conforming to ANSI B16.1, 125 pounds standard. Flanged pipe shall be special thickness Class 53.

L. Flanged fittings shall be ductile as specified herein. Flanges and flanged fittings shall be flat face and shall conform to ANSI/AWWA C110/A21.10 for 250 psi pressure rating. Full face type 1/8-inch thick SBR rubber ring gaskets shall conform to ANSI/AWWA C111/A21.11.

M. Bolts and nuts on flanged fittings shall be hot dipped galvanized steel unless stainless steel is specified or called out on the drawings. Bolts and buts shall conform to AWWA C110 and ANSI B16.1 for Class 125.

N. Pipe and fitting manufacturers shall be the American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, McWane, Tyler, or approved equal.

O. Hardware for buried installations shall be high strength, low alloy steel conforming to the latest edition of AWWA C111/ANSI 21.11 or ASTM A242.

2.02 DETECTION

A. Pipe shall have a 3-inch wide warning tape of the proper color placed directly above the pipe 12 inches below finished grade or a 6-inch warning tape between 12 inches and 24 inches below finished grade.

B. Pipe shall have a solid, 10 gauge, high strength, copper clad steel wire with a polyethylene jacket of appropriate color installed along the pipe alignment as detailed in these standards. Tracer wire shall be manufactured by Copperhead Industries or Manatee County approved equal.

2.03 IDENTIFICATION

A. Each length of pipe and each fitting shall be marked with the name of the manufacturer, size and class, lining type, and shall be clearly identified as ductile iron pipe. All gaskets shall be marked with the name of the manufacturer, size and proper insertion direction.

B. All below grade ductile iron pipe shall be entirely polyethylene-wrapped blue for water mains, purple (Pantone 522 C) for reclaimed water mains and green for sewer mains, per AWWA C105.

C. Poly-wrap shall be by V-BioTM Enhanced Polyethylene Encasement (or equivalent).

D. All above ground ductile iron pipe and appurtenances shall be painted in accordance with Section 09900.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 02617 INSTALLATION AND TESTING OF PRESSURE PIPE

PART 1 GENERAL

Reference Section 1.8, Installation of Pipelines in the Manatee County Public Works Utility Standards Part 1-Utility Standards Manual.

1.01 GENERAL

A. Furnish and install pipe, fittings, valves, fire hydrants, services, and all other appurtenances and incidentals complete and in-place as required by the construction drawings.

B. Where potable or reclaimed water mains are to be installed under pavement, in parking lots, etc., the main shall be DI or protected by a steel casing pipe.

C. All pipe crossing state or federal roads or local arterials & thoroughfares shall be installed in a casing pipe.

D. Services under any kind of pavement shall be Type “L” copper or Schedule 40 stainless steel.

E. Water mains 16-inches and larger shall be ductile iron. High density polyethylene or PVC (for 16” only). The use of HDPE pipe must be authorized by the County prior to ordering and installation.

F. Soil testing in accordance with AWWA C105 shall be performed during the design phase to determine if the soil is corrosive to ductile iron pipe. One (1) soil test shall be performed for pipe lengths under 500 lineal feet, with an additional soil test every 500 of additional ductile iron pipe to be installed. The soil testing shall be performed by a Florida licensed geotechnical engineering and signed and sealed report shall be supplied to the County for review prior to installation of the ductile iron pipe for evaluation. The soil testing results shall be used to determine if additional requirements for the installation of ductile iron pipe and/or the restrained joints is warranted.

G. Ductile iron pipe, with gasket materials as required in these Standards, shall be used in soil that is contaminated with low molecular-weight petroleum products, aromatic hydrocarbons, chlorinated hydrocarbons or organic solvents.

H. Trees shall not be planted or located within 10 feet of any potable water main, reclaimed water main, sanitary force main or gravity sanitary sewer main that is owned and maintained by County. With prior approval, an approved root barrier may be used with 5 feet of clearance.

I. All distribution waterlines that enter private property become private lines and shall have a back-flow preventer installed at the right-of-way. BFP can be part of a meter assembly or a BFP / detector check assembly.

J. Installation tolerances of Pipe Lines:

1. Direct Bury:

a. Vertical Alignment = ±0.5 feet
b. Horizontal Alignment = ±1.0 feet

2. Horizontal Directional Drill (Trenchless Technologies):

a. Vertical Alignment:

1) max. slope shall not exceed 2% (2.0 feet within a length of 100 feet).
2) No reverse curvature within 200 feet
3) No vertical deviation greater than ten (10) percent of the proposed depth of cover at that specific station.

b. Horizontal Alignment:

1) max. rate of deviation shall not exceed 1.5% (1.5 feet within a length of 100 feet
2) No reverse curvature
3) Total deviation not to exceed 2.0 feet

1.02 HANDLING AND STORAGE

A. Prior to installation, all pipe and fittings shall be inspected. Cracked, broken, or otherwise defective materials not in compliance with these standards shall not be used and shall be removed from the project site.

B. The pipeline installer shall take care in the handling, storage and installation of the pipe and fittings to prevent injury to the materials or coatings. Use proper implements, tools and facilities for the safe and proper protection of the work. Lower the pipe and fittings from the truck to the ground and from the ground into the trench in a manner to avoid any physical damages. Under no circumstances shall the pipe or fittings be dropped onto the ground or into the trenches.

C. The pipeline installer shall not distribute material on the job site faster than it can be used to good advantage. Unless otherwise approved by the County, installer shall not distribute more than one week's supply of material in advance of laying. Any materials not to be installed within two weeks of delivery shall be protected from the sunlight, atmosphere and weather by suitable enclosures or protective wrapping until ready for installation. Stored PVC pipe shall be placed on suitable racks with bottom tiers raised above the ground to avoid damage. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's written instructions.

1.03 SURVEY MARKINGS

A. As a marker for the Surveyor, a PVC pipe marker or 2" x 4" marker shall be inserted by the Contractor on the top of pipe for potable water mains, reclaimed water mains

and sanitary force mains at intervals no greater than 200 feet apart and at locations where there is a substantial grade change. The pipe markers shall indicate the pipe diameter and shall be labeled PWM in “safety” blue, RWM in purple, and FM in green, for potable water mains, reclaimed water mains and sanitary force mains, respectively. The Contractor is responsible for making the aforementioned markers available to the Surveyor. The Contractor shall field locate the mains and fittings when markers are not made available to the Surveyor.

B. As a marker for the Surveyor, a PVC pipe marker or 2” x 4” marker shall be inserted by the Contractor on the top of all pipe fittings (other than sanitary sewer service wyes, potable water saddles and reclaimed water saddles). The markers for fittings shall indicate the type of fitting and shall be labeled PWF in “safety” blue, RWF in purple, and FMF in green, for potable water fittings, reclaimed water fittings, and sanitary force main fittings, respectively. The Contractor is responsible for making the aforementioned markers available to the Surveyor. The Contractor shall field locate the mains and fittings when markers are not made available to the Surveyor.

C. A PVC pipe marker or 2” x 4” marker shall be inserted by the Contractor at the beginning and end of each horizontal directional drill (HDD). The HDD Contractor shall provide a certified report and bore log indicating the horizontal and vertical location every 25 linear feet or less along the pipe.

D. A 2” PVC pipe marker with a painted end cap shall be inserted by the Contractor at the ROW line indicating each individual new service location or stub out. The marker shall be a 6 foot length of PVC pipe inserted 2 feet into the ground and shall be painted “safety” blue for potable water, purple for reclaimed water, and green for sewer.

1.04 PROCEDURE FOR TESTING WATER LINES, FORCE MAINS AND RECLAIMED WATER LINES

A. A 48-hour notice is needed prior to testing. A letter stating the reasons testing should be scheduled ahead of other jobs must accompany all emergency testing requests.

B. County and Contractor must be present for all testing, except for testing tapping valves and sleeves.

C. HYDROSTATIC TESTING

1. Refer to Manatee County Public Works Utility Standards Part 1-Utility Standards Manual Section 1.8.7.

1.05 INSPECTION/TESTING PROCEDURE COVERING BORED PIPE LINES OR CASING AND CONDUITS INSTALLED ACROSS PREVIOUSLY TESTED AND/OR COUNTY ACCEPTED WATER AND SEWER PIPE WITHIN DEVELOPMENT PROJECTS UNDER ACTIVE CONSTRUCTION

A. Prior to testing water and sewer lines, every effort will be made to install sleeves for underground utilities that will cross these water and sewer lines or services.

B. Where it has not been possible to pre-install sleeves prior to testing and bores or conduits are required, it is the responsibility of the utility company and/or their

Contractor performing the work to provide Manatee County Utility Operations Department or the Engineer of Record with accurate horizontal and vertical as-built information of the sleeves, bores and conduits installed by said utility company. This applies to all bores and conduits crossing water and sewer lines.

C. Procedures to be followed for installation of conduits, pipe lines and bores that will cross, or be closer than 5'-0" horizontally and 18 inches vertically to, previously tested water and sewer lines that are still under the ownership of the developer/contractor.

1. Notify the County and obtain the best as-built information available. Allow sufficient time for the County to field locate the existing pipe lines.
2. Submit drawings of proposed location to the County and Manatee County Utility Operations Dept. Utility Locations Section for review.
3. Obtain a County Right-of-Way Use Permit if the work area is within a dedicated area of right-of-way.
4. Perform installation in the presence of a County representative. Call (941) 792-8811, ext. 5061 or ext. 5069 with at least two (2) working days notice.
5. Submit two (2) copies of as-built information to the County to incorporate into the record drawings to be submitted to the County.
6. Failure to follow steps 2) thru 5) will result in additional charges for retesting the previously tested water and sewer lines.

D. Procedures to be followed for installation of conduits, pipe lines and bores crossing or closer than 5'-0" horizontally and 18 inches vertically to previously tested water and sewer lines that have been previously accepted by Manatee County:

1. Obtain record drawing information from the County.
2. If roadway has been dedicated to Manatee County, obtain Right-of-Way Use Permit and copy the Project Management Department Locations Section with proposed location drawing.
3. Follow procedures in "Sunshine State One-Call", paying special attention to the requirements of Section VII.

E. Should water or sewer lines be damaged during the bore pipe line or casing installation, the cost of any repairs and retesting will be paid for by the utility company that installed the bore. The actual clearance between a bored casing crossing a water or sewer pipe should not be less than 18 inches.

1.06 DETECTION

A. Direct buried pipe shall have 3" detectable metallic tape of the proper color placed directly above the pipe and 12" below finished grade or 6" detectable tape between 12" and 24" below finished grade.

B. Direct buried or horizontal directional drilled non-metallic pipe shall also have tracer wire installed along the pipe alignment. The tracer wire to be used shall be a solid, 10 gauge, high strength, copper clad steel wire with a polyethylene jacket of appropriate color manufactured by Copperhead Industries or Manatee County approved equal.

END OF SECTION

SECTION 02640 VALVES AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.

B. All of the types of valves and appurtenances shall be products of well established reputable firms who are fully experienced and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these standards as applicable. Valves used in waterworks applications shall comply with Section 8 of NSF Standard 61 for mechanical devices.

C. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of potable water, reclaimed water, wastewater, etc., depending on the applications.

D. All valves and appurtenances shall be of the size shown on the drawings and, to the extent possible, all equipment of the same type on the project shall be from a single manufacturer.

E. All valves and appurtenances shall have the name of the manufacturer, year of the valve and the working pressure for which they are designed cast in raised letters upon some visible part of the body.

F. Special tools, if required for the normal operation or maintenance, shall be supplied with the equipment.

G. All hand actuated buried valves shall have three-piece adjustable valve boxes and 2-inch square AWWA operating nuts. Provide stainless steel extension stems and alignment rings where needed to bring the operating nut to within 4 feet below the box lid.

H. Water and reclaimed water system isolation valves shall be gate valves for sizes 2-inch through 12-inch and shall be butterfly valves for sizes 16-inch and larger.

I. Isolation valves for sewer force main pipelines shall be gate valves, unless otherwise noted on the plans. Tapping valves shall be used for tapping force mains. Plug valves shall be full port, have a 100% circular cross section, and must have prior written authorization from the County for use.

J. Valves shall open when turning the operating nut or wheel counterclockwise and shall close when turning clockwise.

K. All bonnet bolts, gland bolts, flange connection bolts, nuts, washers, and other trim hardware exposed to the outside environment shall be stainless steel. Thrust collar

tie-rod bolts shall be stainless steel. All MJ-type underground bolts, nuts, and washers shall be COR-TEN or stainless steel.

L. All valves shall have a factory applied, holiday free, fusion bonded epoxy coating on the interior and exterior unless otherwise noted in the plans or the following specification. All other painted items exposed to sunlight, including field painted box lids, etc., shall be painted the appropriate color with an epoxy type paint.

M. No valves with a break-way stem shall be allowed.

N. The equipment shall include, but not be limited to, the following:

1. Gate valves (Sec. 2.01)
2. Combination Pressure Reducing and Pressure Sustaining with Check Valves Option (Sec. 2.02)
3. Ball Valves (Sec. 2.03)
4. Butterfly Valves (Sec. 2.04)
5. Plug Valves (Sec. 2.05)
6. Valve Actuators (Sec. 2.06)
7. Air Release Valves (Sec. 2.07)
8. Valves Boxes (Sec. 2.08)
9. Corporation Stops and Saddles (Sec. 2.09)
10. Flange Adapters and Plain End Couplings (Sec. 2.10)
11. Hose Bibs (Sec. 2.11)
12. Swing Check Valves (Sec. 2.12)
13. Hydrants (Sec. 2.13)
14. Restrained Joints (Sec. 2.14)
15. Tapping Sleeves and Tapping Valves (Sec. 2.15)
16. Tracer Wire Boxes (Sec. 2.16)

1.02 SUBMITTALS

A. Submit to the County within 30 days after execution of the contract a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.

B. Complete shop drawings of all valves and appurtenances shall be submitted to the County for approval in accordance with the Specifications.

1.03 TOOLS

Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2 PRODUCTS

2.01 GATE VALVES

A. Where indicated on the drawings or necessary due to locations, size, or inaccessibility, chain wheel operators shall be furnished with the valves. Such operators shall be designed with adequate strength for the valves with which they

are supplied and provide for easy operation of the valve. Chains for valve operators shall be galvanized.

B. Gate valves installed underground shall be provided with a box cast in a concrete pad and a box cover. Stainless steel or equivalent valve extension stems shall be provided to place the valve operating nut no more than 4 feet deep. One valve wrench, 6 feet in length, shall be provided for every 15 valves installed.

C. Gate valves 2 inches to 14 inches in diameter shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509 or AWWA C515 and shall be UL listed and FM approved where applicable. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

D. The valves shall have a non-rising stainless steel stem to eliminate lead content. All bolts, nuts and washers shall be stainless steel to eliminate exterior corrosion and maintain fastener strength. Manufacturer shall use Never-Seez or equivalent during assembly of bolt and nut sets to prevent galling of similar metals. Stem seals shall be provided and shall be of the O-ring type, two above and one below the thrust collar. Valves that are located above grade and located in valve vaults shall be OS&Y with flanged joints.

E. The wedge shall be ductile iron fully encapsulated with an EPDM rubber. The Elastomer type shall be permanently indicated on the disc or body of the valve. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

F. The valve body, bonnet, and bonnet cover shall meet or exceed all the requirements of AWWA C515.

G. Valves meeting AWWA C515 requirements shall be rated for an operating pressure of 250 psi and shall be tested in accordance with AWWA C515.

H. The valves are to have 2-inch cast or ductile iron AWWA operating nuts and shall open left or counterclockwise.

I. The valves shall be covered by a Manufacturer's 10 year warranty on manufacturer's defects and reasonable labor costs for replacement. Warranty shall become effective from the date of purchase by the end user and delivered within 30 days from the receipt of the purchase order. For publicly owned and maintained utilities, the end user is Manatee County Government.

J. Gate valves shall be assembled and tested in a certified ISO 9001:2000 manufacturing facility within the United States and provide their certification of meeting internationally recognized quality control procedures.

K. Acceptable manufacturers are limited to the following: American Flow Control, Series 2500 FL x FL, Kennedy, Model KS-RW/2638 FL x FL, Mueller, Model A-2361 FL x FL, and Clow, Model 2638 FL x FL.

2.02 COMBINATION PRESSURE REDUCING & PRESSURE SUSTAINING WITH CHECK VALVE OPTION

A. Pressure sustaining and check valve shall be pilot operated diaphragm actuated valve with cast iron body, bronze trim, and 125-pound flanged ends. The valve shall be hydraulically operated, diaphragm type globe valve. The main valve shall have a single removable seat and a resilient disc, of rectangular cross section, surrounded on three and a half sides. No external packing glands are permitted and there shall be no pistons operating the main valve or any controls. The valve shall be equipped with isolation valves to service the pilot system while permitting flow if necessary. Main valve and all pilot controls shall be manufactured in the United States of America. Valve shall be single chamber type, with stainless steel stem.

B. Valve shall automatically reduce pressure for the downstream distribution network and sustain a minimum pressure in the high pressure main regardless of distribution demand, and as an option, shall also close when a pressure reversal occurs for check valve operations. The pilot system shall consist of two direct acting, adjustable, spring loaded diaphragm valves.

C. Valve shall be cast iron or ductile iron with main valve trim of brass and bronze. The pilot control valves shall be cast brass with 303 stainless steel trim. Acceptable manufacturers are limited to the following: AVK, Series 41, American Flow Control, Series 52, Kennedy, Series 106 LW or 1106 LW, or Mueller, Series 8001 or A 2600-6-01I.

2.03 BALL VALVES

A. Ball valves for water and reclaimed water, in sizes 3/4-inch through 2-inch, shall be brass body, stem and ball per ASTM B 62, alloy 85-5-5-5, full port, full flow, 1/4-turn check, ball curb valves, rated for 300 psi, Mueller 300 (as specified in the table below), Ford B-Series, or approved equal, with compression, pack joint, flare, threaded or flanged ends as required. Ball valves for wastewater, 2-inch through 3-inch, shall be 316 stainless steel body, cap, stem and ball per ASTM A351, full port, full flow, 1/4-turn check, ball valves, steam rated for 150 psi, pressure rating 1,000 psi CWT, Apollo 76F or approved equal, with threaded or flanged ends as required.

Curb Stops for Water and Reclaimed Water

Pipe Material	Type of Connection	Model
HDPE	Compression x FIP	B-25170 *
HDPE	Pack Joint x FIP	P-25170 *
Copper	Compression x FIP	B-25170
Copper	Flare x FIP	B-25166
Stainless Steel	FIP x FIP Thread	B-20200
* Insert required, part number per manufacturer product information		

B. All valves shall be mounted in such a position that valve position indicators are plainly visible. Above grade ball valves shall have a vinyl coated lever handle.

Lever handle, handle nut, and lever packing gland shall be 304 or 316 stainless steel.

C. Potable plastic service pipe material and compression and pack joint connectors shall not be used in soil that is contaminated with low molecular-weight petroleum products, aromatic hydrocarbons, chlorinated hydrocarbons or organic solvents. Appropriate service tubing shall apply.

2.04 BUTTERFLY VALVES

A. Butterfly valves shall conform to AWWA C504, Class 250 B, Mueller Lineseal XPII, DeZurik AWWA, Pratt HP-250II, or an approved equal.

B. Valve seats shall be an EPDM elastomer. Valve seats 24 inches and larger shall be field adjustable and replaceable without dismounting operator dise or shaft and without removing the valve from the line. Valves 20 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C504.

C. All valves shall be subject to hydrostatic and leakage tests at the point of manufacture. The hydrostatic test for Class 250 valves shall be performed with an internal hydrostatic pressure equal to 500 psi applied to the inside of the valve body of each valve. During the hydrostatic test, there shall be no leakage through the metal, the end joints or the valve shaft seal. The leakage test for the Class 250 valves shall be performed at a differential pressure of 250 psi and against both sides of the valve. No adjustment of the valve disc shall be necessary after pressure test for normal operation of valve. All valves shall be leaktight in both directions.

D. Butterfly valve actuators shall conform to AWWA C504. Gearing for the actuators shall be totally enclosed in a gear case. Actuators shall be capable of seating and unseating the disc against the full design pressure and shall transmit a minimum torque to the valve. Actuators shall be rigidly attached to the valve body.

E. The valve shaft shall be constructed of 18-8, ASTM A-276, Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design. Shaft bearings shall be teflon or nylon, self-lubricated type.

F. Gearing for the operators shall be totally enclosed in a gear case in accordance with paragraph 3.8.3 of the above mentioned AWWA Standard Specification.

G. Operators shall be capable of seating and unseating the disc against the full design pressure of velocity, as specified for each class, into a dry system downstream and shall transmit a minimum torque to the valve. Operators shall be rigidly attached to the valve body.

H. The manufacturer shall certify that the required tests on the various materials and on the completed valves have been satisfactory and that the valves conform with all requirements of this Specification and the AWWA standard.

I. Where indicated on the Drawings, extension stems, floor stands, couplings, stem guides, and floor boxes as required shall be furnished and installed.

2.05 PLUG VALVES

A. Plug valves shall be eccentric, non-lubricating type with integral plug and shafts and shall be furnished with end connections and with actuating mechanisms as called for on the construction plans or as otherwise required. Valves shall seal bubble-tight or water drop-tight in both directions when tested according to the Leakage Test method of AWWA C504 with a hydrostatic pressure of 150 psi.

B. Plug valves shall also be subjected to the internal, full body Hydrostatic Test of AWWA C504 at a pressure two times the rated pressure or a minimum pressure of 300 psi, whichever is greater. During the test, there shall be no leakage through the metal, or through the end joints or shaft seal, nor shall any part of the valve be deformed. Plug valves shall be Kennedy or Dezurik.

C. Flanged valve ends shall be faced and drilled according to ANSI B 16.1, Class 125. Mechanical joint valve ends shall conform to AWWA C111. Threaded ends shall conform to the NPT requirements of ANSI B1.20.1.

D. The plug valve body, bonnet and gland shall be ductile iron per ASTM A 126, Class B. The integral plug and shafts shall be cast iron ASTM A 126, Class B, or 316 stainless steel. The entire plug, except for the shafts, shall be covered with nitrile (Buna N) rubber. The rubber compound shall have been vulcanized to the metal plug and shall have a peel strength of not less than 75 pounds per inch when tested according to ASTM D 429, method B. The valve seat shall be at least 90 percent pure nickel, welded-in overlay into the cast iron body. The top and bottom bearings shall be 316 stainless steel.

E. Plug valves shall have a full port area of 100 percent of the nominal pipe size area.

F. Valves shall have worm gear type actuators with 2-inch square operating nuts.

G. Plug valves shall be installed side-ways with plug shaft horizontal so that the plug rotates upward when it opens, with the flow entering the seat end of the valve.

H. Plug valves shall be coated inside with Protecto 401 or amine-cured novolac ceramic epoxy or another two-part epoxy suitable for sanitary sewer service which has been approved by Manatee County.

I. Acceptable manufacturers are limited to the following: Pratt, Series 600FP/601FP, Milliken, Series 600F/601F, or GA Industries, Figure 517 Eco-Centric.

2.06 VALVE ACTUATORS

A. Butterfly valve and plug valve actuators.

Butterfly valve and plug valve actuators shall conform to the requirements for actuators presented in AWWA C 504 and shall be either manual or motor operated. Actuators shall be capable of seating and unseating the disc against the full design

pressure and velocity, as specified for each class, into a dry system downstream, and shall transmit a minimum torque to the valve. Actuators shall be rigidly attached to the valve body.

B. Manual Actuators.

Manual actuators shall have permanently lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure and velocities. Actuators shall be equipped with handwheel, position indicator, and mechanical stop-limiting locking devices to prevent over travel of the disc in the open and closed positions. They shall turn counter-clockwise to open valves. Manual actuators shall be of the traveling nut, self-locking type or of the worm gear type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Valves located above grade shall have handwheel and position indicator, and valves located below grade shall be equipped with a 2-inch square AWWA operating nut located at ground level and cast iron extension type valve box.

C. Motor Actuators (Modulating)

1) The motor actuated valve controller shall include the motor, actuator unit gearing, limit switch gearing, limit switches, position transmitter which shall transmit a 4-20 mA DC signal, control power transformer, electronic controller which will position the valve based on a remote 4-20 milliamp signal, torque switches, bored and key-wayed drive sleeve for non-rising stem valves, declutch lever and auxiliary handwheel as a self-contained unit.
2) The motor shall be specifically designed for valve actuator service using 480 volt, 60 Hertz, three phase power as shown, on the electrical drawings. The motor shall be sized to provide an output torque and shall be the totally enclosed, non-ventilated type. The power gearing shall consist of helical gears fabricated from heat treated alloy steel forming the first stage of reduction. The second reduction stage shall be a single stage worm gear. The worm shall be of alloy steel with carburized threads hardened and ground for high efficiency. The worm gear shall be of high tensile strength bronze with hobbed teeth. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout. Preference will be given to units having a minimum number of gears and moving parts. Spur gear reduction shall be provided as required.
3) Limit switches and gearing shall be an integral part of the valve control. The limit switch gearing shall be made of bronze and shall be grease lubricated, intermittent type and totally enclosed to prevent dirt and foreign matter from entering the gear train. Limit switches shall be of the adjustable type capable of being adjusted to trip at any point between fully opened valve and fully closed valve.
4) The speed of the actuator shall be the responsibility of the system supplier with regard to hydraulic requirements and response compatibility with other components within the control loop. Each valve controller shall be provided with a minimum of two rotor type gear limit switches, one for opening and one for closing. The rotor type gear limit switch shall have two normally open and two normally closed contacts per rotor. Gear limit switches must be geared to the driving mechanism and in step at all times whether in

motor or manual operation. Provision shall be made for two additional rotors as described above, each to have two normally open and two normally closed contacts. Each valve controller shall be equipped with a double torque switch. The torque switch shall be adjustable and will be responsive to load encountered in either direction of travel. It shall operate during the complete cycle without auxiliary relays or devices to protect the valve, should excessive load be met by obstructions in either direction of travel. The torque switch shall be provided with double-pole contacts.

5) A permanently mounted handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operations, but must be responsive to manual operation at all times except when being electrically operated. The motor shall not rotate during hand operation nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve operator will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. This movement from motor operation to handwheel operation shall be accomplished by a positive declutching lever which will disengage the motor and motor gearing mechanically, but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running. The gear limit switches and torque switches shall be housed in a single easily accessible compartment integral with the power compartment of the valve control. All wiring shall be accessible through this compartment. Stepping motor drives will not be acceptable.

6) The motor with its control module must be capable of continuously modulating over its entire range without interruption by heat protection devices. The system, including the operator and control module must be able to function, without override protection of any kind, down to zero dead zone.

7) All units shall have strip heaters in both the motor and limit switch compartments.The actuator shall be equipped with open-stop-close push buttons, an auto-manual selector switch, and indicating lights, all mounted on the actuator or on a separate locally mounted power control station.

8) The electronics for the electric operator shall be protected against temporary submergence.

9) Actuators shall be Limitorque L120 with Modutronic Control System containing a position transmitter with a 4-20MA output signal or equal.

D. Motor Actuators (Open-Close)

1) The electronic motor-driven valve actuator shall include the motor, actuator gearing, limit switch gearing, limit switches, torque switches, fully machined drive sleeve, declutch lever, and auxiliary handwheel as a self-contained unit.

2) The motor shall be specifically designed for valve actuator service and shall be of high torque totally enclosed, nonventilated construction, with motor leads brought into the limit switch compartment without having external piping or conduit box.

3) The motor shall be of sufficient size to open or close the valve against maximum differential pressure when voltage to motor terminals is 10% above or below nominal voltage.

4) The motor shall be prelubricated and all bearings shall be of the anti-friction type.

5) The power gearing shall consist of helical gears fabricated from heat treated steel and worm gearing. The worm shall be carburized and hardened alloy steel with the threads ground after heat treating. The worm gear shall be of alloy bronze accurately cut with a hobbing machine. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout.

6) Limit switches and gearing shall be an integral part of the valve actuator. The switches shall be of the adjustable rotor type capable of being adjusted to trip at any point between fully opened valve and fully closed valve. Each valve controller shall be provided with a minimum of two rotor type gear limit switches, one for opening and one for closing (influent valves require additional contacts to allow stopping at an intermediate position). The rotor type gear limit switch shall have two normally open and two normally closed contacts per rotor. Additional switches shall be provided if shown on the control and/or instrumentation diagrams. Limit switches shall be geared to the driving mechanism and in step at all times whether in motor or manual operation. Each valve actuator shall be equipped with a double torque switch. The torque switch shall be adjustable and will be responsive to load encountered in either direction of travel. It shall operate during the complete cycle without auxiliary relays or devices to protect the valve should excessive load be met by obstructions in either direction of travel. Travel and thrusts shall be independent of wear in valve disc or seat rings.

7) A permanently mounted handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operation except when being electrically operated. The motor shall not rotate during hand operation, nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve actuator will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. Movement from motor operation to handwheel operation shall be accomplished by a positive declutching lever which will disengage the motor and motor gearing mechanically, but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running.

8) Valve actuators shall be equipped with an integral reversing controller and three phase overload relays, Open-Stop-Close push buttons, local-remote-manual selector switch, control circuit transformer, three-phase thermal overload relays and two pilot lights in a NEMA 4X enclosure. In addition to the above, a close coupled air circuit breaker or disconnect switch shall be mounted and wired to the valve input power terminals for the purpose of disconnecting all underground phase conductors.

9) The valve actuator shall be capable of being controlled locally or remotely via a selector switch integral with the actuator. In addition, an auxiliary dry contact shall be provided for remote position feedback.

10) Valve A.C. motors shall be designed for operation on a 480 volt, 3-phase service. Valve control circuit shall operate from a fuse protected 120 volt power supply.

11) Motor operators shall be as manufactured by Limitorque Corporation, Type L120 or approved equal.

2.07 AIR RELEASE VALVES

A. Air release valves shall be automatic float operated, GA Industries fig-929 for sewer applications, Fig-920 for water and reclaimed water application, or an approved equal, with inlet size and working pressure ratings as required and NPT connections.

B. Valve bodies shall be ductile iron per ASTM A 126, Class B. The orifice, float and linkage shall be stainless steel. The seat shall be (Buna N) nitrile elastomer.

2.08 VALVE BOXES

A. Buried valves shall have adjustable cast iron or HDPE valve boxes. Lids shall be cast iron drop type, and shall have “WATER”, “SEWER”, or “RECLAIM”, as applicable, cast into the top. Lids will be painted “safety” blue for potable, purple for reclaimed, and green for sanitary sewer.

B. Cast iron boxes shall be two-piece, or three-piece, as required, screw type, Tyler Pipe, 6850 Series, Box 461-S through 668-S, with extensions, as required to make the desired box length, or an approved equal. Bottom barrel shall be 5-1/4 inches inside diameter, with a flanged bottom with sufficient bearing area to prevent settling.

C. HDPE boxes shall be two-piece, adjustable, 1/4-inch thick minimum heavy wall, high density polyethylene, with cast iron top and stainless steel adjustable stem, Trench Adapter, as manufactured by American Flow Control, or an approved equal. Bottom barrel shall have flanged bottom to prevent settling. All bolts, screws and pins shall be stainless steel.

D. Reclaimed Valve Boxes shall be square 9-inch x 9-inch load bearing marked “Reclaimed Water” and painted Pantone 522C purple.

E. All valves shall either have operating nuts within 4 feet below the top of the lid or shall have extension stems with centering guides to provide an extended operating nut within 4 feet below the lid. Extension stems shall be fixed to the valve operating nut with a stainless steel fastener.

F. All potable water, sewer, and reclaimed water grade-adjustment risers shall be cast iron material just like the valve box. No plastic or steel risers shall be allowed.

G. A centering device BoxLok or equal shall be installed in the valve box.

H. Stand pipe shall match color code of the system being installed, (blue for potable, Pantone purple 522 C for reclaimed, and green for sanitary sewer).

2.09 CORPORATION STOPS AND SADDLES

A. Corporation stops for connections to ductile iron and PVC water and reclaimed water mains shall be all red brass, alloy 85-5-5-5, per ASTM B 62, and shall conform to AWWA C800. 1-inch through 2-inch corporation stops shall be ball type, 300 psi working pressure rated, with AWWA MIP threaded inlets and compression,

pack joint, flare, or FIP threaded joint outlets, Mueller as shown in the table below, or an approved equal. All joints made to CTS size HDPE tubing shall use stainless steel insert stiffeners.

Corporation Stops

Pipe Material	Type of Connection	Mueller 300 Model
HDPE	Compression x AWWA IP Thread	B-25028 (Saddle) *
HDPE	Compression x AWWA Taper Thread	B-25008 (Direct Tap) *
HDPE	Pack Joint x AWWA IP Thread	P-25028 (Saddle) *
HDPE	Pack Joint x AWWA Taper Thread	P-25008 (Direct Tap) *
Copper	Compression x AWWA IP Thread	B-25028 (Saddle)
Copper	Pack Joint x AWWA Taper Thread	B-25008 (Direct Tap)
Copper	Pack Joint x AWWA IP Thread	P-25028 (Saddle)
Copper	Pack Joint x AWWA Taper Thread	P-25008 (Direct Tap)
Copper	Flare x AWWA IP Thread	B-25025 (Saddle)
Copper	Flare x AWWA Taper Thread	B-25000 (Direct Tap)
Stainless Steel	FIP Thread x AWWA IP Thread	B-20046 (Saddle)
Stainless Steel	FIP Thread x AWWA Taper Thread	B-20045 (Direct Tap)
* Insert required, part number per manufacturer product information		

B. Potable plastic service pipe material and compression and pack joint connectors shall not be used in soil that is contaminated with low molecular-weight petroleum products, aromatic hydrocarbons, chlorinated hydrocarbons or organic solvents. Appropriate service tubing shall apply.

C. Water and reclaimed water service connections to PVC and DIP mains shall be made using red brass saddles, alloy 85-5-5-5, per ASTM B 62. Straps, washers and nuts shall be brass or stainless steel. No ductile iron, cast iron or steel saddles will be allowed. Saddles shall be Smith Blair 325 Bronze saddles with Stainless Steel or brass extra wide strap or equivalent.

D. Connections to PVC sanitary force mains for services up to 2 inches shall be made using Romac Style 306 double bolt stainless steel service saddles or equivalent.

E. Service and air release valve (ARV) connections to HDPE water, reclaimed water and sewer mains may be made using Romac Style 306H saddle or approved equal. All saddles shall be properly sized per the manufacturer product information and be installed according to the manufacturer's written instructions. Connections to HDPE mains shall not be made using narrower saddles similar to the Smith-Blair 325.

2.10 FLANGED ADAPTERS AND PLAIN END COUPLINGS

Plain end couplings and adapters shall be fusion-bonded epoxy coated carbon steel with Ethylene Propylene Diene Monomer (EPDM) rubber gaskets and stainless steel nuts, bolts and spacers. Acrylonitrile butadiene (NBR) gaskets shall be used for potable water mains that are located in soil that is contaminated with low molecular-weight petroleum products or non- chlorinated organic solvents or non-aromatic organic solvents. Fluorocarbon (FKM) gaskets shall be used for potable water mains that are located in soil that is contaminated with aromatic

hydrocarbons or chlorinated hydrocarbons. Fluorocarbon (FKM) gaskets shall be used for potable water mains if the soil is contaminated with aromatic hydrocarbons or chlorinated hydrocarbons, and is also contaminated with low molecular-weight petroleum products or organic solvents. Couplings shall be Dresser Style 38, or another approved equal. Flange adapters shall have a plain end compression seal similar to the style 38, with an ANSI 125 Class flange on the opposite end, and shall be Dresser Style 128W or an approved equal. Stainless steel backup rings shall be used for force mains that are located in corrosive environments including wetwells and valve vaults.

2.11 HOSE BIBS

Hose bibs shall be 3/4" or 1" brass, polished chromium plated brass, with vacuum breaker as noted on the drawings.

2.12 SWING CHECK VALVES

A. Check valves shall be swing type, weighted lever, conforming to AWWA C508. Valves shall be iron-body, bronze-mounted, single disk, 175 psi working pressure for 2- through 12-inch, 150 psi for 14- through 30-inch, with ANSI B16.1 Class 125 flanged ends, by Mueller; No. A-2600-6-01 (sewer), No. A-2602-6-01 (water), or AVK Series 41, or an approved equal.

B. When there is no flow through the line, the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.

C. Check valves shall have bronze seat and body rings, extended bronze or stainless steel hinge pins and stainless steel nuts and bolts on bolted covers.

D. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weight.

2.13 HYDRANTS

Hydrants shall be dry barrel, nostalgic style, and shall be AVK Series 2780, American Darling B-84-B, Mueller Super Centurian 250, or approved equal and shall conform to AWWA C502 and UL/FM certified, and shall in addition meet the specific requirements and exceptions which follow:

A. Hydrants shall be according to manufacturer's standard pattern or nostalgic style and of standard size, and shall have one 5-inch Storz connection or equivalent with two 2½- inch hose nozzles.

B. Hydrant inlet connections shall have mechanical joints for 6-inch pipe.

C. Hydrant valve opening shall have an area at least equal to that area of a 5 1/4-inch minimum diameter circle and be obstructed only by the valve rod. Each hydrant shall be able to deliver 500 gpm minimum through its two 2 1/2 -inch hose nozzles when opened together with a loss of not more than 2 psi in the hydrant per AWWA C502.

D. The upper and lower stem rod shall be stainless steel and shall have a breakable stem-rod coupling of stainless steel, or cast iron or ductile iron with a fusion bonded epoxy coating, with stainless steel pins and clips.

E. Hydrants shall be hydrostatically tested as specified in AWWA C502 and shall be rated at 250 psi minimum.

F. The operating nut shall be 1½ -inch pentagon shaped with a protective weather cover, and open counter clockwise.

G. All nozzle threads shall be American National Standard.

H. Each nozzle cap shall be provided with a Buna N rubber washer.

I. All hydrants shall be traffic break away type and allow for 360 degree rotation to position the Storz connection/nozzle in the desired direction after installation.

J. Hydrants must be capable of being extended without removing any operating parts.

K. Hydrant extensions shall be fusion bonded epoxy coated inside and outside with a stainless steel stem. The breakaway coupling can be fusion bonded epoxy coated or stainless steel. Only one hydrant extension is allowed per hydrant.

L. Weepholes shall be excluded from fire hydrants.

M. Hydrant main valve closure shall be of the compression type opening against the pressure and closing with the pressure. The main valve shall be faced or covered with EPDM elastomer, which shall seat on a bronze ring.

N. Hydrant bonnets, weather cover, nozzle section, caps and shoe shall be cast iron or ductile iron, and shall be holiday free fusion-bonded epoxy coated at the factory, per AWWA C550, inside and outside. Lower barrel shall be fusion bonded epoxy coated inside and outside. Aboveground parts shall also have a top coat of Sherwin-Williams Acrolon 218 HS acrylic polyurethane or approved equal; color Safety Yellow for fire hydrants that are connected to the potable water system or Pantone 522C purple for fire hydrants that are connected to the reclaimed water system.

O. Exterior nuts, bolts and washers shall be stainless steel. Bronze nuts may be used below grade.

P. All internal operating parts shall be removable without requiring excavation.

2.14 RESTRAINED JOINTS

A. Pipe joints shall be restrained by poured-in-place concrete thrust blocks or by other mechanical methods, including tie rods, Stargrip and Allgrip, as manufactured by Star Pipe Products or Megaflange and 2000 PV, as manufactured by EBAA Iron Sales. Flanged joints may be used above ground.

B. All T-bolts, bolts, nuts, washers, and all thread rods shall meet ASTM A-588 requirements (Cor-ten or equivalent) “weathering steel” or be 316 stainless steel. The use of rebar with welded thread is prohibited.
A certification from the supplier shall be provided to the County during the shop drawing review process ensuring all T-bolts, bolts, nuts, washers, and all thread rods meet the A-588 requirements and shall state the project name and contractor in the certification letter. If stainless steel is to be used, no certification letter is required.

C. Restrained joints may also be Lok-Ring, as manufactured by American Cast Iron Pipe Company, or an approved equal.

D. Restrained joint designs, which require wedges and/or shims to be driven into the joints in order to disassemble the pipe shall not be allowed.

2.15 TAPPING SLEEVES AND VALVES

A. Tapping valves shall meet the requirements of AWWA C509/C515 with ductile iron body and shall be rated for a pressure of 250 psi. The valves shall be flanged with alignment ring by mechanical joint with a nonrising stainless steel stem. All bolts, nuts and washers shall be stainless steel. Manufacturer shall use Never-Seez or equivalent during assembly of bolt and nut sets to prevent galling of similar metals. Stem seals shall be provided and shall be of the O-ring type, two above and one below the valve’s thrust collar. Valve shall be designed for vertical burial and shall open counterclockwise. Operating nut shall be AWWA standard 2-inch square for valves 2 inches and up. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve to accommodate full size shell cutter. Gaskets shall cover the entire area of the flange surface and be 1/8-inch minimal thickness of red rubber. The wedge shall be ductile iron fully encapsulated with EPDM rubber. All bolts, nuts and washers between the sleeve and valve shall be stainless steel.

B. Tapping sleeves and saddles shall be stainless steel, seal to the pipe by the use of a gasket compounded for water or sewer, and shall be able to withstand a pressure test of 180 psi for water lines or 150 psi for sewer force mains for one hour with no leakage in accordance with AWWA C110. A stainless steel 3/4-inch NPT test plug shall be provided for pressure testing. All bolts joining the two halves shall be stainless steel and shall be included with the sleeve or saddle; Romac SST III or Romac SST-H.

2.16 TRACER WIRE TEST STATION BOXES

Tracer wire test station boxes shall be provided at plug valves, butterfly valves, blowoff valves, gate valves, fire hydrants and backflow preventers as indicated in these Standards. Tracer wire test station boxes for yard service shall be 2 ½ inch diameter, 15 inch length, ABS plastic with a cast iron rim and lid, P200NFGT as manufactured by Bingham & Taylor, or equal approved by Manatee County. Where test boxes will be in streets or subject to vehicular traffic, use B&T Model P525RD, 5 ¼ -inch diameter or equal, centered in a separate concrete pad similar to a valve box pad.

PART 3 EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage occurring to the above items before they are installed shall be repaired to the satisfaction of the County.

B. After installation, all valves and appurtenances shall be tested at least two hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the County.

C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

D. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections.

E. Flanged joints and mechanical joints shall be made with high strength, low alloy Corten or 316 stainless steel bolts, nuts and washers.

F. Prior to assembly of split couplings, the grooves as well as other parts shall be thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be moderately coated with petroleum jelly, cup grease, soft soap or graphite paste, and the gasket shall be slipped over one pipe end. After the other pipe has been brought to the correct position, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing sections then shall be placed. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact, metal-to-metal, without excessive bolt tension.

G. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8". Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6" from the end.

H. Valve boxes with concrete bases shall be installed as shown on the Drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and the top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box.

3.02 HYDRANTS

A. Hydrants shall be set at the locations designated by the County and/or as shown on the Drawings and shall be bedded on a firm foundation. A drainage pit on

crushed stone as shown on the Drawings shall be filled with gravel or crushed stone and satisfactorily compacted. During backfilling, additional gravel or crushed stone shall be brought up around and 6" over the drain port. Each hydrant shall be set in true vertical alignment and shall be properly braced. Concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the plans. Felt paper shall be placed around the hydrant elbow prior to placing concrete. CARE MUST BE TAKEN TO INSURE THAT CONCRETE DOES NOT PLUG THE DRAIN PORTS. Concrete used for backing shall be as specified herein.

B. When installations are made under pressure, the flow of water through the existing main shall be maintained at all times. The diameter of the tap shall be a minimum of 2" less than the inside diameter of the branch line.

C. The entire operation shall be conducted by workmen thoroughly experienced in the installation of tapping sleeves and valves, and under the supervision of qualified personnel furnished by the manufacturer. The tapping machine shall be furnished by the Contractor if tap is larger than 12" in diameter.

D. The Contractor shall determine the locations of the existing main to be tapped to confirm the fact that the proposed position for the tapping sleeve will be satisfactory and no interference will be encountered such as the occurrence of existing utilities or of a joint or fitting at the location proposed for the connection. No tap will be made closer than 30" from a pipe joint.

E. Tapping valves shall be set in vertical position and be supplied with a 2" square operating nut for valves 2" and larger. The valve shall be provided with an oversized seat to permit the use of full sized cutters.

F. Tapping sleeves and valves with boxes shall be set vertically or horizontally as indicated on the Drawings and shall be squarely centered on the main to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Sleeves shall be no closer than 30" from water main joints. Thrust blocks shall be provided behind all tapping sleeves. Proper tamping of supporting earth around and under the valve and sleeve is mandatory. After completing the tap, the valve shall be flushed to ensure that the valve seat is clean.

3.03 SHOP PAINTING

Ferrous surfaces of valves and appurtenances shall receive a coating of rust-inhibitive primer. All pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

3.04 FIELD PAINTING

All metal valves and appurtenances specified herein and exposed to view shall be painted safety blue.

3.05 INSPECTION AND TESTING

All pipelines shall remain undisturbed for 24 hours to develop complete strength at

all joints. All pipelines shall be subjected to a hydrostatic pressure and leak testing. Refer to Manatee County Public Works Utility Standards Part 1-Utility Standards Manual Section 1.8.7. Prior to testing, the pipe lines shall be supported in a manner approved by the County to prevent movement during tests.

All leaks shall be repaired and lines retested as approved by the County.

END OF SECTION

SECTION 02720 SANITARY SEWER BYPASS PUMPING

PART 1 GENERAL

1.01 SCOPE

The Contractor shall furnish all labor, materials, equipment and incidentals required to maintain existing and anticipated flows within the affected portion of the collection system throughout the construction period.

1.02 PUBLIC IMPACTS

The contractor shall not create a public nuisance due to excessive noise or dust, nor impact the public with flooding of adjacent lands, discharge of raw sewage, or release of other potential hazards, nor shall he encroach on or limit access to adjacent lands. No extra charge may be made for increased costs to the contractor due to any of the above.

1.03 SUBMITTALS

A. The Contractor shall, within 30 days of the date of the Notice to Proceed, submit to the Project Manager a detailed Pumping Plan for each site by-pass pumping will be needed. The Pumping Plan shall address all measures and systems to prevent a sanitary sewer overflow (SSO) as defined by the EPA. The Plan shall include as a minimum:

1. Working drawings and sketches showing work location, pump location, piping layout & routing. Show all proposed encroachment and access impacts on adjacent properties or facilities.
2. Pump, control, alarm and pipe specifications or catalog cuts. Detailed sketch of controls and alarm system.
3. Power requirements and details on methods to provide by-pass power or fueling.
4. Calculation and determination of response times to prevent an SSO after a high water alarm. If anticipated peak flows are 750 G.P.M. or greater, an operator is required on site at all times pump is in service. If the anticipated peak flows are less than 750 G.P.M. an operator may not be required to be on site at all times; show operator on-site schedule.
5. Procedures to be taken in case of power, pump, or piping failures; including contact names and numbers for emergency notifications.
6. Frequency and specific responsibility for monitoring pump operation, fuel levels, pump maintenance and entire length of piping.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Pumps:

1. By-pass pumping system shall consist of at least a primary pump and a

backup pump. Each pump shall have a minimum pumping capacity of 100% of the anticipated peak flows. When bypassing a pump station, 100% of the lift station capacity (G.P.M. & T.D.H) shall be provided.

2. Pumps shall be low noise or sound attenuated. The noise level at any operating condition, in any direction, shall not exceed 70dBA at a distance of twenty three (23) feet (7 meters) from the pump and/or power source.

B. Controls:

The by-pass pump system shall be equipped with automatic controls and an alarm system. The automatic controls will automatically start the backup pump in the event of a high water condition or failure of the primary pump. The alarm system will immediately notify the Contractor of a pump failure or high water condition.

C. Pipe:

Pipe shall be of adequate size and capacity to match the pumps. Pipe type and materials will depend on the particulars of the site conditions, and shall be detailed in the Pumping Plan. Contractor will provide all connections.

PART 3 EXECUTION

3.01 SITE CONDITIONS

Site conditions will vary by site. Contractor is responsible to determine and address requirements such as traffic control, excavation, connections & fittings, impacts on access to adjacent properties, routing and support of by-pass piping, etc., in the Pumping Plan.

3.02 ON-SITE MONITORING

A. All by-pass operations where the anticipated flow rates are 750 G.P.M or greater shall require an employee on-site at all times (full-time on-site monitoring attended by personnel experienced with the pumps and controls, with demonstrated ability to monitor, turn on & off, and switch between pumps while the by-pass pump system is in service.

B. By-pass operations where the anticipated flow rates are less than 750 G.P.M may not require an employee on-site at all times while the by-pass pump system is in operation. The Contractor shall have personnel experienced with the pumps and controls on site within the calculated response time to prevent an SSO after a high water alarm.

C. During by-pass operations, the Contractor shall have posted on site with the permit, a copy of the approved Plan and the name and 24 hour contact number of the primary response person, the job site superintendent, and the construction company owner.

3.03 OPERATIONS

A. The Contractor is responsible for securing and providing power, fuel, site security, traffic control and all other supplies, materials and permits required for the by-pass

pumping.

B. Contractor shall demonstrate automatic pump switching and alarm system to the satisfaction of: the County inspector, Project Manager, or Lift Stations Superintendent prior to beginning by-pass pumping. Satisfactory demonstration shall be documented by the inspector's, PM's or Lift Station Superintendent's dated signature on the posted copy of the approved Pumping Plan.

3.04 DAMAGE RESTORATION & REMEDIATION

A. The Contractor shall be responsible for any pre-pump notifications, all restoration of pre-pump conditions and any damage caused by by-pass operations.

B. Should there be an SSO caused by or as a direct result of the by-pass pumping, the contractor is responsible for all immediate & long term response, notifications, clean up, mitigation, etc. Copies of all written response plans, notifications, documentation, mitigation plans, etc., shall be submitted to the County Project Manager.

END OF SECTION

DIVISION 3 CONCRETE

SECTION 03300 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. Code references

1. Florida Building Code (FBC) 2020 Edition.
2. ACI 301, "Structural Concrete for Buildings."
3. ACI 318, "Building Code Requirements for Reinforced Concrete."
4. ACI 350, "Code Requirements for Environmental Engineering Concrete Structures

1.02 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Minor equipment pads and pipe encasements.
2. Structural Concrete – All other concrete.

B. Related Sections:

1. Section 02220 "Excavation, Backfill, Fill and Grading for Structures" for fill under slabs-on-grade and bottom slabs and footings.
2. Section 07920 “Sealants and Caulking” for concrete joint applications.
3. Section 09900 “Paintings” for all interior and exterior coating liquid containment and non-liquid containment structures applications.
4. Section 09720 “Surface Protection Spray System”

1.03 DEFINITIONS

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

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Submittals:

1. Design Mixtures: Submit concrete mixture proportions, characteristics and location for use for each concrete mixture. Submittal shall include documentation indicating the proposed concrete proportions will produce an average compressive strength equal to or greater than the required average compressive strength and shall consist of field strength records (field test data) or trial mixtures in accordance with ACI 301, 4.2.3.4.a or 4.2.3.4.b, respectively. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
2. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Engineer.

F. Samples: None.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer and testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Waterstops.

6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Semi rigid joint filler.
12. Joint-filler strips.
13. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of pre-installation conference.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 318, "Building Code Requirements for Reinforced Concrete."
4. ACI 350, "Environmental Engineering Concrete Structures."
5. ACI 305, "Hot Weather Concreting."
6. ACI 306, "Cold Weather Concreting."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Mockups: None.

I. Pre-installation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete subcontractor.
    e. Special concrete finish subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi rigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement, if applicable.

B. Waterstops: Store water stops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

    a. High-density overlay, Class 1 or better.
    b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    c. Structural 1, B-B or better; mill oiled and edge sealed.
    d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties for liquid containment structures that have an integral water stop that is tightly welded to the tie.
4. Furnish ties for exposed concrete that are the cone-washer type. The cones shall be made of approved wood or plastic. Common wire will not be allowed for form ties

2.02 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Low-Alloy-Steel Reinforcing Bars: None.

D. Galvanized Reinforcing Bars: None.

E. Epoxy-Coated Reinforcing Bars: None.

F. Stainless-Steel Reinforcing Bars: None.

G. Steel Bar Mats: None.

H. Plain-Steel Wire: ASTM A 82/A 82M. None.

I. Deformed-Steel Wire: ASTM A 496/A 496M.

J. Epoxy-Coated Wire: None.

K. Plain-Steel Welded Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

L. Deformed-Steel Welded Wire Reinforcement: None.

M. Galvanized-Steel Welded Wire Reinforcement: None.

N. Epoxy-Coated Welded Wire Reinforcement: None.

2.03 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel deformed bars, cut true to length with ends square and free of burrs.

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

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type II, gray, no substituted are allowed. Cement replacement by weight can be up 20% of the total weight, replace with Fly Ash and/or Slag.

a. Fly Ash: ASTM C 618, Class F.
b. Slag: ASTM 989, Grade 120

B. Normal-Weight Aggregates: ASTM C 33, Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement. Use Clean, sharp, natural silica sand free of loam, clay, lumps, and other deleterious substances. Dune sand, bank run sand, and manufactured sand are not acceptable.

2. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter. Coarse aggregate shall comply with the following:

a. Crushed stone, processed from natural rock or stone.
b. Washed gravel, either natural or crushed. Slag, pit gravel, and bank-run gravel are not allowed.

c. Coarse Aggregate Size: ASTM C33/C33M, No. 57 stone, unless otherwise approved by ENGINEER.

B. Water: ASTM C 94/C 94M and potable.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.06 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricated corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. BoMetals, Inc.
   b. Greenstreak.
   c. Vinylex Corp.

2. Profile: Ribbed with center bulb.
3. Dimensions: 6 inches by 3/8 inch thick or 9 inches by 3/8 inch thick; tapered.

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Adeka Ultra Seal/OCM, Inc.; Adeka Ultra Seal.
b. Greenstreak; Hydrotite.
c. Vinylex Corp.; Swellseal.
d. Sika; Sika Swell S-2.

C. Self-sealing, non-swelling preformed joint sealant Waterstop: Shall provide a lasting, watertight bond on both fresh and cured concrete surfaces.

1. Products: Henry Company; Synko-Flex Waterstop.

2.07 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class C. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Fortifiber Building Systems Group; Moistop Plus.
b. Raven Industries Inc.; Vapor Block 6.
c. Reef Industries, Inc.; Griffolyn Type-65 or Type-85.
d. Stego Industries, LLC; Stego Wrap, 10 mil Class C.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.08 LIQUID FLOOR TREATMENTS

A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ChemMasters; Chemisil Plus.
b. ChemTec Int'l; ChemTec One.
c. Conspec by Dayton Superior; Intraseal.
d. Curecrete Distribution Inc.; Ashford Formula.
e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
f. Edoco by Dayton Superior; Titan Hard.

g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.

C. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Advanced Floor Products; Retro-Plate 99.
b. L&M Construction Chemicals, Inc.; FGS Hardener Plus.
c. QuestMark, a division of CentiMark Corporation; DiamondQuest Densifying Impregnator Application.

2.09 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating. Allowed for non-liquid containment structures.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Construction Chemicals - Building Systems; Kure 200.
b. ChemMasters; Safe-Cure Clear.
c. Conspec by Dayton Superior; W.B. Resin Cure.
d. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
e. Edoco by Dayton Superior; Res X Cure WB.
f. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
g. L&M Construction Chemicals, Inc.; L&M Cure R.
h. Meadows, W. R., Inc.; 1100-CLEAR.
i. SpecChem, LLC; Spec Rez Clear.
j. Symons by Dayton Superior; Resi-Chem Clear.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: Provide preformed expansion joint filler complying with ASTM D 1752, Type I (spong rubber) or Type II (cork).

B. Semi rigid Joint Filler: Two-component, semi rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing and Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022 thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4500 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 4500 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. Reference Section 1.04.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash and/or slag as needed to reduce the total amount of portland cement, which would otherwise be used. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash only: 20 percent by weight.
2. Slag only: 20 percent by weight.
3. Fly Ash + Slag: 20 percent by weight.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: If required by Architectural contract drawings, add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.13 CONCRETE MIXTURES

A. Minor equipment pads and pipe encasements:

1. Minimum Compressive Strength: 3,000 psi at 28 days.
2. Concrete mixture proportions in accordance with accepted design mixes. Reference Section 1.04.

B. Structural Concrete:

1. Minimum Compressive Strength: 4,000 psi at 28-days.
2. Concrete mixture proportions in accordance with accepted design mixes. Reference Section 1.04.
3. Reference Design Criteria Sheet S00.0.

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.03 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after

cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturers recommended tape.

B. Bituminous Vapor Retarders: if applicable.

3.05 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.06 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07920 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.07 WATERSTOPS

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

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.08 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount

of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.09 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

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

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of

formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces indicated and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

    a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
    b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
    c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
    d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
4. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
5. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

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

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 12-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.
4. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.12 CONCRETE PROTECTING AND CURING

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

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match

adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.
8. Water levels for hydraulic structures.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
10. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as

directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 03350 CONCRETE FINISHES

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required to finish cast-in-place concrete surfaces as specified herein.

1.02 SUBMITTALS

Submit to the County as provided in the Contract Documents, the proposed chemical hardener manufacturer's surface preparation and application procedures.

1.03 SCHEDULE OF FINISHES

A. Concrete for the Project shall be finished in the various specified manners either to remain as natural concrete or to receive an additional applied finish or material under another Section.

B. The base concrete for the following conditions shall be finished as noted and as further specified herein:

1. Exterior, exposed concrete slabs and stairs - broomed finish.
2. Interior, exposed concrete slabs - steel trowel finish.
3. Concrete on which process liquids flow or in contact with sludge - steel trowel finish.
4. Concrete where not exposed in the finished work and not scheduled to receive an additional applied finish or material - off-form finish.
5. Provide concrete surfaces to be left exposed such as walls, columns, beams and joists with smooth rubbed finish.

1.04 RESPONSIBILITY FOR CHANGING FINISHES

A. The surface finishes specified for concrete to receive additional applied finishes or materials are the finishes required for the proper application of the actual products specified under other Sections. Where different products are approved for use, it shall be the Contractor's responsibility to determine if changes in finishes are required and to provide the proper finishes to receive these products.

B. Changes in finishes made to accommodate product different from those specified shall be performed at no additional cost to the County. Submit the proposed new finishes and their construction methods to the County for approval.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland cement and component materials required for finishing the concrete surfaces shall be as specified in the Contract Documents.

B. Hardener shall be Lapidolith as manufactured by Sonneborn Building Products or approved equal. Hardener shall be used on all floors, stair treads and platforms.

PART 3 EXECUTION

3.01 FORMED SURFACES

A. Forms shall not be stripped before the concrete has attained a strength of at least 50 percent of the ultimate design strength. This is equivalent to approximately five "100 day-degrees" of moist curing.

B. Care shall be exercised to prevent damaging edges or obliterating the lines of chamfers, rustications, or corners when removing the forms or doing any work adjacent thereto.

C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to the satisfaction of the County.

D. Off-form finish. Fins and other projections shall be removed as approved. Tie cone holes and other minor defects shall be filled with non-shrink grout specified under the Contract Documents.

3.02 FLOORS AND SLABS

A. Floors and slabs shall be screeded to the established grades and shall be level with a tolerance of 1/8-inch when checked with a 10 foot straight edge, except where drains occur, in which case floors shall be pitched to drains as indicated. Failure to meet either of above shall be cause for removal, grinding, or other correction as approved by the County.

B. Following screeding as specified above, power steel trowel as follows:

1. Immediately after final screeding, a dry cement/sand shake in the proportion of 2-sacks of portland cement to 350-pounds of coarse natural concrete sand shall be sprinkled evenly over the surface at the rate of approximately 500 pounds per 1,000 square feet of floor. Neat, dry cement shall not be sprinkled on the surface. This shake shall be thoroughly floated into the surface with an approved disc type power compacting machine weighing at least 200 pounds if a 20-inch disc is used or 300 pounds if a 24-inch disc is used (such as a "Kelly Float" as manufactured by the Weisner-Rapp Corporation of Buffalo, New York). A mechanical blade-type float or trowel is not acceptable for this work.
   NOTE: This operation (application of the cement/sand shake) may be eliminated at the discretion of the County if the base slab concrete exhibits adequate fattiness and homogeneity.
2. In lieu of power steel troweling, small areas as defined by the County shall be compacted by hand steel troweling with the dry cement/sand shake as ordered.
3. The floor or slab shall be compacted to a smooth surface and the floating operation continued until sufficient mortar is brought to the surface to fill all voids. The surfaces shall be tested with a straight edge to detect high and low spots which shall be eliminated.

4. Compaction shall be continued only until thorough densification is achieved and a small amount of mortar is brought to the surface. Excessive floating shall be avoided.

C. After Paragraph 3.02 A and B procedures are accomplished, floors and slabs for particular conditions shall be completed as scheduled in one of the following finishes:

1. Wood float finish. Hand wood float, maintaining the surface tolerance to provide a grained, nonslip finish as approved.
2. Broomed finish. Hand wood float maintaining the surface tolerance and then broom with a stiff bristle broom in the direction of drainage to provide a nonslip finish as approved.
3. Steel trowel finish. Hand steel trowel to a perfectly smooth, hard even finish free from high or low spots or other defects as approved.

D. Floors, stair treads and platforms shall be given a floor hardener. Application shall be according to manufacturer's instructions.

3.03 APPROVAL OF FINISHES

A. All concrete surfaces will be inspected during the finishing process by the County.

B. Surfaces which, in the opinion of the County, are unsatisfactory shall be refinished or reworked until approved by the County.

END OF SECTION

SECTION 03600 GROUTING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes grouting of equipment bases and such locations as shown on the Drawings and as specified.

B. The types of grouting include the following:

1. Portland Cement Grout
2. Non-shrink, Non-expanding Grout

1.02 DELIVERY AND STORAGE

A. Prevent damage to or contamination of grouting materials during delivery, handling and storage.

B. Store all grouting materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 PREMIXED GROUTS

A. Portland Cement Grout

B. (For grouting CMU cells and similar items – f'c=3000 psi minimum)

1. Portland Cement: ASTM C150, Type II
2. Sand: ASTM C33, Fine Aggregate
3. Water: Potable
4. Pea Gravel: ASTM C33. Coarse aggregate, graded so that at least 90% passes 3/8-inch sieve and 90% is retained by a number 4 sieve.

C. (Grout Mortar for use as fillets and leveling)

1. Portland Cement: ASTM C150, Type II
2. Sand: ASTM C33, Fine Aggregate (Marson's sand)
3. Water: Potable
4. Mix 1-part Portland cement to 3-parts sand.

D. Pre-Mixed non-shrink, Non-expanding Grout (Nonmetallic). Non-shrink grout as shown on the Drawings shall be a mixture of selected silica sands, Portland cement, water reducing agents, plasticizing and shrinkage compensating agents.

Grout shall be nonmetallic non-corrosive, non-staining and comply with CRD-C-588, Type D.

E. The grout shall be non-shrink in accordance with ASTM C827, ASTM C191, and ASTM C109. The water-grout ratio shall be approximately 8 to 10 quarts of water per cubic foot of grout adjustable for varying job conditions.

F. Grout shall not contain calcium chloride or other salt; aluminum or other metals; chemical additives, gypsum or expansive cements. Grout shall not expand after set.

G. Grout shall be used and applied in accordance with the manufacturer's written instructions.

H. Subject to compliance with requirements provide from the following:

1. L&M Construction Chemicals, Inc. – Crystex
2. Grout Corp. - Five Star Non-shrink Grout or equivalent

2.02 NONSHRINK GROUT

A. Non-shrink grout shall conform to the following requirements:

1. Manufactured under rigid quality control specifically for grout used in transferring heavy loads.
2. Contain nonmetallic aggregates specially graded to minimize bleeding.
3. Have an initial setting time of approximately one hour at 70°F.
4. Produce no settlement or drying shrinkage at 3 days or later.
5. Have higher strength at all ages than plain cement grout of the same flowability.
6. Resist attack by oil and water and have lower absorption than plain cement grout of the same flowability.
7. Minimum compressive strength, in accordance with ASTM C-109, shall be 2500 psi after 1 day and 7000 psi after 28 days.

2.03 MIXES

A. For less than 2-inch clearance, or where size or shape of space makes grouting difficult, grout mix shall consist of Portland cement, fine aggregate and water.

B. For greater than 2-inch clearances where coarse aggregate will not obstruct free passage of the grout, extend grout by adding 50 pounds of pea gravel per 100 pounds grout material.

C. Use minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding.

D. Portland cement mortar for raked-out edges of non-shrink grout: one part Portland cement, two parts sand and 0.50 part water by weight.

2.04 MIXING

A. Mix grout in accordance with manufacturer's printed specifications.

B. Mix grouting materials and water in a mechanical mixer for no less than 3-minutes.

C. Mix grout as close to the work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.

D. After the grout has been mixed, do not add more water for any reason.

PART 3 EXECUTION

3.01 PROCEDURES

A. Installation methods and procedures shall be approved by Engineer and shall be in accordance with manufacturer's printed specifications before work is begun.

3.02 SURFACE PREPARATION

A. Surface preparation shall be in accordance with manufacturer's printed specifications.

B. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by bush-hammering, chipping, or other similar means, until a sound, clean concrete surface is achieved.

C. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout. Cover concrete areas with waterproof membrane until ready to grout. Immediately before grouting remove waterproof membranes and clean any contaminated surfaces.

D. Remove foreign materials from metal surfaces in contact with grout. Align, level and maintain final positioning of all components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water and leave none standing.

3.03 PLACING

A. Placing shall be in accordance with manufacturer's printed specifications.

B. Place non-shrink grouting material quickly and continuously by the most practical means permissible; pouring, pumping or under gravity pressure.

C. Do not use either pneumatic-pressure or dry packing methods without written permission of the Engineer.

D. Apply grout from one side only to avoid entrapping air.

E. Final installation shall be thoroughly compacted and free from air pockets.

F. Do not vibrate the placed grout mixture or allow it to be placed if the area is being vibrated by nearby equipment.

G. Do not remove leveling shims for at least 48 hours after grout has been placed. After shims have been removed, fill voids with plain cement-sand grout.

H. After non-shrink grout has reached initial set, rake out exposed edges approximately 1-inch into the grouted area and paint with Portland cement mortar.

3.04 CURING

A. Cure grout for 3-days after placing by keeping wet and covering with curing paper or by another approved method.

END OF SECTION

DIVISION 5 - METALS

SECTION 05500 METAL FABRICATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Steel framing and non-ferrous supports for mechanical and electrical equipment.
2. Steel framing and non-ferrous supports for applications where framing and supports are not specified in other Sections.
3. Miscellaneous steel trim including steel angle corner guards and steel edgings.
4. Metal bollards.
5. Abrasive metal nosings, treads and thresholds.
6. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 03300 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 04005 "Masonry" for installing masonry units, anchor bolts, and other items built into unit masonry.
3. Section 05521 "Pipe and Tube Railings."
4. Section 05530 "Gratings."
5. Section 05531 “Access Hatches.”

1.03 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.04 ACTION SUBMITTALS

A. Product Data: For the following:

1. Metal nosings and treads.
2. Paint products.
3. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and non-ferrous supports for mechanical and electrical equipment.
2. Steel framing and non-ferrous supports for applications where framing and supports are not specified in other Sections.
3. Miscellaneous steel trim including steel angle corner guards and steel edgings.
4. Metal bollards.
5. Abrasive metal nosings, treads and thresholds.
6. Loose steel bearing plates.
7. Loose steel lintels.

1.05 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

B. Welding certificates

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."
4. All field welding shall be inspected by a Certified Welding Inspector (CWI), Hired and paid for by the Contractor.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M. Wide Flange Sections: ASTM A 992/ ASTM A 992M.

D. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 316L.

E. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L.

F. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

G. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

H. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

I. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

J. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches or As indicated.

2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108-inch 0.079-inch 0.064-inch nominal thickness..

K. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

L. Aluminum Shapes, Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

M. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6061-T6.

N. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

O. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.03 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and flat washers; Alloy Group 1 (A1).

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M

malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for All Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.04 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09900 " Painting."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Products in accordance with requirements of Section 09900 “Painting.”

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Products in accordance with requirements of Section 09900 “Painting.”

E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

H. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete: Comply with requirements in Section 03300 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) or greater.

2.05 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed..

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with primer specified in Section 09900 "Painting." where indicated.

2.07 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and prime shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls primer specified in Section 09900 “Painting.”

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.08 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Prime exterior miscellaneous steel trim with primer specified in Section 09900 “Painting.”

2.09 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe 1/4-inch wall-thickness rectangular steel tubing steel shapes, as indicated.

1. Cap bollards with 1/4-inch thick steel plate.
2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.

B. Fabricate bollards with 3/8-inch thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

C. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

D. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.

E. Prime bollards with primer specified in Section 09900 “Painting.”

2.10 ABRASIVE METAL NOSINGS, TREADS AND THRESHOLDS

A. Cast-Metal Units: Cast [iron] [aluminum] [bronze (leaded red or semi-red brass)] [nickel silver (leaded nickel bronze)], with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Nosings: Cross-hatched units, 4 inches wide with 1/4-inch or 1-inch lip, for casting into concrete.
2. Nosings: Cross-hatched units, 1-1/2 by 1-1/2 inches, for casting into concrete.
3. Treads: Cross-hatched units, full depth of tread with 3/4-by-3/4-inch nosing, for application over bent plate treads or existing stairs.
4. Thresholds: Fluted-saddle-type units, 5 inches wide by 1/2 inch high, with tapered edges.

5. Thresholds: Fluted-interlocking- (hook-strip-) type units, 5 inches wide by 5/8 inch high, with tapered edge.
6. Thresholds: Plain-stepped- (stop-) type units, 5 inches wide by 1/2 inch high, with 1/2-inch step.

B. Extruded Units: Aluminum or as indicated on drawings, Bronze, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
2. Nosings: Square-back units, 1-7/8 inches wide, for casting into concrete steps.

C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

D. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.

1. Provide two rows of holes for units more than 5 inches wide, with two holes aligned at ends and intermediate holes staggered.

E. Apply bituminous paint to concealed surfaces of cast-metal units.

F. Apply clear lacquer to concealed surfaces of extruded units.

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

C. Prime plates with primer specified in Section 09900 “Painting.”

2.12 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with primer specified in Section 09900 “Painting.”

2.13 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.14 GUTTERS AND DOWNSPOUTS

A. Gutters: Form from 0.0179-inch- thick, aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Fabricate in minimum 96-inch long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced 24 inches o.c., fabricated from same metal as gutters. Provide bronze, copper, or aluminum wire ball strainers at outlets. Finish gutters to match roof fascia. Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eaves with gutter hangers spaced not more than 2 feet o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

B. Downspouts: Form from 0.0179-inch- thick, aluminum-zinc alloy-coated steel sheet prepainted with coil coating; in 10-foot- long sections, complete with formed elbows and offsets. Finish downspouts to match walls. Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 36 inches o.c. in between. Tie downspouts to drainage system indicated.

C. Install gutters and downspouts: and other accessories according to manufacturer's writ- ten instructions, with positive anchorage to building and weather tight mounting. Coordinate installation with flashings and other components.

2.15 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.16 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 09900 "Painting." as indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 09900 "Painting": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.17 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Install pipe columns on concrete footings and slabs with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.03 INSTALLING METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

1. Do not fill removable bollards with concrete.

B. Anchor bollards to existing construction with expansion anchors, anchor bolts or through bolts. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.

1. Embed anchor bolts at least 4 inches in concrete.

C. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete or in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with non-shrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

D. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

E. Anchor internal sleeves for removable bollards in concrete by inserting in pipe sleeves preset into concrete or formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of sleeve. Fill annular space around internal sleeves solidly with non-shrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward internal sleeve.

F. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

G. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner furnishes padlocks.

H. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.04 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 07920 "Joint Sealants" to provide a watertight installation.

3.05 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with non-shrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.06 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09900 “Painting.”

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION

SECTION 05521 PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Aluminum pipe railings.

B. Related Sections:

1. Section 05500 "Metal Fabrications".

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: Railings to withstand structural loads indicated.

C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

    a. Show method of finishing and connecting members at intersections.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

C. Welding certificates.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication. Provide additional railing posts at middle rail interruption locations.

1.08 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Aluminum Pipe and Tube Railings:

    a. Blum, Julius & Co., Inc.
    b. Hollaender Manufacturing Company.
    c. Superior Aluminum Products, Inc.
    d. Tuttle Railing Systems; Div. of Tuttle Aluminum & Bronze, Inc.

2.02 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.03 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than

the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Tubing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.

D. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

F. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.

G. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.04 FASTENERS

A. General: Provide the following:

1. Aluminum Railings: Type 316 stainless-steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.05 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.06 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

I. Form changes in direction as follows:

1. As detailed.

J. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

O. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

P. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.07 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.08 ALUMINUM FINISHES

A. Mechanical Finish: AA-M12 (Mechanical Finish: nonspecular as fabricated).

B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.02 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.03 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.04 ANCHORING POSTS

A. Anchor posts to concrete and metal surfaces with base plates as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, weld posts to plate and bolt to supporting surfaces. Bolt and plate assembly designed and engineered for this purpose.

3.05 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

C. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt or predrilled hole for exposed bolt anchorage.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

3.06 ADJUSTING AND CLEANING

A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

3.07 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 05530 GRATINGS

PART 1 GENERAL

1.01 GENERAL

A. Contractor shall provide all labor, materials, and equipment as shown, specified, and required to furnish and install trench and platform grating assemblies, miscellaneous supports and frames.

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

1.02 SUMMARY

A. Section Includes:

1. Metal bar gratings.
2. Metal frames and supports for gratings.

B. Related Sections:

1. Section 03300 “Cast-In-Place Concrete” for anchorage to concrete walls.
2. Section 05500 "Metal Fabrications" for non-ferrous metals framing system components.
3. Section 05521 "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Walkways and Elevated Access Platforms Used as Exits: Uniform load of 100 lbf/sq. ft. – All steel and aluminum applications.
2. Limit deflection to L/240 or 1/4 inch, whichever is less.

1.04 ACTION SUBMITTALS

A. Product Data: For the following:

1. Clips and anchorage devices for gratings.

B. Shop Drawings: Include plans, sections, details, and attachments to other work.

1. Shop Drawings detailing fabrication and installation of all work. Include plans, elevations and details of sections and connections. Show panel section layouts, miscellaneous supports, and fastener types and locations.

2. Furnish setting drawings, templates, and installations details for installing frames and anchorages, including concrete inserts. Deliver such items to Project site in time for installation.

1.05 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.06 QUALITY ASSURANCE

A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."

B. NAAMM Metal Bar Grating Manual ANSI/NAAMM MBG 532, “Heavy Duty Steel Grating.”

C. Welding Qualifications:

1. Quality procedures and personnel according to AWS D1.1, “Structural Welding Code – Steel”.
2. Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

1.07 PROJECT CONDITIONS

A. Field Measurements: Contractor shall field measure and verify actual locations of walls, beams and other construction contiguous with gratings by field measurements before fabrication to ensure proper installation.

1.08 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.01 HEAVY DUTY STEEL

A. ASTM A36 for hot rolled structural steel bars, and ASTM A510 for carbon steel wire rods and coarse round wire.

2.02 STEEL

A. ASTM A1011 for hot rolled carbon steel sheet and strip. ASTM A510 for carbon steel wire rods and coarse round wire.

2.03 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Shapes: ASTM B 221, alloys as follows:

1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
2. 6061-T1, for grating crossbars.

C. Aluminum Sheet: ASTM B 209, Alloy 5052-H32.

2.04 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.

B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1 (A1).

2.05 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.06 FABRICATION

A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Welding: Comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

1. Fabricate toe plates to fit grating units and weld to units in shop unless otherwise indicated.
2. Fabricate toe plates for attaching in the field.
3. Toe plate Height: 4 inches unless otherwise indicated.

2.07 METAL BAR GRATINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. IKG Industries; a division of Harsco Corporation.
2. Ohio Gratings, Inc.

B. Rectangular Bar Grating: As noted on the drawings and as indicated below.

1. Bearing Bar Spacing: 1-3/16 inches o.c.
2. Bearing Bar Depth: Varies as noted on drawings and as required to comply with structural performance requirements.
3. Bearing Bar Thickness: 3/16 inch and as required to comply with structural performance requirements.
4. Crossbar Spacing: 4 inches o.c.
5. Aluminum Finish: Mill finish.
6. Steel Finish: Galvanized.

C. Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.

1. Provide no fewer than four saddle clips for each grating section composed of rectangular bearing bars 3/16 inch or less in thickness and spaced

15/16 inch or more o.c., with each clip designed and fabricated to fit over two bearing bars.

2. Furnish threaded bolts with nuts and washers for securing grating to supports.
3. Furnish self-drilling fasteners with washers for securing grating to supports.

D. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.

E. Do not notch bearing bars at supports to maintain elevation.

2.08 GRATING FRAMES AND SUPPORTS

A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors a maximum 16 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.

2.09 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

D. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.02 INSTALLING METAL BAR GRATINGS

A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach non-removable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

END OF SECTION

SECTION 05531 ACCESS HATCHES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, equipment and incidentals required and install access hatches as shown on the Drawings and specified herein. Prefabricated access hatches and frames shall be sized as shown on the drawings.

1.02 COORDINATION

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

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

1.03 SUBMITTALS

A. Detail fabrication shop drawings, provided for assemblies indicated in the Contract Documents, showing sizes of members, method of assembly, anchorage, and connection to other members shall be submitted to the Owner's Representative for approval before fabrication.

1.04 FIELD MEASUREMENTS

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

1.05 REFERENCED SPECIFICATIONS

A. Unless otherwise specified, materials shall conform to the following:

Aluminum (Extruded Shapes)	6061-T6 (Alum. alloy)
Aluminum Bar Structural	6061-T6 (Alum. alloy)
Bolts and Nuts	ASTM 276 Stainless Steel, Type 316
Fasteners Stainless	AISI, Type 316
Steel Plate and Sheet Wire	AISI, Type 316
Welding Rods for Steel/Alum.	AWS Spec. for Arc Welding

PART 2 PRODUCTS

2.01 ANCHORS, BOLTS AND FASTENING DEVICES

A. Anchors, bolts, etc., shall be furnished as necessary for installation of the work of this Section.

B. The bolts used to attach the various members to the anchors shall be the sizes

shown or required. Stainless steel shall be attached to concrete or masonry by means of 316 stainless steel machine bolts, and iron or 316 stainless steel shall be attached with 316 stainless steel machine bolts unless otherwise specifically noted.

C. For structural purposes, unless otherwise noted, expansion bolts shall be Wej-it "Ankr-Tite", Phillips Drill Co. "Wedge Anchors", or Hilti "Kwik-Bolt", or an approved equal. When length of bolt is not called for on the Drawings, the length of bolt provided shall be sufficient to place the wedge portion of the bolt a minimum of 1-inch behind the reinforcing steel within the concrete. Material shall be as noted on the Drawings. **If not listed, all materials shall be 316 stainless steel**.

2.02 ALUMINUM ITEMS

A. Prefabricated aluminum hatches shall be manufactured by Bilco, Halliday, US Foundry or approved equal. Hatches shall be double or single leaf type as shown on drawings. Hatches shall be watertight. All hatches shall be provided with fall proof grating inserts.

B. Aluminum Hatches (Pedestrian loading): Entry access and pump removal hatches shall be flush aluminum access doors. Hatches shall be extruded frame and drain. Frames shall be 1/4" (min.) aluminum with strap anchors. Cover shall be 1/4" (min.) aluminum diamond or checker skid resistant surface pattern plate, reinforced to withstand a live load of 300 pounds per square foot, unless indicated otherwise in specifications or drawings with stainless steel hinges bolted to the underside and torsion rods or spring operators for ease of operation and the cover shall open to 90 degrees and lock automatically in the position. A vinyl grip handle shall be provided to release the cover for closing. Hardware shall be stainless steel. Factory finish shall be a mill finish with bituminous coating applied to exterior of the frame. Manufacturer shall guarantee against defects in material or workmanship for a period of five years (min.). Covers shall be equipped with recessed lifting handle which lies flush with the door surface, and a stainless steel staple which may be used to secure the door with a padlock when closed.

C. Miscellaneous aluminum shapes and plates shall be fabricated as shown. If angle frames are provided for hatches, assembly shall be furnished complete with welded strap anchors attached. Furnish all miscellaneous aluminum shown, but not otherwise detailed. Structural shapes and extruded items shall conform to the detail dimensions on the Plans within the tolerances published by the American Aluminum Association.

2.03 PART 3 EXECUTION

3.01 FABRICATION

A. All metal work for access hatches shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.

B. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connection to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by fitting.

C. The face of welds shall be dressed flush and smooth. Exposed joints shall be close fitting and jointed where least conspicuous.

D. Welding of parts shall be in accordance with the Standard Code of Arc and Gas Welding in Building Construction of the AWS and shall only be done where shown, specified, or permitted by the Engineer. All welding shall be done only by welders certified as to their ability to perform welding in accordance with the requirements of the AWS Code. Component parts of built-up members to be welded shall be adequately supported and clamped or held by other adequate means to hold the parts in proper relation for welding.

E. Welding of aluminum work shall be on the unexposed side as much as possible in order to prevent pitting or discoloration.

F. All aluminum finish exposed surfaces, except as specified below, shall have manufacturer's standard mill finish. A coating of methacrylate lacquer shall be applied to all aluminum shipment from the factory.

G. Castings shall be of good quality, strong, tough, even-grained, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind which render them unfit for the service for which they are intended. Castings shall be thoroughly cleaned and will be subjected to a hammer inspection in the field by the Engineer. All finished surfaces shown on the Drawings and/or specified shall be machined to a true plane surface and shall be true and seat at all points without rocking. Allowances shall be made in the patterns so that the thickness specified or shown shall not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95 percent of the theoretical weight computed from the dimensions shown. The Contractor shall provide facilities for weighing castings in the presence of the Engineer showing true weights, certified by the supplier.

3.02 INSTALLATION

A. Install all furnished items embedded in concrete. Items to be attached to concrete after such work is completed shall be installed in accordance with the details shown. All dimensions shall be verified at the site before fabrication is started.

B. Where aluminum is embedded in concrete, apply a heavy coat of approved bitumastic troweling mastic in accordance with the manufacturer's instructions prior to installation.

END OF SECTION

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07920
SEALANTS AND CAULKING

PART 1 GENERAL

1.01 APPLICABLE PUBLICATIONS

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

American Society for Testing and Materials (ASTM) Publications: C 920-79 Elastomeric Joint Sealants

1.02 SUBMITTALS

Submit under provisions of Section 01340.

Certificates of Conformance or Compliance: Submit certificates from the manufacturers attesting that materials meet the specified requirements.

Manufacturer's Descriptive Data: Submit complete descriptive data for each type of material. Clearly mark data to indicate the type the Contractor intends to provide. Data shall state conformance to specified requirements. Data for sealant and calking shall include application instructions, shelf life, mixing instructions for multicomponent sealants, and recommend cleaning solvents.

1.03 DELIVERY AND STORAGE

Deliver materials to the job site in the manufacturers' external shipping containers, unopened, with brand names, date of manufacture, and material designation clearly marked thereon. Containers of elastomeric sealant shall be labeled as to type, class, grade, and use. Carefully handle and store all materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 100 degree F or less than 40 degree F.

PART 2 PRODUCTS

2.01 MANUFACTURER

Manufacturer: Subject to compliance with requirements provide products manufactured by single source.

2.02 MATERIALS

Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
Products shall conform to the reference documents listed for each use. Color of sealant and calking shall match adjacent surface color unless specified otherwise. For ASTM C 920 sealants, use a sealant that has been tested on the type(s) of substrate to which it will be applied. Interior Calking or Sealant: Provide ASTM C 920, Type M, Grade NS, Class 12.5, Use NT. Color of calking or sealant shall be selected by Owner from manufacturer's full range.

Exterior Sealant: For joints in vertical surfaces, provide ASTM C 920, Type M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C 920, Type M, Grade P, Class 25, Use T. Color of sealant shall be selected by Owner from manufacturer's full range.

Latex rubber modified, acrylic emulsion polymer sealant compound; manufacturer's standard, one part, nonsag, mildew resistant, acrylic emulsion sealant complying with ASTM C834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent

Floor Joints Sealant: Provide ASTM C-920, Type S or M, Grade P, Class 25, Use T. Color of sealant shall be selected by Owner from manufacturer's standard colors.

Primer for Sealant: Use a non-staining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

Bond Breakers: Use the type of consistency recommended by the sealant manufacturer for the particular application.

Silicone Joint Sealants: Use Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT

Backstops: Use glass fiber roping or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by the sealant manufacturer. Backstop material shall be compatible with the sealant. Do not use oakum and other types of absorptive materials as backstops.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Surfaces shall be clean, dry to the touch, and free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to

destroy or impair adhesion. Where adequate grooves have not been provided, clean out grooves to a depth of ½" and grind to a minimum width of ¼" without damage to the adjoining work. No grinding shall be required on metal surfaces.

Steel Surfaces: Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a solvent that leaves no residue.

Copper or Bronze Surfaces: Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. Use non-staining solvents recommended by the item manufacturer.

3.02 SEALANT PREPARATION

Do not modify the sealant by addition of liquids, solvents, or powders. Mix multicomponent elastomeric sealants in accordance with manufacturer's printed instructions.

3.03 APPLICATION

Backstops: Where joint cavities are constructed deeper than indicated, tightly pack the back or bottom with backstop material to provide a joint of the depth indicated. Install backstops dry and free of tears or holes.

Primer: Just prior to application of the sealant or calking compound, clean out all loose particles from joints. Apply primer in accordance with compound manufacturer's directions. Do not apply primer to exposed finish surfaces.

Bond Breaker: Provide bond breakers as recommended by the sealant manufacturer for each type of joint and sealant used.

Sealant and Caulking Compounds: Use a compound that is compatible with the material to and against which it is applied. Do not use a compound that has exceeded its shelf life or has become too jelled to be discharged in a continuous flow from the gun. Apply the compound in accordance with the manufacturer's printed instructions. Force the compound into the joints with sufficient pressure to fill the joints solidly. Compound shall be uniformly smooth and free from wrinkles.

Interior Sealant and Caulking: Provide sealant or caulking at all exposed joints in the building and at all joints indicated to receive sealant or caulking.

Exterior Sealant: Provide sealant at all joints around the perimeter of openings and at all exposed joints on the building and at all joints indicated to receive sealant.

Floor Joints Sealants: Provide sealant in all control joints and in other floor joints indicated or specified.

Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated

3.04 PROTECTION AND CLEANING

Protection: Protect areas adjacent to joints from compound smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

Cleaning: Immediately scrape off fresh compound that has been smeared on masonry and rub clean with a solvent as recommended by the compound manufacturer. Upon completion of compound application, remove all remaining smears and stains resulting therefrom and leave the work in a clean and neat condition.

END OF SECTION

DIVISION 9 PAINTING

SECTION 09865 SURFACE PREPARATION AND SHOP PRIME PAINTING

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required for the surface preparation and application of shop primers on ferrous metals, excluding stainless steels, as specified herein.

1.02 SUBMITTALS

A. Submit to the County for approval, as provided in the Contract Drawings for shop drawings, manufacturer's specifications and data on the proposed primers and detailed surface preparation, application procedures and dry mil thickness.

B. Submit representative physical samples of the proposed primers, if required by the County.

PART 2 PRODUCTS

2.01 MATERIALS

A. Submerged Services: Shop primer for ferrous metals which will be subject to splash action or which are specified to be considered submerged service shall be sprayed with one coat of Koppers 654 epoxy Primer or Koppers Inertol Primer 621-FDA, dry film thickness 3.5 to 4.5 mils by Koppers Co., Inc., or equal.

B. Nonsubmerged Services: Shop primer for ferrous metals other than those covered by paragraph 2.01 A shall be sprayed with one coat of Koppers Pug Primer, dry film thickness 3.0 to 4.0 mils by Koppers Co., Inc. or equal.

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

D. Compatibility of Coating Systems: Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in the Contract Documents for use in the field and which are recommended for use together.

PART 3 EXECUTION

3.01 APPLICATION

A. Surface Preparation and Priming:

1. Non submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming. Submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC-SP-10. Near White, immediately prior to priming.
2. Surfaces shall be dry and free of dust, oil, grease, dirt, rust, loose mill scale and other foreign material before priming.
3. Shop prime in accordance with approved paint manufacturer's recommendations.
4. Priming shall follow sandblasting before any evidence of corrosion has occurred and within 24 hours.

END OF SECTION

SECTION 09900 PAINTING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, tools, materials, equipment, scaffolding or other structures and incidentals necessary to complete this Contract in its entirety.

B. The work includes painting and finishing of all new interior and exterior exposed items above and below grade and submergered surfaces, such as concrete, structural steel, miscellaneous metals, ceilings, walls, floors, doors, frames, transoms, roof fans, construction signs, guardrails, posts, fittings, valves, tanks, equipment and all other work obviously required to be painted unless otherwise specified herein or on the Drawings. The omission of minor items in the Schedule of Work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specification as stated herein.

C. The following items shall not be painted:

1. Any code-requiring labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.
2. Any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts, unless otherwise indicated.
3. Aluminum handrails (except where in contact with concrete) walkways, windows, louvers and grating unless otherwise specified herein.
4. Signs and nameplates.
5. Finish hardware.
6. Chain link fence.
7. Piping buried in the ground or embedded in concrete.
8. Concealed surfaces of pipe or crawl space.
9. Nonferrous metals, unless specifically noted otherwise.
10. Electrical switchgear and motor control centers.
11. Stainless steel angles, tubes, pipe, etc.
12. Products with polished chrome, aluminum, nickel or stainless steel finish.
13. Plastic switch plates and receptacle plates.
14. Flexible couplings, lubricated bearing surfaces, insulation and metal and plastic pipe interior.
15. Sprinkler heads.
16. Lifting chain on cranes and hoists
17. Electrical cable, festooned conductor system, cables, collector pole brackets, etc.

D. All work shall be done in strict accordance with this Specification, the Design Drawings and the painting package, including manufacturer's printed instructions.

E. The Contractor will obtain, at its own expense, all permits, licenses and inspections and shall comply with all laws, codes, ordinances, rules and regulations promulgated by authorities having jurisdiction which may bear on the Work. This

compliance will include Federal Public Law 91-596 more commonly known as the "Occupational Safety and Health Act of 1970".

1.02 DEFINITIONS

A. Field Painting is the painting of new or rebuilt items at the job site. Field painting shall be the responsibility of the Contractor.

B. Shop Painting is the painting of new or rebuilt items in the shop prior to delivery to the jobsite.

C. Abbreviations The abbreviations and definitions listed below, when used in this specification, shall have the following meanings:

1. SSPC - Steel Structures Painting Council
2. Exterior - Outside, exposed to weather
3. Interior Dry - Inside, concealed or protected from weather
4. Interior Wet - Inside, subject to immersion services
5. ASTM - American Society of Test Materials
6. NACE - National Association of Corrosion Engineers
7. NSF - National Sanitation Foundation
8. AWWA - American Water Works Association

D. Dry Film Thickness shall be in Mils.

1.03 RESOLUTION OF CONFLICTS

A. It shall be the responsibility of the Contractor to arrange a meeting prior to the start of painting, or flooring installation between the Contractor, the Paint Manufacturer, whose products are to be used, and the County. All aspects of surface preparation, application and coating systems as covered by this Specification will be reviewed at this meeting.

B. Clarification shall be requested promptly from the County when instructions are lacking, conflicts occur in the Specifications, or the procedure seems improper or inappropriate for any reason.

C. Copies of all manufacturer's instructions and recommendations shall be furnished to the County by the Painting Contractor.

D. It shall be the responsibility of the Coating Manufacturer to have their factory representative meet in person with the Contractor and County a minimum of three times during the job as a consultant on surface preparation, mil thickness of coating and proper application of coating unless meeting is determined to be unnecessary by the County.

1.04 SUBMITTALS

A. Contractor shall submit catalog data and cut sheets for the painting system being used if not the TNEMEC materials specified.

B. Samples as detailed in 3.01 B shall be submitted regardless of system being used,

showing each color to be used.

C. Hazardous Material Disposal documentation shall be submitted if applicable.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Effective oil and water separators shall be used in all compressed air lines serving spray painting and sandblasting operations to remove oil or moisture from the air before it is used. Separators shall be placed as far as practicable from the compressor.

B. All equipment for application of the paint and the completion of the work shall be furnished by the Contractor in first-class condition and shall comply with recommendations of the paint manufacturer.

C. Contractor will provide free of charge to the County a "Nordson-Mikrotest" or "Positest" dry film thickness gauge for ferrous metal and an OG232 "Tooke" gauge or equal for non-ferrous and cementitious surface, to be used to inspect coatings by the County and Contractor. The gauges may be used by the Contractor and returned each day to the County. County will return gauges to Contractor at completion of job.

2.02 MATERIALS

A. All materials specified herein are manufactured by the TNEMEC Company, Inc., North Kansas City, Missouri. These products are specified to establish standards of quality and are approved for use on this Project.

B. Equivalent materials of other manufacturers may be substituted on approval of the County. Requests for substitution shall include manufacturer's literature for each product giving the name, generic type, descriptive information and evidence of satisfactory past performance and an independent laboratory certification that their product meets the performance criteria of the specified materials.

C. Abrasion - Fed. Test Method Std. No. 141, Method 6192, CS-17 Wheel, 1,000 grams load.

D. Adhesion - Elcometer Adhesion Tester.

E. Exterior Exposure - Exposed at 45 degrees facing the ocean (South Florida Marine Exposure)

F. Hardness - ASTM D3363-74

G. Humidity - ASTM D2247-68

H. Salt Spray (Fog) - ASTM B117-73

I. Standard practice for Operating the Severe Wastewater Analysis Testing Apparatus ASTM G210-13

J. 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. Prime and finish coats of all surfaces shall be furnished by the same manufacturer.

K. All coatings to be shop applied must meet the requirements for volatile organic compounds (VOC) of not more than 3.5 lbs/gallon after thinning.

L. Colors, where not specified, shall be as selected by the County or their Representative.

M. All coatings in contact with potable water need to be NSF Certified in accordance with ANSI/NSF Standard 61.

N. All above ground potable water mains and appurtenances shall be painted Scott Paints safety blue or approved equal; purple (Pantone purple 522 C) for reclaimed water; or Hunter Green (Rustoleum 7538) for pressure sewer. Contractor shall submit color chart to owner for color selection approval prior to ordering material.

PART 3 EXECUTION

3.01 INSPECTION OF SURFACES

A. Before application of the prime coat and each succeeding coat, all surfaces to be coated shall be subject to inspection by the County. Any defects or deficiencies shall be corrected by the Contractor before application of any subsequent coating.

B. Samples of surface preparation and of painting systems shall be furnished by the Contractor to be used as a standard throughout the job, unless omitted by the County.

C. When any appreciable time has elapsed between coatings, previously coated areas shall be carefully inspected by the County, and where, in his opinion, surfaces are damaged or contaminated, they shall be cleaned and recoated at the Contractor's expense. Recoating times of manufacturer's printed instructions shall be adhered to.

D. Coating thickness shall be determined by the use of a properly calibrated "Nordson-Mikrotest" "Positest" Coating Thickness Gauge (or equal) for ferrous metal or an OG232 "Tooke" Paint Inspection gauge (or equal) for non-ferrous and cementitious surfaces. Please note that use of the "Tooke" gauge is classified as a destructive test.

3.02 SURFACE PREPARATION

The surface shall be cleaned as specified for the paint system being used. All cleaning shall be as outlined in the Society for Protective Coatings (SSPC) Surface Preparation Specification, And the International Concrete Repair Institute (ICRI) unless otherwise noted. If surfaces are subject to contamination, other than mill scale or normal atmospheric rusting, the surfaces shall be pressure washed, and acid or caustic pH residues neutralized, in addition to the specified surface

preparation.

3.03 STANDARDS FOR SURFACE PREPARATION

A. Chemical and/or Solvent Cleaning: Remove all grease, oil, salt, acid, alkali, dirt, dust, wax, fat, foreign matter and contaminates, etc. by one of the following methods: steam cleaning, alkaline cleaning, or volatile solvent cleaning.

B. Hand Tool Cleaning: Removal of loose rust, loose mill scale and loose paint to a clean sound substrate by hand chipping, scraping, sanding and wire brushing.

C. Power Tool Cleaning: Removal of loose rust, loose mill scale and loose paint to a clean sound substrate by power tool chipping, descaling, sanding, wire brushing and grinding.

D. Flame Cleaning: Dehydrating and removal of rust, loose mill scale and some light mill scale by use of flame, followed by wire brushing.

E. White Metal Blast Cleaning: Complete removal of all mill scale, rust, rust scale, previous coating, etc., leaving the surface a uniform gray-white color.

F. Commercial Grade Blast Cleaning: Complete removal of all dirt, rust scale, mill scale, foreign matter and previous coating, etc., leaving only shadows and/or streaks caused by rust stain and mill scale oxides. At least 66% of each square inch of surface area is to be free of all visible residues, except slight discoloration.

G. Brush-Off Blast Cleaning: Removal of rust scale, loose mill scale, loose rust and loose coatings, leaving tightly-bonded mill scale, rust and previous coatings. On concrete surfaces, brush-off blast cleaning shall remove all laitance, form oils and solid contaminates. Blasting should be performed sufficiently close to the surface so as to open up surface voids, bugholes, air pockets and other subsurface irregularities, but so as not to expose underlying aggregate.

H. Pickling: Complete removal of rust and mill scale by acid pickling, duplex pickling or electrolytic pickling (may reduce the resistance of the surface to corrosion, if not to be primed immediately).

I. Near-White Blast Cleaning: Removal of all rust scale, mill scale, previous coating, etc., leaving only light stains from rust, mill scale and small specks of previous coating. At least 95% of each square inch of surface area is to be free of all visible residues and the remainder shall be limited to slight discoloration.

J. Power Tool Cleaning to Bare Metal: Complete removal of rust, rust scale, mill scale, foreign matter and previous coatings, etc., to a standard as specified on a Commercial Grade Blast Cleaning (SSPC-SP-6, NACE-3) by means of power tools that will provide the proper degree of cleaning and surface profile.

K. Surface Preparation of Concrete (SSPC-SP13)

L. Visual standards "Pictorial Surface Preparation Standards for Painting Steel Surfaces", and the National Association of Corrosion Engineer, "Blasting Cleaning Visual Standards" TM-01-70 and TM-01-75 shall be considered as standards for

proper surface preparation.

M. Oil, grease, soil, dust, etc., deposited on the surface preparation that has been completed shall be removed prior to painting according to Solvent Cleaning under this Specification.

N. Weld flux, weld spatter and excessive rust scale shall be removed by Power Tool Cleaning as per these Specifications.

O. All weld seams, sharp protrusions and edges shall be ground smooth prior to surface preparation or application of any coatings.

P. All areas requiring field welding shall be masked off prior to shop coating, unless waived by the County.

Q. All areas which require field touch-up after erection, such as welds, burnbacks, and mechanically damaged areas, shall be cleaned by thorough Power Tool as specified in these Specifications.

R. Touch-up systems will be same as original specification except that approved manufacturer's organic zinc-rich shall be used in lieu of inorganic zinc where this system was originally used. Also strict adherence to manufacturer's complete touch-up recommendations shall be followed. Any questions relative to compatibility of products shall be brought to the County's attention; otherwise, Contractor assumes full responsibility.

3.04 PRETREATMENTS

When specified, the surface shall be pretreated in accordance with the specified pretreatment prior to application of the prime coat of paint.

3.05 STORAGE

Materials shall be delivered to the job site in the original packages with seals unbroken and with legible unmutilated labels attached. Packages shall not be opened until they are inspected by the County and required for use. All painting materials shall be stored in a clean, dry, well-ventilated place, protected from sparks, flame, direct rays of the sun or from excessive heat. Paint susceptible to damage from low temperatures shall be kept in a heated storage space when necessary. The Contractor shall be solely responsible for the protection of the materials stored by himself at the job site. Empty coating cans shall be required to be neatly stacked in an area designated by the County and removed from the job site on a schedule determined by the County. County may request a notarized statement from Contractor detailing all materials used on the Project.

3.06 PREPARATION OF MATERIALS

A. Mechanical mixers, capable of thoroughly mixing the pigment and vehicle together, shall mix the paint prior to use where required by manufacturer's instructions; thorough hand mixing will be allowed for small amounts up to one gallon. Pressure pots shall be equipped with mechanical mixers to keep the pigment in suspension, when required by manufacturer's instructions. Otherwise, intermittent hand mixing

shall be done to assure that no separation occurs. All mixing shall be done in accordance with SSPC Vol. 1, Chapter 4, "Practical Aspects, Use and Application of Paints" and/or with manufacturer's recommendations.

B. Catalysts or thinners shall be as recommended by the manufacturer and shall be added or discarded strictly in accordance with the manufacturer's instruction.

3.07 APPLICATION

A. Paint shall be applied only on thoroughly dry surfaces and during periods of favorable weather, unless otherwise allowed by the paint manufacturer. Except as provided below, painting shall not be permitted when the atmospheric temperature is below 50 deg F, or when freshly painted surfaces may be damaged by rain, fog, dust, or condensation, and/or when it can be anticipated that these conditions will prevail during the drying period.

B. No coatings shall be applied unless surface temperature is a minimum of 5 Degrees above dew point; temperature must be maintained during curing.

C. See coating schedule for actual coating systems to be used on this project.

3.08 DEW POINT CALCULATION CHART

DEW POINT CALCULATION CHART

Ambient Air Temperature - Fahrenheit

Relative Humidity	20	30	40	50	60	70	80	90	100	110	120
90%	18	28	37	47	57	67	77	87	97	107	117
85%	17	26	36	45	55	65	76	84	95	104	113
80%	16	25	34	44	54	63	73	82	93	102	110
75%	15	24	33	42	52	62	71	80	91	100	108
70%	13	22	31	40	50	60	68	78	88	96	105
65%	12	20	29	38	47	57	66	76	85	93	103
60%	11	29	27	36	45	55	64	73	83	92	101
55%	9	17	25	34	43	53	61	70	80	89	98
50%	6	15	23	31	40	50	59	67	77	86	94
45%	4	13	21	29	37	47	56	64	73	82	91
40%	1	11	18	26	35	43	52	61	69	78	87
35%	-2	8	16	23	31	40	48	57	65	74	83

SURFACE TEMPERATURE AT WHICH CONDENSATION OCCURS

Dew Point

Temperature at which moisture will condense on surface. No coatings should be applied unless surface temperature is a minimum of 5deg above this point. Temperature must be maintained during curing.

Example

If air temperature is 70 deg F and relative humidity is 65%, the dew point is 57 deg F. No coating should be applied unless surface temperature is 62 deg F minimum.

A. No coating shall be applied unless the relative humidity is below 85%.

B. Suitable enclosures to permit painting during inclement weather may be used if provisions are made to control atmospheric conditions artificially inside the enclosure, within limits suitable for painting throughout the painting operations.

C. Field painting in the immediate vicinity of, or on, energized electrical and rotating equipment, and equipment and/or pipes in service shall not be performed without the approval of the County.

D. Extreme care shall be exercised in the painting of all operable equipment, such as valves, electric motors, etc., so that the proper functioning of the equipment will not be affected.

E. The Contractor's scaffolding shall be erected, maintained and dismantled without damage to structures, machinery, equipment or pipe. Drop cloths shall be used where required to protect buildings and equipment. All surfaces required to be clear for visual observation shall be cleaned immediately after paint application.

F. Painting shall not be performed on insulated pipe within three (3) feet of insulation operations or on insulation whose covering and surface coat have not had time to set and dry. Painting shall not be performed on uninsulated pipe within one (1) foot of any type of connection until the connection has been made, except as directed by the County.

G. The prime coat shall be applied immediately following surface preparation and in no case later than the same working day. All paint shall be applied by brushing, paint mitt and roller, conventional spraying, or airless spraying, using equipment approved by the paint manufacturer.

H. Each coat of paint shall be recoated as per manufacturer's instructions. Paint shall be considered recoatable when an additional coat can be applied without any detrimental film irregularities such as lifting or loss of adhesion.

I. Surfaces that will be inaccessible after assembly shall receive either the full specified paint system or three shop coats of the specified primer before assembly.

J. Finish colors shall be in accordance with the COLOR SCHEDULE and shall be factory mixed (i.e., there shall be no tinting by the Contractor, unless authorized by the County).

K. All edges and weld seams in immersion service shall receive a "stripe coat" (applied by brush) of the 2nd coat prior to application of the full 2nd coat.

L. All open seams in the roof area of tanks shall be filled after application of the topcoat with a flexible caulking such as Sika Flex 1A.

3.09 WORKMANSHIP

A. The Contractor must show proof that all employees associated with this Project shall have been employed by the Contractor for a period not less than six (6) months.

B. Painting shall be performed by experienced painters in accordance with the recommendations of the paint manufacturer. All paint shall be uniformly applied without sags, runs, spots, or other blemishes. Work which shows carelessness, lack of skill, or is defective in the opinion of the County, shall be corrected at the expense of the Contractor.

C. The Contractor shall provide the names of at least three other projects of similar size and scope that they have successfully completed under their current company name.

3.10 APPLICATION OF PAINT

A. By Brush and/or Rollers

1. Top quality, properly styled brushes and rollers shall be used. Rollers with a baked phenol core shall be utilized.
2. The brushing or rolling shall be done so that a smooth coat as nearly uniform in thickness as possible is obtained. Brush or roller strokes shall be made to smooth the film without leaving deep or detrimental marks.
3. Surfaces not accessible to brushes or rollers may be painted by spray, by dauber or sheepskins, and paint mitt.
4. It may require two coats to achieve the specified dry film thickness if application is by brush and roller.

B. Air, Airless or Hot Spray

1. The equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied and shall be equipped with suitable pressure regulators and gauges.
2. Paint shall be applied in a uniform layer, with a 50% overlap pattern. All runs and sags should be brushed out immediately or the paint shall be removed and the surface resprayed.
3. High build coatings should be applied by a cross-hatch method of spray application to ensure proper film thickness of the coating.
4. Areas inaccessible to spray shall be brushed; if also inaccessible to brush, daubs or sheepskins shall be used, as authorized by the manufacturer.
5. Special care shall be taken with thinners and paint temperatures so that paint of the correct formula reaches the receiving surface.
6. Nozzles, tips, etc., shall be of sizes and designs as recommended by the manufacturer of the paint being sprayed.
7. The first coat on concrete surfaces in immersion service should be sprayed and back rolled.

3.11 PROTECTION AND CLEANUP

A. It shall be the responsibility of the Contractor to protect at all times, in areas where

painting is being done, floors, materials of other crafts, equipment, vehicles, fixtures, and finished surfaces adjacent to paint work. Cover all electric plates, surface hardware, nameplates, gauge glasses, etc., before start of painting work.

B. At the option of the County during the course of this project, the Contractor will contain all spent abrasives, old paint chips, paint overspray and debris by means suitable to the County, including, but not limited to, full shrouding of the area.

C. If shrouding is required, the Contractor must provide a complete design of the intended shroud or cover. Care must be taken not to modify or damage the structure during the use of the shroud. If damage should occur, the Contractor is held responsible for all repairs.

D. At completion of the work, remove all paint where spilled, splashed, spattered, sprayed or smeared on all surfaces, including glass, light fixtures, hardware, equipment, painted and unpainted surfaces.

E. After completion of all painting, the Contractor shall remove from job site all painting equipment, surplus materials and debris resulting from this work.

F. The Contractor is responsible for the removal and proper disposal of all hazardous materials from the job site in accordance with Local, State and Federal requirements as outlined by the Environmental Protection Agency.

G. A notarized statement shall be presented to the County that all hazardous materials have been disposed of properly including, but not limited to: name of disposal company, disposal site, listing of hazardous materials, weights of all materials, cost per pound and EPA registration number.

3.12 TOUCH-UP MATERIALS

The Contractor shall provide at the end of the Project at least one (1) gallon of each generic topcoat in each color as specified by the County for future touch-up. Two gallons may by required for (2) component materials.

3.13 ON-SITE INSPECTION

During the course of this Project, the County will reserve the option of incorporating the services of a NACE Level III inspection service. The inspection service will be responsible for assuring the proper execution of this Specification by the successful Contractor.

3.14 STEEL - STRUCTURAL, TANKS, PIPES AND EQUIPMENT

A. EXTERIOR EXPOSURE (NON-IMMERSION)

1. System No. 1095-1: Epoxy/High Build Urethane

This system is highly resistant to abrasion, wet conditions, corrosive fumes and chemical contact. Provides 3-4 times the color and gloss retention of conventional paints. Second coat to be close to finish color but not the same color. This system should be used for above ground exterior steel

surfaces that are neither submerged, nor buried.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Shop Coat: 66HS-1211 Epoxoline Primer	3.0 - 4.0
2nd Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 3.0
3rd Coat: 1095-Endura-Shield III	2.0 - 3.0
Dry Film Thickness	7.0 - 10.0
Minimum	8.0 Mils

2. System No. 1095-2: High Build Urethane for Marginally Cleaned Surfaces or Topcoating Existing System

This system can be used over factory finish paint or cover non-sandblasted steel and offer the high performance of a urethane coating. Specify Series 1074U Endura-Shield for gloss finish.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning or SSPC-SP3 Power Tool Cleaning

Shop Coat: Manufacturer Standard Primer (or existing coating)	3.0-5.0
2nd Coat: 135 Chembuild	3.0 - 5.0
3rd Coat: 1095-Color Endura-Shield	2.0 - 3.0
Dry Film Thickness	8.0 - 13.0
Minimum	9.5 Mils

4. System 90-97: Zinc/Epoxy/Urethane

This system offers the added corrosion protection of a zinc rich primer. Series 90-97 Tneme-Zinc is an organic zinc-rich primer that can be used for field touch up of a zinc primer or for touch up of galvanized surfaces that are damaged.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Shop Coat: 90-97 Tneme-Zinc	2.5 - 3.5
2nd Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 3.0
3rd Coat: 1095 Endurashield	2.0 - 3.0
Dry Film Thickness	6.5 - 9.5
Minimum	8.0 Mils

B. INTERIOR EXPOSURE (NON-IMMERSION)

1. System No. 66HS-1: High Build Epoxy

This system will provide chemical and corrosion resistance against abrasion, moisture, corrosion fumes, chemical contact and immersion in non-potable water. Primer coat must be touched-up before second coat is applied. Substitute Series 161HS for low temperature cure or quick recoats. Use this system for interior exposed, non submerged metals.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Shop Coat: 66HS-1211 Epoxoline Primer	3.0 - 5.0
2nd Coat: 66HS-Color Hi-Build Epoxoline	4.0 - 6.0
Dry Film Thickness	7.0 - 11.0
Minimum	9.0 Mils

2. System No. 66HS-2: High Build Epoxy (Over OEM Finishes)

This system is to be used over standard manufacturer's primer to offer a high performance epoxy finish. Excellent for areas of rust not able to be completely cleaned.

Surface Preparation: Spot SSPC-SP6 Commercial Blast Cleaning or SSPC- SP11 Power Tool Cleaning to Bare Metal

Shop Coat: Manufacturer's Standard (or existing coating)	1.0 - 2.0
2nd Coat: 27WB	2.5 - 4.0
3rd Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 4.0
Dry Film Thickness	5.5 - 10.0
Minimum	7.0 Mils

C. IMMERSION

1. System No. 104-1: High Solids Epoxy (Non-Potable Water)

This system will provide chemical and corrosion resistance for protection against abrasion, moisture, corrosive fumes, chemical contact and immersion in ***mild to moderate*** Wastewater, such as clarifiers, chlorine contact basins, aeration basins, settling basins and other open top (aerobic) structures. Primer coat must be touched-up before second coat is applied. Scarify the surface before topcoating if the Series 66HS has been exterior-exposed for 60 days or longer. Substitute Series 161HS for low temperature cure or quick recoats.

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning

Shop Coat: 66HS-1211 Epoxoline Primer	3.0 - 5.0
2nd Coat: 104-Color Hi-Build Epoxoline	6.0-8.0
3rd Coat: 104-Color Hi-Build Epoxoline	6.0-8.0
Dry Film Thickness	15.0 - 21.0
Minimum	11.0 Mils

2. System No. 20HS-1: Epoxy-Polyamide (Potable Water)

This system meets American Water Works Association AWWA D 102 Inside Paint System Number 1. Series 20HS meets the new requirements of approval for potable water use as established by the National Sanitation Foundation Standard 61. Substitute Series FC20HS for low temperature cure or quick recoats.

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning

Shop Coat:20HS-WH02 Pota-Pox (Tank White)	3.0 - 5.0
2nd Coat: 20HS-1255 Pota-Pox (Beige)	4.0 - 6.0
3rd Coat: 20HS-WH02 Pota-Pox (Tank White)	4.0 - 6.0
Dry Film Thickness	11.0-17.0
Minimum	12.0 Mils

3.15 OVERHEAD METAL DECKING, JOIST

A. INTERIOR EXPOSURE

System No. 115-1: Uni-Bond

This system should be used on ceiling areas where a one-coat system is desired. Can be applied over steel, galvanized and aluminum decking, joist, shop primed beams, conduits and concrete.

Surface Preparation: Surfaces must be dry, clean and free of oil, grease and other contaminates. Allow concrete to cure 28 days.

Coating:	115-Color Uni-Bond
Dry Film Thickness	2.5 - 4.0

B. EXTERIOR EXPOSURE

System No. 1029-1: Enduratone

This system can be applied over a wide variety of coatings and factory finishes. It can also be applied direct to galvanized aluminum decking, joists, & conduits

Surface Preparation: Pressure clean to remove all dirt, oil, grease, chemicals and foreign contaminates. Remove loose paint and all rust by hand and power tool cleaning (SSPC-SP 2 & 3)

1st Coat:	1029-Color Endura-tone	2.0-3.0
2nd Coat:	1029-Color Enduratone	2.0-3.0
Dry Film Thickness		4.0-6.0

3.16 GALVANIZED STEEL - PIPE AND MISCELLANEOUS FABRICATIONS

A. EXTERIOR / (NON-IMMERSION)

System No. 1095-3: Epoxy/High Build Urethane
Series 66HS has excellent adhesion to galvanized steel. This system is highly resistant to abrasion, wet conditions, corrosive fumes and chemical contact. Provides 3-4 times the color and gloss retention of conventional paints. First coat to be same color as or close to the finish color. Specify Series 1074U Endura-Shield for gloss finish.

Surface Preparation: SSPC-SP1 Solvent Cleaning, followed by Sweep Abrasive Blasting (SSPC-SP7)

1st Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 4.0
2nd Coat: 1095-Color Endura-Shield	2.0 - 4.0
Dry Film Thickness	4.0 - 8.0
Minimum	5.0 Mils

B. INTERIOR EXPOSURE (NON IMMERSION) AND ALUMINUM IN CONTACT WITH CONCRETE

System No. 66HS-3: Polyamide Epoxy

Surface Preparation: SSPC-SP1 Solvent Cleaning

1st Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 4.0
2nd Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 4.0
Dry Film Thickness	4.0 - 8.0
Minimum	5.0 Mils

3.17 CONCRETE

A. EXTERIOR - ABOVE GRADE

1. System No. 1026-1: Acrylic Emulsion Low Sheen

If semi-gloss finish is desired, use Series 1029 Tneme-Cryl SG as the second coat.

Surface Preparation: Allow new concrete to cure for 28 days. Surface must be clean and dry.

1st Coat: 1026-Color Tneme-Cryl	2.0 - 3.0
2nd Coat:1026-Color Tneme-Cryl	2.0 - 3.0
Dry Film Thickness	4.0 - 6.0
Minimum	5.0 Mils

2. System No. 156-1: Modified Acrylic Elastomer

If texture is needed, use 157 Enviro-Crete TX (medium texture) For application over previously applied coatings, use TNEMEC Series 151 Elasto-Grip at 1.0 - 2.5 mils DFT prior to the application of Series 156 Enviro-Crete.

Surface Preparation: Surface must be clean and dry.

1st Coat: 156-Color Enviro-Crete	4.0 - 8.0
2nd Coat: 156-Color Enviro-Crete	4.0 - 8.0
Dry Film Thickness	8.0 - 16.0
Minimum	10.0 Mils

B. EXTERIOR - BELOW GRADE

1. System No. 46-31: Coal Tar-Epoxy

Surface Preparation: Surface shall be clean and dry.

One Coat:	46H-413 Hi-Build Tneme-Tar
Dry Film Thickness	14.0 - 20.0

C. EXTERIOR/INTERIOR EXPOSURE (NON-IMMERSION)

1. System No. 1026-2: Acrylic Emulsion, Low Sheen (Interior/Exterior)

This system will provide a decorative coating with good exterior durability, color retention, and a high vapor transmission rate. ***For Semi-Gloss finish, use 1029-Color Tneme-Cryl S/G.***

Surface Preparation: Surface shall be clean and dry. Allow concrete to cure for 28 days.

Block Filler (CMU only): 1254 Epoxoblock	125 SF/GL
1st Coat: 1026-Color Tneme-Cryl	2.0 - 3.0
2nd Coat:1026-Color Tneme-Cryl	2.0 - 3.0
Dry Film Thickness	4.0 - 6.0
Minimum	5.0 Mils

*Does not include Block Filler

2. System No. 66HS-4: Epoxy-Polyamide (Interior)

Series 66HS provides excellent protection from abrasion, moisture, corrosive fumes and chemical contact.

Surface Preparation: Surfaces shall be clean and dry. Allow concrete to cure for 28 days. All surfaces must be clean and dry.

Block Filler (CMU only): 1254 Epoxoblock	125 SF/GL
1st Coat: 66HS-Color Hi-Build Epoxoline	3.0 - 5.0
2nd Coat: 66HS-Color Hi-Build Epoxoline	4.0 - 6.0
Dry Film Thickness	7.0-11.0*
Minimum	9.0 Mils

*(Does not include Block Filler)

D. IMMERSION - POTABLE & NON-POTABLE WATER

1. System No. 104-2: High Solids Epoxy (Non-Potable Water). This system will provide chemical and corrosion resistance for protection against abrasion, moisture, corrosive fumes, chemical contact and immersion in ***mild to moderate*** Wastewater, such as clarifiers, chlorine contact basins, aeration basins, settling basins and other open top (aerobic) structures.

Surface Preparation: Existing Concrete: all existing surfaces (walls, floors, top of walls) shall be pressure washed with 3,000-4,000psi potable water to remove all contaminants. Completely remove existing failing coating system using sweep abrasive blasting. New Concrete: Allow new concrete to cure for 28 days. Sweep abrasive blast per SSPC-SP13 to remove all laitance, fines, curing compounds, form release oils, and other contaminants, and to establish a surface profile equal to ICRI CSP 5 or

greater.

Apply Tnemec Series 218 to all surfaces at a minimum of 1/16" to re-surface concrete, fill voids and bugholes, mitigate concrete outgassing, and to create a monolithic, paintable surface.

1st Coat: 104-1255 H.S. Epoxy Primer	6.0 - 8.0
2nd Coat: 104 Color H.S. Epoxy	6.0 - 8.0
3rd Coat: 104 Color H.S. Epoxy	6.0-8.0
Dry Film Thickness	18.0 - 240.0
Minimum	20.0 Mils

2. System No. 20HS-2 Epoxy-Polyamide (Potable Water)

This system meets American Water Works Association AWWA D 102 Inside System No. 1. Series 20HS meets the requirements of approval for potable water use as established by the National Sanitation Foundation Standard 61.

Surface Preparation: Allow new concrete to cure for 28 days. Sweep abrasive blast per SSPC-SP13 to remove all laitance, fines, curing compounds, form release oils, and other contaminants, and to establish a surface profile equal to ICRI CSP 5 or greater.

Apply Tnemec Series 218 to all surfaces at a minimum of 1/16" to re-surface concrete, fill voids and bugholes, and to create a monolithic, paintable surface.

1st Coat: 20HS-15BL Pota-Pox	4.0 - 6.0
2nd Coat: 20HS-1255 Pota-Pox Finish	4.0 - 6.0
3rd Coat: 20HS -15BL	4.0 - 6.0
Dry Film Thickness	12.0 - 17.0
Minimum	13.0 Mils

E. INTERIOR EXPOSURE (NON-IMMERSION)

1. System No. 66HS-5: High Solids Epoxy

This system will produce a slick, tile-like finish that has excellent chemical and water resistance. Surface will be easy to clean.

Surface Preparation: Allow new concrete to cure for at least 28 days. Surface to be clean and dry.

1st Coat: 66HS-Color H.S. Epoxy	6.0 - 8.0
2nd Coat: 66HS-Color H.S. Epoxy	6.0 - 8.0
Dry Film Thickness	12.0 - 16.0
Minimum	4.0 Mils

2. System No. 113-1: Acrylic-Epoxy Semi-Gloss

This system will provide high performance and can be applied directly over

existing coatings without lifting. Can be used when low odor is required during application. Specify Series 114 Tneme-Tufcoat for Gloss Finish.

Surface Preparation: Allow new concrete to cure for at least 28 days. Surface must be clean and dry.

One or Two Coats: 113-Color Tneme-Tufcoat
Dry Film Thickness 4.0 - 6.0

3.18 CONCRETE FLOORS

A. EPOXY FLOOR COATINGS

1. System No. 290-1: Epoxy- Chemical Resistant Urethane

This system will provide a durable, long-wearing coating that bonds tightly to concrete and stands up under heavy foot traffic, frequent cleaning, spillage of water, oil, grease, or chemical, and UV Exposure.

Surface Preparation: Allow new concrete to cure for 28 days. Mechanically abrade or Sweep Abrasive Blast Cleaning

Moisture vapor transmission should not exceed three lbs per 1,000 sq ft in a 24 hour period. (Reference ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.") Relative humidity should not exceed 80%. (Reference ASTM F 2170 "Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes.")

Note: For moisture content up to 10 lbs per 1,000 sq ft or relative humidity up to 90%, Series 208 may be substituted for Series 201 as the primer.

1st Coat: 201- Epoxoprime	5.0-7.0
2nd Coat: 237-Color Tneme-Glaze	8.0-10.0
3rd Coat: 290 CRU	2.0-3.0
Dry Film Thickness	15.0- 20.0
Minimum	17.0 Mils

For a non-skid finish, broadcast 30-50 mesh clean, dry silica sand into the 2nd coat at a rate of 5 lbs per 150 square feet.

2. System No. 241/222: Decorative Quartz Flooring (Non-Slip)

This system provides a decorative, chemical, abrasion, impact resistant, non-slip, seamless flooring system with a moisture mitigating base coat that resists up to 20 lbs of moisture vapor pressure.

Surface Preparation: Allow new concrete to cure for 28 days. Mechanically abrade or Sweep abrasive Blast to provide a minimum surface profile equal to ICRI CSP3

1st Coat: 241 Ultra-Tread MVT	70 square feet per small kit
2nd Coat: 222 Deco-Tread	(1 ct. @ 1/16" ea.)
3rd Coat: 284 Tneme-Glaze (clear)	8.0 - 12.0
Minimum Dry Film Thickness	1/8"+

3.19 POROUS MASONRY

A. EXTERIOR/INTERIOR EXPOSURE

1. System No. 156-2: Modified Epoxy - Sand Texture

Modified Waterborne Acrylate. This system offers long term protection against wind-driven rain, mold/mildew growth, chalking & fading, and bridges hairline cracks.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 157-Color Envirocrete	6.0-9.0
2nd Coat: 157 Envirocrete	6.0-9.0
Dry Film Thickness	12.0-18.0
Minimum DFT:	14.0 mils

2. System No. 104-3: High Solids Epoxy (Interior Only)

This system will produce a film thickness of 16 mils. The surface will be tile-like for easy cleaning and will provide protection against chemical attack, corrosive fumes, high humidity and wash down. Backroll first coat to fill porosity.

Surface Preparation: Surface to be clean and dry.

1st Coat: 104-Color H.S. Epoxy	8.0 - 10.0
2nd Coat: 104-Color H.S. Epoxy	8.0 - 10.0
Dry Film Thickness	16.0 - 20.0
Minimum	18.0 Mils

3. System No. 113-2: Acrylic-Epoxy Semi-Gloss (Interior Only)

Series 113 Tneme-Tufcoat has very low odor and can be used when painting in occupied areas.

Specify Series 114 Tneme-Tufcoat for a gloss finish.

Surface Preparation: Surface must be clean and dry.

1st Coat: 1254 Epoxoblock WB	125 SF/Gal
2nd Coat: 113-Color Tneme-Tufcoat*	4.0 - 6.0
	**4.0 - 6.0

** Two coats may be required if applied by roller*
*** Total Dry Film Thickness of Topcoats Only*

4. System No. 156-3: Modified Acrylic Elastomer

If texture is needed, use 157 Enviro-Crete TX For application over previously applied coatings, use TNEMEC 151 Elasto-Grip at 1.0 - 2.5 mils DFT in lieu of Series 1254.

Surface Preparation: Surfaces must be clean and dry.

1st Coat: 1254 Epoxoblock WB	125 SF/Gal
2nd Coat: 156-Color Enviro-Crete	4.0 - 8.0
3rd Coat: 156-Color Enviro-Crete	4.0 - 8.0
Dry Film Thickness	8.0 - 16.0
Minimum	10.0 Mils

3.20 GYPSUM WALLBOARD

A. INTERIOR EXPOSURE

1. System No. 113-3: Acrylic-Epoxy

Surface Preparation: Surface must be clean and dry.

1st Coat: 51PVA Sealer	1.0 - 2.0
2nd Coat: 113 H.B. Tneme-Tufcoat*	4.0 - 5.0
Dry Film Thickness	5.0 - 7.0
Minimum	6.0 Mils

*Two coats may be required if application is by brush and roller.

2. System No. 66HS-5: Hi-Build Epoxoline

Surface Preparation: Surface must be clean and dry.

1st Coat: 51PVA Sealer	1.0 - 2.0
2nd Coat: 66HS-Color Hi-Build Epoxoline*	4.0 - 6.0
Dry Film Thickness	5.0 - 8.0
Minimum	5.0 Mils

*Two coats may be required if applied by roller

3. System No. 1026--3: Acrylic Emulsion, Low Sheen
(Interior/Exterior Exposure)
This system is designed for mild use areas like office walls, laboratory ceilings, stairwells, etc. For Semi-Gloss finish, use 1029-color Tneme-Cryl S/G.

Surface Preparation: Surface must be dry and clean.

1st Coat: 1026-Color Tneme-Cryl	2.0 - 3.0
2nd Coat: 1026-Color Tneme-Cryl	2.0 - 3.0
Dry Film Thickness	4.0 - 6.0
Minimum	5.0 Mils

3.21 WOOD

A. EXTERIOR/INTERIOR EXPOSURE

1. System No. 1029-2: Acrylic Emulsion Semi-Gloss

Specify Series 1028 Hi-Build Tneme-Gloss for High Gloss finish.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 10-99W Undercoater	2.0-3.0
2nd Coat: 1029 Enduratone	1.5 - 3.5
3rd Coat: 1029 Enduratone	1.5 - 3.5
Dry Film Thickness	5.0 - 10.5
Minimum	6.0 Mils

3.22 PVC PIPE

A. EXTERIOR OR INTERIOR

System No. 1095-4: Acrylic Polyurethane

Surface Preparation: SSPC-SP1 followed by hand or power sanding to scarify / degloss surface.

Two Coats: 1095 Endurashield Dry Film Thickness 2.0-3.0 mils per coat.

3.23 INSULATED PIPE

A. INTERIOR EXPOSURE

System No. 1026-4: Acrylic Emulsion, Low Sheen

For semi-gloss finish, use 1029-Color Tneme-Cryl S/G.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 1026-Color Tneme-Cryl	2.0 - 3.0
2nd Coat: 1026-Color Tneme-Cryl	2.0 - 3.0
Dry Film Thickness	4.0 - 6.0
Minimum	5.0 Mils

3.24 HIGH HEAT COATING

A. EXTERIOR/INTERIOR EXPOSURE

1. System No. 1528-1: Inert Multipolymeric Matrix (1200 deg F Maximum)

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning - 1.5 Mil Surface Profile

1st Coat: 1528-Color Endura-Heat DTM	2.0-4.0
2nd Coat: 1528-Color Endura-Head DTM	2.0-4.0
Dry Film Thickness	4.0-6.0

3.25 SURFACES EXPOSED TO H2S/H2SO4 (SEVERE EXPOSURE/IMMERSION)

A. CEMENTITIOUS SURFACES

System No. 434-1: Polyamine Epoxy Mortar system

Surface Preparation: Allow new concrete to cure for 28 days. Sweep abrasive blast per SSPC-SP13 to remove all laitance, fines, curing compounds, form release oils, and other contaminants, and to establish a surface profile equal to ICRI CSP 5 or greater.

Apply Tnemec Series 218 to all surfaces at a minimum of 1/16" to re-surface concrete, fill voids and bugholes, mitigate concrete outgassing, and to create a monolithic, paintable surface.

1st Coat: 434 Perma-Shield	125 mils
2nd Coat: 435 Perma-Glaze	18.0-20.0
Dry Film Thickness	143-145
Minimum	144.0

B. FERROUS METAL SURFACES

System No. 142-1: Flake /Aluminum Oxide Filled Polyamine Epoxy
Surface Preparation: SSPC-SP-10 Near White Metal Blast Cleaning (1.5 Mil Profile)

1st Coat: Series 1 Omnithane	2.5-3.5
2nd Coat: 142 Epoxoline	14 - 18.0
Dry Film Thickness	16.0 – 23.5.0
Minimum	20.0 Mils

3.26 EXTERIOR OF PRESTRESSED CONCRETE TANKS

A. System No. 156-4: New Tanks

Surface Preparation: Allow new concrete to cure for at least (3) days. Surface to be clean and dry.

1st Coat: 156-Color Envirocrete	4.0 - 6.0
2nd Coat: 156-Color Envirocrete	4.0 - 6.0
Dry Film Thickness	8.0 - 12.0
Minimum	10.0 Mils

B. System No. 156-5: Existing Tanks (Previously Painted)

Surface Preparation: Remove all dirt, oil, grease, chalk, and loose paint per high pressure water blast (min. 3500 psi).

1st Coat: 151 Elasto-Grip	1.0 - 2.5
Stripe Coat: Stripe all hairline cracks with a brushed coat of Series 156 Envirocrete	3.0 - 5.0
Topcoat: 156-Envirocrete	4.0 - 6.0
Dry Film Thickness (Cracks)	8.0 - 13.5
Dry Film Thickness (Other)	5.0 - 8.5

3.27 SECONDARY CONTAINMENT AREAS

A. System No. 239SC-1: Modified Novolac Epoxy

This system offers superior chemical resistance to a wide range of aggressive chemicals, including Sulfuric Acid, Hydrofluosilicic Acid, Sodium Hydroxide, Sodium Hypochlorite, Polymer Emulsion, and hydrocarbons.

Surface Preparation: Allow new concrete to cure for 28 days. Sweep abrasive blast per SSPC-SP13 to remove all laitance, fines, curing compounds, form release oils, and other contaminants, and to establish a surface profile equal to ICRI CSP 5 or greater.

Moisture vapor transmission should not exceed three lbs per 1,000 sq ft in a 24 hour period. (Reference ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.") Relative humidity should not exceed 80%. (Reference ASTM F 2170 "Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes.") Note: For moisture content up to 10 lbs per 1,000 sq ft or relative humidity up to 90%, Series 241 may be substituted for the primer. Refer to the Series 241 product data sheet for more information.

Apply Tnemec Series 218 to all vertical surfaces at a minimum of 1/16” to re-surface concrete, fill voids and bugholes, and to create a monolithic, paintable surface.

ApplyTnemec Series 215 or 218 as needed to fill voids in horizontal surfaces.

Primer: Tnemec Series 239SC RCK	6.0-8.0
Basecoat: Tnemec Series 239SC MCK	60.0-80.0
Fiberglass Mat: Tnemec Series 211-0215SC	NA
Saturant Coat: Tnemec Series 239SC RCK	10.0-12.0
Top Coat: Tnemec Series 282	8.0-10.0
Dry Film Thickness	84.0-110.0

Notes:

1. *See Tnemec’s Fiberglass Mat Reinforced Mortar Application Guide for System details*
2. *Series 282 is not color stable. For extended color and gloss retention, apply a finish coat of Tnemec Series 290 CRU @ 2.0-3.0 mils DFT*

B. System No. 61-1: Cycloaliphatic Amine Epoxy

This system offers superior resistance to gasoline, diesel fuel, and other hydrocarbons. Use TNEMEC Series 215 between coats as a filler and surfacer

wherever it is required.

Surface Preparation: Allow new concrete to cure for 28 days. Sweep abrasive blast per SSPC-SP13 to remove all laitance, fines, curing compounds, form release oils, and other contaminants, and to establish a surface profile equal to ICRI CSP 5 or greater.

Moisture vapor transmission should not exceed three lbs per 1,000 sq ft in a 24 hour period. (Reference ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.") Relative humidity should not exceed 80%. (Reference ASTM F 2170 "Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes.") Note: For moisture content up to 10 lbs per 1,000 sq ft or relative humidity up to 90%, Series 241 may be applied prior to the "Primer" coat. Refer to the Series 241 product data sheet for more information.

Apply Tnemec Series 218 to all ***vertical*** surfaces at a minimum of 1/16" to re-surface concrete, fill voids and bugholes, mitigate concrete outgassing, and to create a monolithic, paintable surface.

Apply Tnemec Series 215 or 218 as needed to fill voids in ***horizontal*** surfaces.

Primer: 61-5002 Tneme-Liner (Beige)	8.0 - 12.0
Topcoat: 61-5001 Tneme-Liner (Gray)	8.0 - 12.0
Dry Film Thickness	16.0 - 24.0

3.28 CLEAR WATER REPELLENT FOR CONCRETE, MASONRY AND BRICK

A. Silane /Siloxane Sealer (Min. 42% Solids)

Surface Preparation: Allow new concrete to cure 28 days. All surfaces must be clean, dry, and free of oils, curing compounds, form release oils, and other contaminants that might interfere with the penetration of the sealer.

COATING: BRICK, CONCRETE
Tnemec Series 662 .... Two Coats @ 75-200 SF/GAL

SPLIT FACED OR POROUS MASONRY
Tnemec Series 662..... Two Coats @ 35-100 SF/GAL

3.29 CANAL PIPE (AERIAL) CROSSINGS

A. System 701-1: **NEW**. Zinc/Epoxy/Fluoropolymer for New Pipe or Existing Pipe Requiring Removal of Existing Coatings

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Primer: 90-97 Tneme-Zinc	2.5 - 3.5
2nd Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 3.0
3rd Coat: 701-Color Hydroflon	2.0 - 3.0
Dry Film Thickness	6.5 - 9.5
Minimum	8.0 Mils

B. System No. 701-2: **EXISTING**. High Build, Semi- Gloss Fluoropolymer for Marginally Cleaned Surfaces or Topcoating Over Existing Systems

Surface Preparation: High Pressure Water Blast (min. 3500 psi) or Solvent Clean (SSPC-SP1) and Spot Hand or Power Tool Clean (SSPC-SP 2 - 3) or Brush Blast (SSPC-SP7). Existing coatings must be clean, dry and tightly adhering prior to application of coatings.

Spot Coat: 135-Color Chembuild	3.0 - 5.0
Prime Coat: 135-Color Chembuild	3.0 - 5.0
2nd Coat: 701-Color Hydroflon	2.0 - 3.0
Minimum Dry Film Thickness (NIC Spot Coat)?	6.0

3.30 PROJECT DESIGNER SYSTEMS REFERENCE GUIDE

A. STEEL

EXTERIOR (NON-IMMERSION)

A.1 System No. 1095-1-1: Epoxy/High Build Urethane
A.2 System No. 1095-2: High Build Urethane
A.4 System 90-97: Zinc/Epoxy/Urethane

INTERIOR EXPOSURE (NON-IMMERSION)

B.1 System No. 66HS-1: High Solids Epoxy
B.2 System No. 66HS-2: High Build Epoxy

IMMERSION

C.1 System No. 104-1: High Solids Epoxy (Non-Potable)
C.2 System No. 20HS-1: High Build Epoxy (Non-Potable)

B. OVERHEAD METAL DECKING, JOIST (INTERIOR EXPOSURE)

System No. 115-1: Uni-Bond

C. OVERHEAD METAL DECKING, JOINT (EXTERIOR EXPOSURE)
System No. 1029-1 Enduratone

D. GALVANIZED STEEL-PIPE AND MISCELLANEOUS FABRICATORS

System No. 1095-3: Epoxy/High Build Urethane

E. GALVANIZED STEEL-INTERIOR EXPOSURE (NON-IMMERSION) AND ALUMINUM IN CONTACT WITH CONCRETE

System No. 66HS-3: Polyamide Epoxy

F. CONCRETE

EXTERIOR-ABOVE GRADE

A.1 System No. 1026-1: Acrylic Emulsion Low Sheen
A.2 System No. 156-1: Modified Acrylic Elastomer

EXTERIOR-BELOW GRADE

B.1 System No. 46-61: Coal Tar Pitch Solution

EXTERIOR/INTERIOR EXPOSURE (NON-IMMERSION)

C.1 System No. 1026-2: Acrylic Emulsion Low Sheen
C.2 System No. 66HS-4: Epoxy-Polyamide

IMMERSION (POTABLE & NON-POTABLE)

D.1 System No. 104-2: High Solids Epoxy (Non-Potable)
D.2 System No. 20HS-2: Epoxy Polyamide (Potable)

INTERIOR EXPOSURE (NON-IMMERSION)

E.1 System No. 66HS-5: High Solids Epoxy
E.2 System No. 113-1: Acrylic Epoxy Semi-Gloss

G. CONCRETE FLOORS

A.1 System No. 290-1: Epoxy-Polyamide
A.5 System No. 241/222: Decorative / Functional Flooring (Non-Slip)

H. POROUS MASONRY - EXTERIOR/INTERIOR EXPOSURE

A.1 System No. 156-2: Modified Epoxy-Sand Texture
A.2 System No. 104-3: High Solids Epoxy (Interior Only)
A.3 System No. 113-2: Acrylic Epoxy Semi-Gloss (Interior Only)
A.4 System No. 156-3: Modified Acrylic Elastomer

I. GYPSUM WALLBOARD

A.1 System No. 113-3: Acrylic Epoxy
A.2 System No. 66HS-5: Hi-Build Epoxoline
A.3 System No. 1026-3: Acrylic Emulsion, Low Sheen

J. WOOD EXTERIOR/INTERIOR EXPOSURE.

A.1 System No. 1029-2: Acrylic Emulsion Semi-Gloss
A.2 System No. 6-5: Acrylic Latex

K. PVC PIPE EXTERIOR/INTERIOR EXPOSURE

A.1 System No. 1095-5: Acrylic Polyurethane

L. INSULATED PIPE-INTERIOR EXPOSURE

A.1 System No. 1026-4: Acrylic Emulsion, Low Sheen

M. HIGH HEAT SURFACES-FERROUS METAL

A.1 System No. 1528-1: Silicone Aluminum (1200deg F Maximum)

N. SURFACES EXPOSED TO H_2S/H_2SO_4 (SEVERE EXPOSURE/IMMERSION)

A.1 System No. 434-1: Polyamine Epoxy Mortar Systems
A.2 System No. 142-1: Flake / Aluminum Oxide Filled Polyamine Epoxy

O. EXTERIOR OF PRESTRESSED CONCRETE TANKS

A. System 156-4 New Tanks
B. System 156-5: Existing Tanks (Previously Painted)

P. SECONDARY CONTAINMENT AREAS

A. System No. 239SC-1: Modified Novolac Epoxy
B. System No. 61-1: Cycloaliphatic Amine Epoxy

Q. CLEAR WATER REPELLENT FOR CONCRETE, MASONRY AND BRICK

A. Silane /Siloxane Sealer (Min. 42% Solids)

R. CANAL PIPE (AERIAL) CROSSINGS

A. System No. 701-1: Zinc/Epoxy/Fluoropolymer
B. System No. 701-2: High Build/Fluoropolymer
C. Ductile Iron Pipe Above Grade: Series 66 High Build Epoxy

3.31 COATING SCHEDULE

LS12A AND LS13A

1. Ductile iron pipe non-submerged exposed to interior corrosive environment – System 66HS-1

END OF SECTION

SECTION 09970 SURFACE PROTECTION SPRAY SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install and test the coating system complete and ready for operation for the structures listed in the specifications and as shown on the Drawings.

B. The work includes coating of all surfaces as shown and specified on the Drawings. This includes, but is not limited to walls, floors, concrete divider, concrete slabs and all other work obviously required to be coated unless otherwise specified herein or on the Drawings. The omission of minor items of Work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specification as stated herein.

1.02 RELATED WORK

B. Concrete surface cleaning and preparation is the responsibility of the General contractor.

C. Removal and offsite disposal of rubble is the responsibility of the General Contractor.

1.03 SUBMITTALS

A. Submit to the County shop drawings and schedules of all surfacing systems and appurtenances required. Submit design data and specification data sheets listing all parameters used in the surfacing system design and thickness calculations based on applicable provisions of ASTM.

B. Submit to the County the name of the surfacing supplier, a list of materials to be furnished, and the qualification (per 1.05 A) of the application contractor.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

ASTM D-638
ASTM D-790

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

1.05 QUALIFICATIONS

A. The Contractor performing the surfacing work shall be fully qualified, experienced a minimum of seven years and equipped to complete this work expeditiously and in a satisfactory manner. The Contractor shall submit the following information to the Engineer for review and approval before any surfacing work is performed.

1. The number of years of experience in performing this type of specialized work must be seven years minimum.
2. Name of the surfacing manufacturer and supplier for this work and previous work listed below. The Contractor shall be an approved installer as certified and licensed by the surfacing manufacturer and equipment supplier.
3. A list of clients that the Contractor has performed this type of work.

    a. The list shall contain names and telephone numbers of persons who can be called to verify previous satisfactory performance.
    b. Installation dates and a description of the actual work performed.
    c. The surfacing manufacturer shall provide an installation list of his product used for similar projects. The list shall provide the same information as required in paragraphs 3.a and 3.b above.

B. The County reserves the right to approve or disapprove the Contractor, based on the submitted qualifications.

1.06 GUARANTEE

All surfacing shall be guaranteed by the Contractor for a period of five years from the date of acceptance. During this period, all defects discovered in the surfacing, as determined by the County, shall be repaired or replaced in a satisfactory manner at no cost to the County, this shall include, but is not limited to, all work and costs associated with the shutdown of any pump stations and all bypass operations needed for the proper repairs to be made.

1.07 QUALITY ASSURANCE

A. All surfacing products shall be from a single manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM Standards D-638 and D-790 as applicable.

B. The Contractor shall employ specialty workers who have proven ability to perform the Work included herein. This will consist of a minimum of two years or two project experiences installing this product. This is a requirement for each and every employee.

1.08 DELIVERY, STORAGE AND HANDLING

A. Care shall be taken in shipping, handling and placing to avoid damaging. Any material damaged in shipment shall be replaced as directed by the County.

B. Any material showing deterioration, or which has been exposed to any other adverse storage condition that may have caused damage, even though no such damage can be seen, shall be marked as rejected and removed at once from the work.

PART 2 PRODUCTS

2.01 GENERAL

A. The material sprayed onto the surface shall be a urethane resin system formulated for the application within a sanitary sewer environment. The urethane will exhibit suitable corrosion resistance to corrosive gases and fluids found within domestic sanitary sewage. Unless dictated by varying effluent, the spray system shall be a urethane and exhibit the cured physical strengths specified herein.

B. When cured, the surface coating shall form a continuous, tight-fitting, hard, impermeable surfacing data which is chemically resistant to any chemicals or vapors normally found in domestic sewage.

C. The surface shall be an integral part of the structure being protected after being placed and cured. The surface shall cover the complete interior of the structure. The surface shall provide a continuous watertight seal or barrier.

1. The surface shall effectively seal the interior surfaces of the structure and prevent any leakage.
2. Provide water resistance data on surface based on ASTM Standards.
3. The surface shall be compatible with the thermal conditions of the EQ Return PS. Surface temperature will range from 30 to 80 degrees F. Provide test data on thermal compatibility based on ASTM Standards.

2.02 MATERIALS

A. Approved materials include

1. Aquatapoxy A-6 and Raven 405 epoxy by Raven Lining Systems
2. Green Monster by GML Coatings, LLC.
3. Sauereisen 210 system (210T & 210GL - Manatee County Light Brown Formula)

B. Polyurethane spray application shall comply with the following specifications:

The cured urethane system shall conform to the minimum physical standards, as listed below. The long-term data is for a 50-year design life of the process.

Cured Urethane	Standard	Long-Term Data
Tensile Stress	ASTM D-638	2000 psi
Flexural Stress	ASTM D-790	1100 psi
Flexural Modulus	ASTM D-790	80,000 psi

C. Epoxy spray application shall be 100% VOC free / 100% solids.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. The contractor shall clean each structure and shall dispose of any resulting material.

B. All contaminants including: oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed.

C. All concrete or mortar that is not sound or has been damaged by chemical exposure shall be removed to a sound concrete surface or replaced.

D. Surface preparation method(s) should be based upon the conditions of the substrate, service environment and the requirements of the protective coating to be applied.

E. Surfaces to receive protective coating shall be cleaned and abraded to produce a sound surface with adequate profile and porosity to provide a strong bond between the protective coating and the substrate. Generally, this can be achieved with a high pressure water cleaning using equipment capable of 5,000 psi at 4 gpm. Other methods such as abrasive blasting, shot blasting, grinding, scarifying or acid etching may also be used. Detergent water cleaning and hot water blasting may be necessary to remove oils, grease or other hydrocarbon residues from the concrete. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound clean neutralized surface that is not excessively damaged.

F. A concrete structure suitably prepared for coating shall have all loose, soft, discolored or otherwise deteriorated material removed and the surface profile shall be in accordance with ICRI Guidelines No. 03732. Expose aggregate and obtain a uniform surface texture resembling an ICRI – CPS (Concrete Surface Profile) #4-6. The County may use one or more of the following observations/tests to determine whether the substrate has been properly cleaned and prepared:

   a. Visual appearance of the surface – The prepared substrate shall have the appearance of sound concrete, free from discolored, white, chalky and cracked areas.
   b. Aural observations – When struck with a metal hammer or similar metal tool, the prepared substrate shall exhibit the characteristic sound of solid, competent concrete. Care should be taken not to fracture sound concrete.
   c. Mechanical abrasion tests – The substrate should be competent enough such that it cannot be scraped off with the claw of a hammer or similar metal tool.
   d. pH testing – The County may use wetted litmus paper applied to the surface of the substrate to ensure that the pH of the substrate is 7 or higher.
   e. Phenolthalein testing – The County may apply a few drops of phenolthalein to the surface of the concrete, which if the concrete is competent should yield a purple color.

G. The County is not obligated to use all of the above tests, but may do so at the County's sole discretion. Often visual, mechanical and/or aural observations and tests alone will be adequate, but the pH and/or phenolthalein tests may be used if there is still some uncertainty.

H. If after cleaning, a surface does not meet these requirements, the County shall have authority to require additional cleaning effort and/or increased blasting pressure

as required to adequately prepare the surface. If necessary, the County may also require acid etching of the concrete surface to create the desired texture. The County may also require mechanical removal of damaged concrete or other substrate materials.

I. A mild chlorine solution may be used to neutralize the surface to diminish microbiological bacteria growth prior to final rinse and coating system if approved by the Manufacturer's Representative.

J. The time between structure cleaning and preparation activities and application of the first coating layer shall be within the coating manufacturer's recommendation.

K. All surfaces should be inspected by the Inspector during and after preparation and before any repair material is applied.

L. No separate payment shall be made for any preparatory work required prior to application of the surface coating.

3.02 INSTALLATION

A. The Contractor shall notify the Project Manager at least 48 hours in advance, giving the date, start time and estimated completion time for the work being conducted.

B. The installation of the surface coating shall be in complete accordance with the applicable provisions of ASTM and the manufacturer's specifications. A representative of the manufacturer shall be present during the actual installation.

1. Prior to placing the surface coating, the manufacturer's representative must approve the surface preparation work and installation conditions including temperatures.
2. All surfaces shall be sufficiently smooth and even, to ensure good flow handling characteristics when complete.
3. All surfaces shall have the surface coating applied to the required thickness by spray application.

D. Application procedures shall conform to the recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment.

E. The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order.

F. The protective coating material must be spray applied by a Certified Applicator of the protective coating manufacturer.

G. Polyurethane spray application shall be applied such that all surfaces shall be coated in accordance with the manufactures recommended thickness but not be less than 125 mils.

H. Epoxy spray application shall be applied such that all surfaces shall be coated in accordance with the following:

1. Specified surfaces shall be coated by spray application of a moisture tolerant, solvent-free, 100% solids, epoxy protective coating as further described herein. Spray application shall be to a minimum wet film thickness in accordance with the following table or manufacturer's recommendation, whichever is greater:

Concrete, New/Smooth	80-100 mils for immersion, 60-80 mils for atmospheric, splash and spill exposure
Concrete, Rough	100-125+ mils
Masonry/Brick	125-150+ mils
Steel	16-80 mils for immersion, 16-40 mils for atmospheric, splash and spill exposure; also profile dependent
Fiberglass Systems	40-60 mils tack coat, 9 oz/yd2 fabric, 40-60 mils top coat. Varies with circumstances

2. Airless spray application equipment approved by the coating manufacturer shall be used to apply each coat of the protective coating. Air assisted spray application equipment may be acceptable, especially for thinner coats (<10 mils), only if the air source is filtered to completely remove all oil and water.
3. If necessary, subsequent top coating or additional coats of the protective coating should occur as soon as the basecoat becomes tack free, ideally within 12 hours but no later than the recoat window for the specified products. Additional surface preparation procedures will be required if this recoat window is exceeded.

3.03 FIELD TESTING AND ACCEPTANCE

A. Field acceptance of surface coatings shall be based on the County's evaluation of the proper surfacing of the structure and the appropriate installation and curing test data along with review of the structure inspections.

B. The surface coatings shall provide a continuous monolithic surfacing with uniform thickness throughout the structure interior. If the thickness of the coating surface is not uniform or is less than specified, it shall be repaired or replaced at no additional cost to the County.

1. The County will measure the surface cured thickness from a specimen retrieved by the Contractor. The Contractor shall retrieve the specimen by physically cutting through the surfacing (by drilling or coring). There will be up to three thickness measurement locations in each structure. A

suitable non-destructive type of thickness measurement may also be used.

2. All the surface coating thickness measurement locations shall be repaired by the Contractor in accordance with the manufacturer's recommendations. These repairs shall be included in the five year surface coating guarantee.

C. All pipe connections shall be open, clear, and watertight.

D. There shall be no cracks, voids, pinholes, uncured spots, dry spots, lifts, delaminations or other type defects.

E. If any defective surface coating is discovered after it has been installed, it shall be repaired or replaced in a satisfactory manner within 72 hours and at no additional cost to the County. This requirement shall apply for the entire five year guarantee period.

END OF SECTION

Delete this Page.

DIVISION 11 EQUIPMENT

SECTION 11310 SUBMERSIBLE, NON-CLOG WASTEWATER PUMP

PART 1 GENERAL REQUIREMENTS

1.01 DESCRIPTION OF WORK

A. Work Included in this Section: The CONTRACTOR shall provide all the required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, and test equipment for furnishing, installation, adjustment, and full test loading of all the mechanical work shown on the Drawings and included in these Specifications.

B. CONTRACTOR and PUMP MANUFACTURER shall coordinate with the provider of the variable frequency motor controllers to provide the thermal and leak detection signals to the drive manufacturer and supply any ancillary equipment required for these signals, including any conditioning devices.

1. PUMP MANUFACTURER shall provide ancillary devices, if required for the ability to bring thermal and leak detection signals into the new variable frequency motor controllers at Station 12A for a total of three (3) pumps. Coordinate with Variable Speed Motor Controller Manufacturer for installation. CONTRACTOR to oversee coordination.

1.02 QUALITY ASSURANCE

A. Reference Standards

1. American Iron and Steel Institute (AISI):

    a. Steel Products Manual

2. American National Standard Institute (ANSI)
3. American Society of Mechanical Engineers (ASME)
4. American Water Works Association (AWWA)
5. ASTM International (ASTM):

    a. A48, Standard Specification for Gray Iron Castings.

6. FM Global (FM)
7. Hydraulic Institute Standards for Centrifugal, Rotary and Reciprocating Pumps (HI)
8. National Electrical Manufacturer's Association (NEMA):

    a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum)
    b. ICS 6, Enclosures for Industrial Controls

9. National Fire Protection Agency (NFPA):

    a. 70, National Electrical Code (NEC)

10. Underwriters Laboratories, Inc. (UL)
11. Electronic Industries Association (EIA)
12. Insulated Cable Engineers Association, Inc. (ICEA)
13. Institute of Electrical and Electronic Engineers, Inc. (IEEE)
14. National Electrical Contractors Association
15. National Electrical Safety Code (NESC)
16. Occupational Safety and Health Agency (OSHA)

B. Available Manufacturers: Subject to compliance with requirements, provide from the following:

1. Flygt (140-HP Model N3231/706)
2. ENGINEER approved equal.

1.03 SUBMITTALS

A. Submit manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.

B. Submit certified copies of reports of factory test specified in this section and required by referenced standards.

C. Submit shop drawings showing all dimensions; also include performance data and physical characteristics.

D. Submit manufacturer's parts list, operation and maintenance literature and instructions.

E. Submit six (6) copies of the operating and maintenance manuals prepared specifically for this installation. Manuals shall include all required cuts, drawings, equipment lists, descriptions and similar items that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

F. Certified Factory Tests: Each pump shall be given a complete non-witnessed performance test to include head/capacity, Hp and efficiency to prove that the pumps supplied conform to the requirements of this specification. The curves shall be plotted from no flow at shut off head to maximum flow at minimum head specified. No shipment of the pumps shall be made until after the ENGINEER’s approval of the testing is obtained.

G. For soft start applications, submit:

1. Critical speed and half critical speed data for each pump model.

2. Certification that the pump manufacturer is bearing coordination responsibility for the pump(s) and soft starter(s) for their specific application to avoid overheating and harmonic vibrations caused by rotational speed and carrier-frequency-induced rotational "cogging".
3. Certified statement signed by a State of Florida licensed professional engineer that the L10 bearing lives meet or exceed the specified requirements.

1.04 GUARANTEE AND WARRANTY

A. In addition to the requirements in the General Conditions and the Special Conditions, the CONTRACTOR shall require the manufacturer to furnish a warranty valid through the warranty period to assure that any equipment specified herein which does not meet the performance requirements for the specifications, is repaired to the COUNTY's satisfaction or replaced with equipment that does meet the performance requirements of the specification. The warranty shall be for minimum period of two years from the date of Final Acceptance for the portion of work associated with the equipment specified herein.

PART 2 PRODUCTS

2.01 SUBMERSIBLE NON-CLOG WASTEWATER PUMPS

A. Furnish and install three (3) submersible non-clog wastewater pumps. The pumps shall be equipped with a close coupled 140 HP, submersible electric motor connected for operation on 460 volts, 3 phase, 60 hertz to be installed in a dry pit application as shown on the Drawings. The power cables shall be sized according to NEC and ICEA standards.

B. The pumps shall be capable of delivering the following 3,203 gpm at 112 FT TDH. See attached performance curve.

E. Power and pilot cable supports shall be provided and consist of a wire braid sleeve with attachment loops or tails to connect to the underside of the access frame.

2.02 MATERIALS

A. Dry Pit Application, LS12A Lift Station

1. Pump case: Cast iron, ASTM A48, Class 35B.
2. Motor housing: Cast iron, ASTM A48, Class 25 or Class 30.
3. Impeller: Cast iron, ASTM A48, Class 35B.
4. Shaft: Stainless steel, ASTM A479 S43100-T.
5. Wear rings: Corrosion and wear resistant materials.
6. O-rings: Nitrile (Buna-N) or fluorocarbon (Viton).
7. Fasteners: 316 L Stainless steel.
8. Lower ring seal: Tungsten-carbide both faces.

9. Upper ring seal: Tungsten-carbide both faces or carbon and ceramic or carbon and Niresist.
10. Seal metal parts: Stainless steel.

2.03 EQUIPMENT

A. LS12A Lift Station – 140 HP

1. Number of pumps: Three (3) – One (1) duty, two (2) standby
2. Design condition:

    a. 3,203 GPM at 112 FT TDH with minimum pump efficiency of 77.7 percent.
    b. Achievable flow and TDH conditions: See attached performance curve

3. Pump configuration:

    a. Dry pit.

4. Maximum pump speed: 1185 rpm.
5. Nameplate driver horsepower: 140.
6. Drive type: Variable speed.
7. Discharge: 8 IN DIA.
8. Motor requirements:

    a. Service factor: 1.15.

9. Ambient conditions:

    a. Wastewater maximum temperature: 104 DegF.
    b. Air maximum temperature: 176 DegF.

2.04 COMPONENTS

A. General

1. Provide pumps capable of handling raw, unscreened sewage.
2. Where watertight sealing is required, machine and fit mating surfaces with O-rings.
3. Provide with heavy duty lift lugs or hoisting bail designed for lifting the entire pump and motor assembly.

B. Pump Construction

1. Major pump components shall be of gray cast iron, ASTM A 48, Class 35B, with smooth surfaces devoid of blow holes or other casting irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel. All metal

surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by a factory applied EPO Duasolid spray coating consisting of 1-layer Temanyl PVB and 3-layer of Duasolid 50 on the exterior of the pump.

2. Sealing design shall incorporate metal to metal contact between machined surfaces. Pump/Motor unit mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O rings. Joint sealing will be the result of controlled compression of rubber O rings in two planes and O ring contact of four sides without the requirement of a specific bolt torque limit. Rectangular cross sectioned rubber, paper or synthetic gaskets that require specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O rings, grease or other devices shall be used.

C. Impeller

1. Provide nonclog-type dynamically balanced impeller in accordance with HI Standards.
2. Provide impeller and volute wear rings as necessary to assure efficient sealing between volute and impeller.
3. The impeller shall be of Hard-Iron ® (ASTM A-532 (Alloy III A) 25% chrome cast iron), dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

D. Volute Bottom/Insert Ring

1. The pump volute shall be a single piece grey cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of Hard-Iron ® (ASTM A-532 (Alloy III A) 25% chrome cast iron) and provide effective sealing between the multi-vane semi-open impeller and the volute housing. The clearance between the internal volute bottom and the impeller leading edges shall be adjustable.

E. Shaft

1. Design pump shaft of sufficient size to transmit full driver output.
2. Use shaft which is accurately machined and constructed with sufficient materials.
3. Design shaft for a maximum deflection of 0.002 IN measured at the stuffing box.

F. Shaft Seal

1. Seal shaft with double mechanical seal running in an oil filled chamber.
2. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced.
3. Hold interface in contact by its own spring system.
4. Pump and motor shaft shall be a solid continuous shaft. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be of AISI 431 stainless steel.

G. Mechanical Seal

1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The lower seal shall be independent of the impeller hub. The seals shall operate in an lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal. For special applications, other seal face materials shall be available.
2. Should both seals fail and allow fluid to enter the stator housing, a port shall be provided to direct that fluid immediately to the stator float switch to shut down the pump and activate an alarm. Any intrusion of fluid shall not come into contact with the lower bearings.
3. The following seal types shall not be considered acceptable or equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to affect sealing shall be used.
4. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with

positive anti leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication.

5. The motor shall be able to operate continuously while non-submerged without damage while pumping under load.
6. Seal lubricant shall be FDA Approved, nontoxic.

H. Bearings

1. The pump shaft shall rotate on at least three grease-lubricated bearings. The upper bearing, provided for radial forces, shall be a single roller bearing. The lower bearings shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust.
2. The minimum L10 bearing life shall be 100,000 hours at any point along the usable portion of the pump curve at maximum product speed.
3. The lower bearing housing shall include an independent thermal sensor to monitor the bearing temperature. If a high temperature occurs, the sensor shall activate an alarm and shut the pump down.
4. Insulated Bearings: The upper support bearing, provided for radial forces, shall be a single roller bearing and shall have an insulated outer ring to provide protection against potential bearing damage from electrically induced currents that can be created especially when the motor is used with a VFD. The outer ring shall have a plasma-spray technique or oxide-ceramic coating that provides an insulating barrier between the bearing face and the bearing housing of the pump.

I. Motors

1. Motor shall be 3 PH, 60 cycle, 460 V.
2. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40°C (104°F) with an 80°C temperature rise and capable of at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum.
3. Thermal switches shall be embedded in the stator end coils to monitor the temperature of each phase winding. One PT-100 type temperature sensor shall be installed in the stator winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction

chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. A mechanical float switch (FLS) shall be mounted in the junction chamber to signal if there is water intrusion. A pump memory module shall be provided and mounted in the junction chamber to record pump run time, number of starts as well as contain the motor unit performance and manufacturing data and service history. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

4. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no load characteristics.
5. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.
6. The motor horsepower shall be adequate so that the pump is non overloading throughout the entire pump performance curve from shut off through run out.
7. Assure motor is capable of running dry for extended periods without damage to motor or seal.

J. Cooling System

1. Each pump/motor unit shall be equipped with an integral, closed-loop motor cooling system. The motor cooling jacket shall encircle the stator housing and shall be of Type 304 stainless steel. The closed-loop motor cooling system shall provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air in dry-pit installation mode. A high efficiency impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the system. The cooling liquid shall pass about the stator housing in the closed loop system between the motor housing and close-fitting guide sleeve in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C) in accordance with NEMA standards. Operational restrictions that limit the ambient or pumped liquid temperatures at levels less than 40°C are not acceptable.

K. Power and Control Cables

1. Provide power cable and control cable to pump suitable for submersible applications in wastewater and indicate same by a code or legend permanently embossed on cables.
2. Size cables in accordance with applicable NEC specifications.
3. Provide power cable and control cable as shown on the Drawings.
4. Provide each cable with a strain relief, cord grip, and explosion proof seal installed in accordance with NEC Article 500.
5. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

M. Temperature Monitor

1. Furnish each phase of the motor with a temperature monitor embedded in the motor windings.
2. Arrange controls so as to shut the pump down and sound alarm should any one of the monitors detect high temperature and automatically reset once the stator temperature returns to normal. These thermal switches shall be used in conjunction with and supplement to external motor overload protection and shall be connected to the motor control panel.
3. Set temperature of the temperature monitors at not higher than 90 percent of insulation temperature rating.

N. Coatings

1. For dry pit applications, apply epoxy system to the exterior of the pump casing and motor housing that is equal to or better than that specified in Specification Section 09900.
2. Protect all metallic surfaces coming into contact with sewage except stainless steel and bronze by a corrosion-resistant coating.

O. Moisture Sensor

1. Provide two moisture sensors in the oil chamber of the pumps.
2. The leads for these sensors shall be brought out through a waterproof connection such that the sensors may be connected to the sensor module located in the control cabinet.

2.05 SPARE PARTS

A. Tools and spare parts shall be furnished as specified herein.

B. Spare parts shall be marked with parts numbers and shall indicate the equipment for which they are intended. Spare parts shall be packed in suitable containers also marked with the parts numbers and the equipment for which they are intended.

C. Prior to final acceptance of the work, the CONTRACTOR shall turn over to the COUNTY, all specified spare parts. The CONTRACTOR shall prepare a listing of all such spare parts and include a copy of the list in the operation and maintenance manuals.

D. Prior to final acceptance of the work, the CONTRACTOR shall turn over to the COUNTY all special and/or proprietary hand tools necessary for the complete dismantling and maintenance of the pump and motor assembly.

E. The following spare parts and tools shall be furnished for each pump:

1. One set of ceramic stationary seal and rotating carbon seal.
2. Two sets of spare gaskets and "O" rings including hydraulic sealing flange gasket, special impeller pullers, and special wrenches needed for breakdown of pump.
3. One stainless steel, glycerin-filled pressure gauge and diaphragm seal unit.

2.06 SOURCE QUALITY CONTROL

A. Secure from the pump manufacturer the following inspections and tests on each pump before shipment from factory:

1. Check impeller, motor rating and electrical connections for compliance with Specification.
2. Test motor and cable insulation for moisture content or insulation defects.
3. Prior to submergence, run pump dry to establish correct rotation and mechanical integrity.
4. Run pump for 30 minutes submerged, a minimum of 6 FT under water.
5. After operational test #4, perform insulation test (#2) again.

B. Factory test of head (FT) versus flow (gpm) for each pump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the pumps to be sure all passages are clean and clear of obstruction and that impellers rotate freely. Examine pump mounting surface and also make certain that bolts are properly located. Correct any irregularities prior to installation.

3.02 INSTALLATION

A. Install pumps in accordance with specifications, drawings and manufacturer's written instructions. Install units level and plumb. Securely anchor units. Insure that stress is not applied to suction and discharge connections by piping. Make sure all connections are tight.

B. Seal pump cable end with a high quality protective covering, to make it impervious to moisture or water seepage prior to electrical installation.

3.03 TESTING

A. After installation, test pumps in accordance with Hydraulic Institute Standards. The pump shall be field tested to establish field head and overall efficiency. Report and test shall include voltage and amperage measurements

3.04 STARTUP AND TRAINING

A. A factory trained representative shall be provided for installation supervision, start-up and test services and operation and maintenance personnel training. The representative shall make a minimum of 2 visits, minimum 4 hours on site for each visit to the site. The first visit shall be for the assistance in the installation of equipment. Subsequent visits shall be for checking the complete installation, start-up and training of the system. Manufacturer’s representative shall test operate the system in the presence of the ENGINEER and verify that the equipment conforms to the requirements. Representative shall revisit the Site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.

END OF SECTION

SECTION 13050 PREFABRICATED CONCRETE BUILDING

PART 1 GENERAL

1.01 SCOPE

A. The prefabricated building system shall be factory assembled, pre-tested, shipped to the site, and suitably anchored to the respective concrete foundation or framing slabs.

1.02 GENERAL

A. The building shall be manufactured by Concrete Modular Systems, Inc. (727-945-1864); Oldcastle Infrastructure, (888-965-3227); or approved equal. The manufacturer shall be a Florida Department of Community Affairs approved vendor for modular precast concrete buildings, and must have a minimum of 5 years of experience manufacturing and setting transportable precast concrete buildings. The building design and construction shall conform to all applicable federal, state, and local building codes and standards including the Florida Building Code (FBC) 2020, Minimum Design Loads for Buildings and Other Structures (ASCE 7-16), Structural Welding Code (AWS D1.1-2020), ACI-318-14, ACI-318R-14, and AISC 360-16.

B. The building shall be guaranteed to be completely weather-tight under all weather conditions for a period equal to or greater than the correction period. Leaks which occur during the period, whether through roofs, walls, doors, accessory equipment, or materials shall be repaired to the satisfaction of the OWNER at no additional cost to the OWNER.

C. All openings and penetrations shall be verified by CONTRACTOR prior to casting.

1.03 SUBMITTALS

A. Complete DRAWINGS and data for the building shall be furnished showing anchor bolt locations, sizes, and projections; details of sidewall, end wall, and roof framing; transverse cross-sections; locations of all openings; details of louver; flashing details; and erection instructions. Color samples of manufacturer's standard finishes shall be submitted. DRAWINGS and data shall be submitted in accordance with the Submittals section.

B. Complete SPECIFICATIONS and DRAWINGS covering the galvanized steel door and a complete hardware schedule shall be submitted in accordance with the Submittals section. DRAWINGS shall indicate an elevation of the door, details of construction, assembly and erection details, profiles and thickness of materials, anchors, accompanied by the manufacturer's installation manual, indicating standard recommendations and details of erection. The hardware schedule shall indicate each item of hardware required, manufacturer's name, manufacturer's number or symbol, and finish.

C. A letter of certification signed and sealed by a Professional Engineer registered in the state of Florida shall be submitted for the structural framing, roof, anchorage, covering panels of the building system, doors, windows and louvers.

PART 2 PRODUCTS

2.01 STRUCTURAL DESIGN

A. The applicable building code is the 2020 Florida Building Code. The building shall be designed for the criteria in the following table.

Roof live load, lb per sq ft of horizontal projection (no live load reduction is permitted)	65 PSF
Roof Dead Load	Actual, 15 PSF min
Roof Collateral Dead Load	20 psf
Wind Load	160 MPH, Risk Category III, ASCE 7-16, Exposure C, Enclosed
Floor Live Load	125 PSF
Floor Dead Load	Actual

2.02 BUILDING CONSTRUCTION

A. The building shall be constructed of solid, one-piece concrete panels. Wall panels shall be bolted or welded to adjacent panels and roof / floor slab panels. Joints shall be caulked inside and out to make the building weatherproof. The wall panels shall be minimum 4" thick solid panels of concrete with primary structural reinforcement of steel bars and welded wire fabric.

B. If applicable interior wall construction shall be R-14 insulation with ¾" plywood panels with plastic laminate facing suitable for equipment mounting, wall panels that are continuous from base to eave with no horizontal joints.

C. Exterior wall panel assembly shall develop strength to resist the design wind loads. The exterior finish on the walls of the building shall be as indicated on the drawings and if applicable paint color to be selected by OWNER.

D. If applicable, the ceiling for the building shall be R-21 insulation with 5/8" gypsum board.

E. All welding shall be in accordance with AWS D1.1 Structural Welding Code.

F. All necessary erection hardware, fasteners, trim, flashing, closures and other accessories necessary for a complete building shall be furnished.

G. The exterior roof shall be a minimum 4" thick concrete panels which shall extend 2" (min.) over the walls to act as a drip edge. The roof shall contain primary reinforcement of steel bars and welded wire fabric as well as secondary reinforcement of polypropylene fibers.

H. Caulking shall be provided at all bases, corners, eaves, doors, and other openings to provide a completely weather-tight installation. Exterior flashing shall be finished in a complementing color as the section to which it is attached.

2.03 DOOR MATERIALS

A. Materials used in the manufacture and installation of galvanized steel doors and frames shall be as follows:

Doors	Galvanized steel sheets zinc coated on (2) sides in conformance with ASTM A653, G60 designation/coating weight, 0.053 inch minimum sheet thickness, with manufacturer's standard 10 year warranty.
Internal Reinforcing	Manufacturer's standard
Core	Rigid polyurethane 1 ½" thick block, in conformance with ASTM C591, laminated to exterior panels.
Frame	Metal frames in conformance with ANSI/SDI 100, fabricated with galvanized steel sheets zinc coated, 0.064 inch minimum sheet thickness.
Anchoring Devices	Galvanized steel concealed fasteners.
Expansion Anchors	As per manufacturer's instructions.

2.04 DOOR CONSTRUCTION

A. Doors shall be full flush and seamless, neat in appearance and free from defects. Door frames and framing members shall be erected plumb and in accordance with the manufacturer's recommendations and standard installation manuals, subject to the following modifications.

B. Framing members shall be anchored to steel by machine screws. Anchors for head, jamb, and sill members shall be spaced not more than 24 inches apart.

Weather-stripping and other accessories shall be secured with countersunk machine screws.

C. Hardware shall be carefully and properly installed, doors hung, and each item of hardware lubricated and adjusted for perfect operation. Doors and frames shall be protected during fabrication, shipment, and erection of the building to prevent damage to materials or finished work.

D. Door assemblies shall be comprised of galvanized steel sheet type with polyurethane core. Doors and hardware shall comply with the latest Florida Product Approval system requirements.

E. Door window and louver locations and openings shall be as shown on the design drawings.

F. The building shall be equipped per specifications as shown on the design drawings and other specifications.

G. Shop Finish: A color impregnated gel coat finish of 25 mils minimum thickness shall be applied to all door and frame surfaces. The finish surfaces shall be smooth and free from irregularities. Color will be selected from the manufacturer's standard color chart. A minimum of 8 colors shall be available for selection.

H. Frames: Frames for doors shall be cold rolled galvanized steel sheet fabricated with mitered or coped continuous welded corners shipped for field assembly. Frame face shall be sized according to the actual size and width of the opening provided.

I. Workmanship: The finish work shall be strong and rigid, neat in appearance, and free from defects. Fabricate with edges straight and true, with corner joints well formed, and with fastenings concealed where practicable. All joints on exposed surfaces shall be smooth so they are invisible after finishing.

J. Joints: Joints for frames shall be mitered or butted and continuously sealed on the reverse side to produce rigid joints which are invisible on the face of the frame. Frame bottoms shall be held rigidly in position by spreader bars to maintain proper alignment during shipment and erection. Fiberglass reinforced plastic frames shall have concealed reinforcements for hardware according to manufacturer's standards.

K. Sizes and Clearances: Doors shall be 1-3/4 inches thick, full flush type, of the sizes and design indicated. Clearances for doors shall be 1/8 inch at heads and jambs, 1/4" at meeting stiles of pair doors, and 3/4" at bottom unless otherwise indicated or specified.

L. Construction: Doors shall be constructed with specified outer sheets. Side edges of doors shall be flush and closed watertight. All seams shall be continuously

sealed. Doors shall be prepared at the factory for hardware as specified. Door edges shall be beveled or rounded.

1. Internally reinforced doors shall have solid reinforcement at all joints and all hardware locations.
2. Solid polyurethane core shall be laminated to the exterior panels.
3. Out-swinging exterior doors shall be finish flush at the top, with all seams and joints closed watertight as specified for side edges.

M. Installation: Frames shall be set in position, plumbed, aligned and braced securely until permanent anchors are set or as required by manufacturer.

N. Frames: Frames for doors and transoms shall be formed to the sizes and shapes required.

O. CONTRACTOR shall verify equipment fits through doors provided.

P. Door colors shall be as selected by the OWNER.

2.05 DOOR HARDWARE

A. Doors shall be mortised, reinforced, drilled, and tapped for mortised hardware. Reinforcing units shall be provided for locksets. Reinforcing plates shall be provided for mortised and surface-applied hardware according to manufacturer's standards.

B. A lock guard shall be provided on the exterior of entrance doors to cover the latch bolt.

C. Hinges shall be heavy duty with a security stud. Unless otherwise required, a security stud will be specified. If preferred by the OWNER, a Roton continuous hinge may be used.

D. Access control locksets shall match OWNER standard, Shlage Locksets. Coordinate with OWNER for cylinder type, keying, and key code.

E. Hardware shall be furnished and installed by the door manufacturer in accordance with the schedule listed herein. Hardware shall be furnished complete with machine screws, bolts, and other attachments as required, finished to match the hardware.

F. Hardware shall be stainless steel.

G. The location of hardware items shall be in accordance with DHI "Recommended Locations for Builders' Hardware". Two keys shall be furnished with the lock.

H. Panic exit hardware shall be bar type.

I. The following hardware shall be provided for the Building:

Analyzer Building Door: D-101

Item	Quantity	Remarks
Butt Hinges	3	Stanley, FBB 199-630 4-1/2" x 4-1/2" NRP, or equal
Access Control Lockset	1	LS-2P-C-26D-AM-xxx by International Electronics Inc. or equal.
Closer	1	LCN 4041 HAL-CUSH Hold Open, or equal
Latch Guard	1	Ives, LG1-630
Threshold, cast abrasive	1	Wooster, 115 Alumogrit 4" x ½", or equal
Drip Cap, Frame	1	Reese, R199-A, or equal
Weather Stripping, Head and Jambs	1 Set	Reese D70S, or equal
Weather Stripping, Sill	1	Reese 323, or equal

2.06 PAINTING AND FINISHES

A. All surfaces to receive paint shall be cleaned of any grease, dust, or dirt. Pre-finished surfaces shall be masked or otherwise protected to avoid damage from spilled paint, overspray, or spatter.

B. Factory finished surfaces which have become damaged during shipping, assembly, or erection shall be touchup painted with materials supplied by the building manufacturer. No other finish will be accepted. All touchup painting shall produce a final finish satisfactory to the ENGINEER and OWNER.

C. Finish of the exterior surfaces of the wall panels shall be split face block (color selected by OWNER). Finish of metal surfaces shall be an epoxy or marine-grade enamel. Colors of panels, trim, and flashing shall be complimentary and match the existing adjacent building(s) and approved by OWNER.

D. Refer to DRAWINGS and other project SPECIFICATIONS on coatings for more details.

2.07 ELECTRICAL

A. The applicable electrical code is the latest edition adopted by the state of Florida, National Electrical Code.

B. Building Power. The building power shall be provided by the CONTRACTOR in close coordination with the building manufacturer. A general layout of electrical equipment, lighting and receptacles is shown on the drawings. The CONTRACTOR shall install all electrical equipment including conduit, wiring, lighting, receptacles, and exterior lighting as shown on the electrical drawings and as noted in specifications.

C. Access Security Control Conduits. Conduits and gang receptacle boxes shall be installed by the building manufacturer within the walls adjacent to each entry door for future installation of access control and security equipment (by others).

2.08 EQUIPMENT & PIPE MOUNTING SYSTEM

A. Mounting system shall be resistant to the potentially corrosive environment.

B. Materials shall utilize a Unistrut Nonmetallic Channel Framing System, including the following fiberglass pieces: pipe clamps, pipe supports, nuts, bolts and associated accessories.

2.09 HVAC

A. Quantity (2) minimum of 3 Ton, 208V, 1 phase split unit system ceiling mounted indoor unit.

PART 3 EXECUTION

A. The building shall be assembled in accordance with the building manufacturer's instructions.

B. All members shall be carefully leveled. Sill angles and door frames shall be caulked in place and sealed.

END OF SECTION

SECTION 13100 INSTRUMENTATION AND CONTROL, GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED SECTIONS

A. The CONTRACTOR shall coordinate the work of this section as it relates to other sections of the specification. Particularly:

1. Section 11210 – Vertical Turbine Pumps
2. Section 16050 – Electrical General Provisions

1.02 DESCRIPTION of WORK

A. The CONTRACTOR shall provide an approved professional SYSTEM INTEGRATOR to have total system responsibility for instrumentation, controls, services and systems as indicated in the contract drawings and described herein.

B. This section of the specifications shall be considered as a single unit and shall be included in the single source responsibility from the SYSTEM INTEGRATOR.

C. The SYSTEM INTEGRATOR, working together with the CONTRACTOR, shall provide and install the total requirements for System Controls and Instrumentation as described herein and shown in the contract drawings.

D. This project provides refurbishment of three lift stations. The existing control panel backboard for each lift station will be relocated into a new control panel enclosure by the CONTRACTOR. The control panel enclosure will be provided by the SYSTEM INTEGRATOR and the SYSTEM INTEGRATOR shall provide a new UPS for each panel.

E. The CONTRACTOR shall provide new conduit and cable to all existing and new field instrumentation and equipment. The SYSTEM INTEGRATOR shall perform loop checks of all instruments. The SYSTEM INTEGRATOR shall confirm all RTU to/from SCADA control and operations. An instrument index list has been provided in Appendix 1 of section 13100 and an RTU input/outputs list is provided in Appendix 2 of section 13100. These lists were compiled from field photos and as-built documentation and are not to be considered as all inclusive. The lists have been provided as a guide for the CONTRACTOR and SYSTEM INTEGRATOR to utilize in determining complete scope.

F. The CONTRACTOR shall provide new alarm beacon outside the building and demo the existing beacon.

G. Communications between the RTU and the SCADA computer shall occur over a radio link. The CONTRACTOR shall be responsible for the installation of the cable between the control panel radio equipment and the antenna. New cable shall be routed the entire length, no splicing is acceptable. SCADA to RTU communication shall be tested and the SYSTEM INTEGRATOR shall provide verification of the communications quality.

H. The SYSTEM INTEGRATOR will be responsible for hiring/providing the services of the RTU manufacturer Data Flow Systems (DFS) for the programming of the

Remote Terminal Units (RTU) and the SCADA Computer (HMI) including screens, database, and control logic. Relocation of the control panel should be seamless to the RTU and SCADA.

I. The SYSTEM INTEGRATOR, in conjunction with the Contractor and project Electrician, shall relocate the existing control panel back panels to the new control panels as shown in the contract documents. Activities shall include verification of all signals into the PLC and the operation of all field devices. The CONTRACTOR shall test all I/O prior to commencing work and provide a list of any deficiencies including I/O not in service and/or not operating correctly to the OWNER.

J. After all field signals are configured, installed, terminated and tested to the RTU the SYSTEM INTEGRATOR shall perform an Operational Readiness Test (ORT) to confirm the connectivity and operation of all field signals.

K. The SYSTEM INTEGRATOR shall include time, after the completion of the ORT, to demonstrate the operation of all field signals to the SCADA System Programmer and the OWNER'S REPRESENTATIVE.

1.03 CONTROL AND INSTRUMENTATION SYSTEM RESPONSIBILITY

A. The SYSTEM INTEGRATOR shall be responsible to oversee the coordination between the proposed instrumentation and controls and providing system start-up services so that the entire hardware system operates as intended.

B. Work shall include but not be limited to the following: Provide all components regardless of manufacturer and apply total SYSTEMS INTEGRATION ENGINEERING to assure that each component is appropriate for the service intended and that it is applied and utilized in keeping with the recommended standards of practice designated by the manufacturer.

C. The SYSTEM INTEGRATOR shall also oversee the installation, start-up and calibration of every system component to verify that all details of the system are properly executed.

D. The SYSTEM INTEGRATOR shall provide technical services including interface design, coordination with related equipment and systems provided by others.

E. The SYSTEM INTEGRATOR shall execute communications diagnostics and testing procedures to verify and demonstrate that the interface to the RTU and SCADA is properly installed and configured and shall demonstrate to the Engineer that the system components have been properly installed and configured for full functionality.

F. Additional hardware may be required to achieve proper interface or systems operation (i.e. signal converters, signal re-transmitters, interposing relays and similar items). These shall be provided and installed by the SYSTEMS INTEGRATOR as part of the total systems responsibility at no additional cost to the Owner to form a system which is well ordered and complete.

G. The work shall include complete testing of all equipment and wiring at the completion of the work and making any minor changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; sub-standard work will be rejected.

1.04 QUALITY ASSURANCE

A. AVAILABLE SYSTEM INTEGRATORS: A single sub-contractor shall be designated as the SYSTEM INTEGRATOR. This supplier shall be responsible for all of the specialized controls and instrumentation for the project. The instrumentation SYSTEM INTEGRATOR shall provide all engineering, equipment, materials and hardware as well as assuring proper installation, adjustment, and startup of all systems, regardless of manufacturer.

B. The SYSTEMS INTEGRATOR shall be a company which is regularly engaged in the business of instrumentation and controls systems integration in the state of Florida in the water and wastewater industry.

C. The CONTRACTOR, with the Owner's concurrence, shall select the SYSTEMS INTEGRATOR from one of the names listed below or an approved equal:

1. CEC Controls, Inc.: 5306 4th Avenue Circle East, Bradenton, FL 34208; (941) 803-9464; www.ceccontrols.com.
2. Commerce Controls Inc.: 41069 Vincenti Court, Novi, MI, 48375; (248)476-1442; www.commercecontrols.com
3. Curry Controls Company: 4245 S Pipkin Road, Lakeland, FL 33811; (863) 646-5781; www.currycontrols.com
4. Revere Control Systems: 3810 Drane Field Rd Suite 7, Lakeland, FL 33811; (863) 226-0219; www.reverecontrol.com
5. Rocha Controls: 5025 W. Rio Vista Ave., Tampa, FL, 33634; (813) 628-5584; www.rochacontrols.com.

1.05 SHOP DRAWING SUBMITTALS

A. The shop drawing submittals shall provide detailed information specific to the project requirements as outlined below:

B. Catalog cuts and Component Data Sheets shall be provided for each individual component, device, system or subsystem supplied as a component of this project. Catalog cuts shall include catalog information, descriptive literature, application information, operating ranges and accuracy statements, wiring diagrams, power sources, options and accessories. All applicable options or accessories shall be marked with dark arrows so that the exact model, configuration and accessories are clearly delineated.

C. Each catalog cut shall be accompanied with an appropriate component data sheet as a cover which shall summarize the job-specific data which describes each component supplied with specific data including manufacturer, model number, scale, range, set-points, options included, materials of construction, mounting hardware, power requirements and accessories. Each catalog cut section will be separated by tabs or color sheets to easily distinguish section separation.

D. A Bill of Materials shall be provided that shall list all the instruments, equipment, panels and devices supplied in this project, grouped by remote location designations, and identified by code numbers consistently and systematically. The tabulation shall include as a minimum the instrument name and model, the code number, a description, options and accessories provided and the quantities.

E. Panel drawings shall be provided for each enclosure, control panel, or system schematic provided. Drawings shall be clearly legible and shall include front panel elevation and layout of the internal panel components, drawn to scale. Panel drawings shall be fully detailed showing hinges, doors, latches, subpanels, component cut-outs, panel face mounted devices, nameplates and service legends.

F. Complete control diagrams shall be provided, in ladder and loop schematic form, showing all wiring details including all devices, electrical connections, wire numbering, terminal strip location and numbering, wire color code and termination designations at each device.

G. The loop diagrams shall meet the minimum requirements of ISA S5.4. The physical location of each component, in every loop, shall be clearly designated, both in the panel and in the field.

H. Field Wiring Diagrams shall be provided, showing all wiring interconnections between equipment, panels, junction boxes and field mounted devices. The diagram shall identify each cable and conductor by size and type (i.e. gauge, THHN, twisted, shielded, coaxial, etc.), as well as color code and numbering. Termination details shall be included at the panel, at the field device termination point and at any intermediate connections required.

I. Installation Details shall be provided for each field mounted device which shall include mounting details, piping, tubing, wiring connections, pilot tube routing, materials and accessories, sunshields and other necessary details required for proper equipment installation.

J. All documentation shall be provided in an 11" x 17" format hardcopy and pdf.

1.06 DOCUMENTATION

A. The SYSTEM INTEGRATOR shall provide full documentation for all hardware, instrumentation and equipment including complete manuals for installation, operation, calibration and troubleshooting. All documentation shall be neatly organized, readable and complete.

B. Complete hardware installation, operation, maintenance and troubleshooting manuals shall be provided. Three sets will be required.

C. At the completion of the project, the SYSTEM INTEGRATOR shall provide complete as-built drawings describing all instrumentation systems and all instrumentation-related wiring interface details accurately and completely. Wiring diagrams shall include complete and detailed as-built wiring diagrams for all locations. These shall include all components as described under SHOP DRAWING SUBMITTALS above but shall be corrected to include all information reflected by AS-BUILT conditions.

D. Submitted documentation will be reviewed against as-built conditions and final acceptance will not be issued until all discrepancies are corrected. All final documentation shall be an accurate depiction of the final implementation.

E. All final Record documentation shall be grouped and provided in bound hardcopy O&M sets. Each bound set shall include a writable portable pen drive containing all Record documentation in electronic format. Acceptable electronic formats are Microsoft DOC for original document, AutoCAD DWG for and drawing files and Adobe PDF for document print versions. AutoCAD documents shall include all files, title blocks, symbols, libraries etc. needed to recreate and/or modify the original document.

F. Three (3) complete sets will be required.

1.07 SYSTEM SCHEMATICS IN THE CONTRACT DRAWINGS

A. In some cases, schematics have been included in the contract drawings to clarify the intended control function and to explain typical interactions of system components. These schematics provide recommended details for various aspects of the system design. They do not purport to include all of the details and components of the total system design.

B. It shall be the responsibility of the SYSTEM INTEGRATOR to ensure that the final installation is in compliance with the design and the functions described herein.

PART 2 PRODUCTS

2.01 GENERAL

A. These specifications are intended to give a general description of what is required but do not cover details of construction which may vary in accordance with the exact requirements of the equipment offered. Installations shall include all necessary parts, equipment, sockets, modules, connectors, and other components, required to form a complete and fully functional system.

B. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. Where possible the system shall contain products of a single manufacturer and consist of equipment models which are currently in production. Equipment provided shall be of modular construction.

C. Materials used in the system 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.

2.02 ENCLOSURES

A. Refer to other sections of these specifications for detailed equipment descriptions and models.

B. All new control panels shall be manufactured according to the standards of Underwriters Laboratory and shall be given the UL 508A Industrial Control Panels label indicating that the complete panel, including all components, is certified for UL compliance as manufactured as a complete control assembly. UL labels shall be certified and installed in panels at the factory. Panels shipped or installed

without UL label, shall be returned to the factory by the SYSTEMS INTEGRATOR for re-certification, at no additional cost to the OWNER.

C. RTU cabinet shall be housed in NEMA 12, steel enclosure. The enclosures shall be continuous hinged with a single door. Cabinets shall include a lock hasp suitable for standard size padlock. Cabinet size and equipment arrangements shall be similar to that shown in the contract drawings.

D. The panel shall include a removable back and side panels on which control components shall be mounted. Back and side panels shall be secured to the enclosures with collar studs and be carbon steel with a white powder epoxy coating.

E. Print storage pockets shall be provided on the inside of each panel. Pockets shall be of sufficient size to hold all the prints required to describe the equipment. Complete and accurate schematics shall be provided in every cabinet. Schematics shall be laminated and provided in 11" x 17" format.

F. All work shall be performed in a professional manner and in consideration of allowing ease of future troubleshooting and maintenance. All equipment should be mounted so as to minimize crowding within the panel. All devices shall be mounted and wired in a neat and workmanlike manner. Each component shall be prominently identified with the use of permanent engraved legend plates.

G. Construction:

1. All components shall be of the highest industrial quality and securely mounted to the removable back panels with screw and lock washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.
2. Panels shall be provided with circuit breakers to supply individual power feeds to each device. Panels shall include a duplex convenience GFCI receptacle. The panel door shall have an adjustable hinge lock for holding the open door in a selected position. Panels shall be provided with a fluorescent light and switch.

H. Wiring:

1. All interconnecting wiring shall be stranded conductors, sized appropriately for the amp load, 600 volt insulation and rated for not less than 90 degree C.
2. Power distribution wiring on the line side of fuses shall be 14 AWG minimum. Control wiring on the secondary side of fuses shall be 16 AWG minimum. Analog circuits shall utilize 16 AWG shielded, twisted pair cables, insulated for not less than 600 volts. There will be 480VAC conductors routed through the control panel to the DFS system.
3. Power and low voltage dc wiring systems shall be routed in separate wireways. Crossing of different system wires shall be at right angles. Different system wires routed parallel to each other shall be separated by at least 2 inches. Different wiring systems shall terminate on separate terminal blocks. Wiring troughs shall not be filled to more than 60 percent visible fill.

4. Terminal blocks shall be barrier type with the appropriate voltage rating (600 volts minimum). They shall be raised channel mounted type.
5. All wiring shall include unique identification. Wire and type markers shall be the sleeve type with heat impressed letters and numbers. Direct wiring between field equipment and panel equipment will not be allowed.
6. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within 6-inches of the side panel or adjacent terminal.
7. All wiring connected to live circuits independent of the panel's normal circuit breaker protection shall be clearly identified as such.
8. All wiring shall be clearly tagged and color coded. All tagged numbers and color coding shall correspond to the panel wiring diagrams and loop drawings and the overall tagging system. All power wiring, control wiring, grounding, and dc wiring shall utilize different color insulation for each wiring system used. The wiring color code and tagging system shall be submitted and included as a legend on the schematic diagrams. Provide a terminal block schedule describing all terminal point functions.
9. Each control circuit shall be individually protected by circuit breakers. All protecting devices shall be clearly labeled and located for ease of maintenance.
10. Provide surge protection on all incoming power supply lines at each panel. Provide surge protection on instrumentation and control circuits as specified herein or as shown on the drawings.

    a. General: Equip control panels with surge protection devices to protect equipment from damage due to electrical transients induced in interconnecting lines from lightning discharges and nearby electrical devices.
    b. Suppressor Locations:

        1) At point of connection between each equipment item, including AC powered transmitters and its power supply conductors (direct wired equipment).
        2) On analog pairs at each end of the cable when the pair travels outside of a panel
        3) On discrete input signal and power (wetting voltage) cables when the cable extends beyond the panel.
        4) In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to the design of equipment.

11. Grounding: All SPDs shall be grounded per the manufacturer's recommendations. Furnish control panels with an integral copper grounding bus for connection of suppressors and other required instrumentation. Provide single-point connection of all grounds to grounding bus using the shortest possible path. For surge suppressors use No. 8 cable for ground connection or install suppressor directly on ground bus using grounding screw. Each grounded object shall have a separate connection to the ground bus. Do not connect cable shields to suppressor ground terminal or daisy-chain ground connections. Provide 1-inch wide by 1/8-inch thick copper ground bus as a minimum.

I. Equipment Mounting/Arrangement: 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 removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Internal components shall be prominently identified with the use of permanent engraved phenolic legend plates, ¼" (minimum) white letters on black background. Legend plate text shall be submitted for review prior to fabrication.

J. Components:

1. Control Station and Indicators

   a. All operating controls and instruments shall be securely mounted on the front door. All control and instrument devices shall be clearly labeled to indicate function.
   b. Selector Switches and Pilot Lights shall be 30.5 mm, round, NEMA Type 4/4X/13 Corrosion Resistant/Watertight/Oiltight heavy duty industrial type units.
   c. Selector switches shall be 3-position Hand-Off-Remote non-illuminated maintained type with black standard knob. Contact arrangements shall be as required but with a minimum of two contact closures in both the Hand (Open) and Remote (Closed) positions. Operation of equipment in manual mode shall bypass all safety shutdown circuits except motor overload shutdown unless noted otherwise.
   d. Pilot Lights shall be push to test, LED. Lens colors shall be Red for Stopped, Green for Running and Amber for Alarm.
   e. Units shall be Allen Bradley 800H series or approved equal.

2. Control / Interposing Relays

   a. Control Relays shall be plug-in general-purpose type with DIN rail mounted sockets. Units shall, as a minimum have 10 Amp, 120 VAC 4PDT contacts, push-to-test button and status indicator. Relay coils shall be a 120/240 VAC, 12 VDC or 24 VDC as required.
   b. Units shall be IDEC, Square-D, Allen Bradley or approved equal.

3. Circuit Breakers

   a. Circuit Breakers shall be provided on the main power feed to the enclosure and as required to provide isolation for all component group power feeds. Units shall be rated as recommended by the equipment manufacturer for maximum equipment protection.
   b. Component Circuit Breakers shall be rated for 120 VAC, 10,000 ampere interrupting capability and UL approved. Units shall be thermal magnetic type with DIN rail mounting.
   c. Unit shall be Allen Bradley 1492 Series, General Electric V-Line Series or approved equal.

4. Terminal Blocks

a. Terminal blocks shall be used for all external wiring connections and for internal voltage bus connections. Blocks shall be screw connection clamp type, DIN rail mounted units, sized appropriately for the application and held in place with end stops. Terminals shall be labeled on both sides of the block and the strip shall be labeled on the end stop. Jumpers between blocks shall be pin connector type without loss of space on terminals or rails.

b. General purpose units shall be rated for 600 VAC at 30 amps and capable of accepting up to a 10 AWG wire. Ground blocks shall have a green/yellow body and be electrically grounded to the mounting rail. The block shall accept up to a 10 AWG wire.

c. Units shall be Allen Bradley 1492-W4 series, Weidmueller WDU-4 series or equal.

J. Nameplates: All external components and the enclosure shall be supplied with permanent engraved legend plates. Nameplates shall be made of 1/16-inch thick machine engraved black background phenolic which reveals white lettering when engraved. Engraved text shall be 3/16-inch high for component legends, ½-inch high for the enclosure legend. Legend plates shall be securely fastened in place using stainless steel screws. Legend plate text shall be submitted to the Engineer for review prior to fabrication.

2.03 SURGE PROTECTION DEVICES (SPD) – POWER, CONTROL AND ANALOG SIGNAL

A. All electronic systems, equipment and devices provided in this contract shall be protected from surges. Protection shall be provided at panel entry points for power as well as analog and discrete signals.

B. SPDs shall be listed/recognized by UL 1449, latest edition, Standard for Safety Surge Protective Devices.

C. Analog instruments such as pressure transmitters, flow meters, etc. shall be protected from power spikes and surges at both the instrument and at the final termination point.

D. Field mounted 4-20 ma two-wire transmitters shall be equipped with field mounted signal transient protectors. Field mounted four-wire transmitters shall be equipped with appropriately rated transient protectors on both power and signal side.

E. These protective devices shall be external to and installed in addition to any protective devices built into the equipment. Power and signal protection shall be installed in either a NEMA 4X enclosure or in the enclosure that houses the equipment to be protected.

F. All surge protection devices shall be mounted and wired per the manufacturer's recommendations including local grounding for surge energy dissipation.

G. Surge protection devices for 120 VAC Power Connections shall be Phoenix Contact PTL-SEC-T3-120, DEHN 952210 (DG M TN 150) or approved equal

H. Surge protection devices for panel mounted 120 VAC control circuits shall be IDEC RH2-ULCAC110 or approved equal interposing relays.

I. Surge protection devices for panel mounted DC voltage or analog signal circuits shall be Phoenix Contact SURGETRAB, S-PT-EX-24VDC (2800035), DEHN 929 921(DPI ME 24 N A2G),or approved equal.

J. Surge protection devices for field mounted two-wire transmitters shall be Phoenix Contact SURGETRAB, S-PT-EX-24VDC (2800035), DEHN 929 921(DPI ME 24 N A2G), or approved equal

K. Surge protection devices for field mounted four-wire transmitters shall be equal to Phoenix Contact BoxTrab, BXT-N4X 4-Wire (5603514), DEHN 999 990 (DEHNslac) or approved equal

L. Provide surge protection devices for all PLC panel analog inputs, analog outputs, and discrete inputs that leaves the PLC panel.

PART 3 EXECUTION

3.01 INSTALLATION

A. The SYSTEM INTEGRATOR shall provide all labor, materials, equipment, and expertise required to carry out the installation, calibration, testing and start-up of all equipment in a manner in keeping with the best standard practices available and in accordance with the manufacturer's recommendations for each piece of equipment supplied.

B. All work shall be scheduled, in advance, with the Engineer and the Owner to minimize down time of any system. Detailed plans and sequencing shall be included in the construction schedule submitted by the CONTRACTOR.

C. Careful attention must be paid to provide installations at each location which are both functional and esthetically acceptable.

D. All conduits used in conjunction with control panels or instrumentation of any kind shall be sealed using a suitable duct-sealing compound to minimize the possible damage caused by vapors or moisture. It shall be the responsibility of the SYSTEM INTEGRATOR to verify that this is accomplished early in the project, so that corrosion damage does not occur during the time of construction.

E. The CONTRACTOR/SYSTEM INTEGRATOR shall provide the ENGINEER a weekly written report detailing construction progress. This report shall include specific tabulations of equipment on which construction/installation has been completed.

F. Equipment shall be located so that it is accessible for operation and maintenance. The CONTRACTOR/SYSTEMS INTEGRATOR shall examine the Contract Drawings and Shop Drawings for various items of equipment to determine the best arrangement for the work as a whole and shall supervise the installation of all equipment.

G. All equipment shall be installed in accordance with the manufacturer's instructions.

The locations of equipment 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 equipment and, in case of any interference with other work, proceed as directed by the ENGINEER and furnish all labor and materials necessary to complete the work in an approved manner.

H. Two complete sets of approved shop drawings shall be kept at the job site during all on site construction. Both sets shall be identically marked up to reflect any modifications made during field installation or start up. All markings shall be verified and initialed by the Engineer or his designated representative. Following completion of installation and the operational readiness testing, one set of the marked up drawings shall be provided to the Engineer, the other retained by the CONTRACTOR/SYSTEM INTEGRATOR for incorporation of the markups into the final as-built documentation.

I. All work shall be in strict accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the CONTRACTOR/SYSTEM INTEGRATOR shall bear full responsibility for such violations and assume all costs arising there from.

J. The CONTRACTOR/SYSTEM INTEGRATOR shall take steps to keep electrical and control enclosures clean and free of contaminants throughout installation. Under no circumstances are electrical and control enclosures to be cleaned using compressed air to blow out dust, which could cause contaminants to be forced into sensitive electronics.

K. Provisions shall be made to completely capture filings (metal, etc.) when drilling into enclosures to prevent contamination of electrical equipment.

L. Upon completion of construction/installation work, the CONTRACTOR/SYSTEM INTEGRATOR shall thoroughly clean all soiled surfaces of installed equipment and materials and remove all surplus materials, rubbish and debris that has accumulated during the construction work. The entire area shall be left neat, clean and acceptable to the Owner.

3.02 WIRING AND GROUNDING

A. The following wiring practice guidelines shall be used in order to minimize ground loops, minimize the effects of electromagnetic interference/radio frequency interference (EMI/RFI) and to provide maximum practical immunity from damage resulting from lightning-induced transients.

B. Common wires or conductors shall not be utilized (either within panels or external to panels, or for grounding of field devices) for signal shielding, signal grounding, or safety grounds.

C. Exposed wire lengths extending from within shielded signal cables shall be minimized to reduce pick-up of EMI/RFI by signal circuits. Exposed lengths of less than one inch is preferred with a maximum exposed length of two inches only permitted where necessary. No splicing of signal wires shall be permitted.

D. All signal wiring shall be shielded, both within panels and external to panels. Unless otherwise specified, all signal wiring shall be No. 16 AWG stranded tinned two-conductor twisted pair with 100 percent coverage of aluminized Mylar or aluminized polyester shield and tinned copper drain wire.

E. The shield on each process instrumentation cable shall be continuous from source to destination and grounded at one end only. In general, grounding of signal cable shields shall be done at the control panel end. No signal cable shall share a common cable shield grounding wire with any other signal cable or other circuit. The exposed length of cable shield grounding wires shall not exceed two inches prior to termination with less than one-inch maximum length preferred.

F. All outdoor instruments and all outdoor enclosures shall be grounded using the practice defined in Section 800.40 of the National Electric Code.

3.03 WARRANTY

A. The CONTRACTOR/SYSTEM INTEGRATOR shall guarantee the material and/or workmanship of all installed equipment and systems for a period of (12) twelve months from the date of final acceptance of the complete system by the Owner.

B. During this warranty period, the CONTRACTOR/SYSTEM INTEGRATOR shall provide, at no additional cost to the Owner, the services of a trained, competent field service engineer who shall arrive on site within 36 hours of notification by the Engineer or Owner to repair and/or replace any faulty device or equipment supplied by the system supplier as part of this contract. All preventive and corrective activities shall be documented with service reports, which shall identify the equipment being serviced, state the condition of the equipment, describe all work performed, and list materials used. A copy of all service reports shall be delivered to the Engineer and Owner on or before the next business day.

END OF SECTION

INSTRUMENTATION AND CONTROL SYSTEM INSTRUMENT SCHEDULE
MANATEE COUNTY FLORIDA

LS-1M, LS-12A & LS-13A PROJECTS (Similar for all)

TAG	SPECIFICATION	DESCRIPTION	SERVICE	RANGE/SET POINT	SUPPLIER	NOTES
FE/FIT-203l4	N/A EXIST	Magnetic Flow Tube / Transmitter	Lift Station Flow	0-2500 GPM	Exist	
PIT-203L1	N/A EXIST	Pressure Transmitter	Lift Station Line Pressure	0-100 PSI	Exist	Loop Powered
LIT-203C1	N/A EXIST	Level Transmitter	Wet Well	0-23.1 FT	Exist	
LT-203L2	N/A EXIST	Level Transmitter	Deisel Fuel Tank	0-1000 Gallons	Exist	
LSL-203A5	N/A EXIST	Non-Mercury Float Level Switch	Wetwell Low Level		Exist	Hard Intlk
LSH-203A10	N/A EXIST	Non-Mercury Float Level Switch	Wetwell High Level		Exist	
LSH-203J7	N/A EXIST	Non-Mercury Float Level Switch	Dry Well High Level		Exist	
OS-203A11	N/A EXIST	Rain Gauge Pulse Switch	Rain		Exist	
OA-203B5	Electrical DWG	Alarm Beacon	Pump Control Panel Alarm Light		NEW	
ES/S--203B7	16410	Shunt contact	Shunt tripped power lost indication		NEW	
ES/U--203B7	13100/2.02.J.2	Relay contact	UPS power lost indication		NEW	

INSTRUMENTATION AND CONTROL SYSTEM PLC INPUT/OUTPUT SCHEDULE
Manatee County

LS-1M, LS-12A & LS-13A REHABILITATION PROJECTS (Similar For All)

TAG	DESCRIPTION	TYPE	INACTIVE	ACTIVE	UNITS	LOCATION	NOTES
LI_203C1	Wet Well Level	AI	0	23.1	FT	RTU	
FI_203I4	Lift Station Flow	AI	0	2500	GPM	RTU	120V power existing
PI_203L1	Lift Station Pressure	AI	0	100	PSI	RTU	Loop powered
LI_203L2	Fuel Tank Level	AI	0	1000	GAL	RTU	Loop powered
SI_203I1	Pump No. 1 VFD Speed Reference	AI	0	1180	RPM	RTU	
SI_203I2	Pump No. 2 VFD Speed Reference	AI	0	1180	RPM	RTU	
SI_203I3	Pump No. 3 VFD Speed Reference	AI	0	1180	RPM	RTU	
EI_203C3	Voltage AB 480VAC	AI	0	600	VAC	RTU	
EI_203C4	Voltage AC 480VAC	AI	0	600	VAC	RTU	
SC_203H1	Pump No. 1 VFD Speed	AO	0	100	%	RTU	
SC_203H2	Pump No. 2 VFD Speed	AO	0	100	%	RTU	
SC_203H3	Pump No. 3 VFD Speed	AO	0	100	%	RTU	
OI_203J8	Sump Pump Running	DI	OFF	ON		RTU	ON WHEN SUMP RUNS
LAH_203J7	Dry Well High Level Float	DI	OFF	HIGH		RTU	
OI_203A12	Pump Control Panel Alarm Silence	DI	OFF	SILENCED		RTU	Not Used - no station audible indication
OI_203A1	Pump No. 1 Run Indication	DI	STOPPED	RUNNING		RTU	
OI_203A2	Pump No. 2 Run Indication	DI	STOPPED	RUNNING		RTU	
OI_203A3	Pump No. 3 Run Indication	DI	STOPPED	RUNNING		RTU	
OA_203J4	Pump No. 1 VFD Fault	DI	FAULT	OKAY		RTU	
OA_203J5	Pump No. 2 VFD Fault	DI	FAULT	OKAY		RTU	
OA_203J6	Pump No. 3 VFD Fault	DI	FAULT	OKAY		RTU	
HI_203J1	Pump No. 1 In Remote Indication	DI	NOT IN REMOTE	IN REMOTE		RTU	
HI_203J2	Pump No. 2 In Remote Indication	DI	NOT IN REMOTE	IN REMOTE		RTU	
HI_203J3	Pump No. 3 In Remote Indication	DI	NOT IN REMOTE	IN REMOTE		RTU	
OI_203A6	Generator Run Indication	DI	STOPPED	RUNNING		RTU	
OA_203A7	Generator Failure	DI	NORMAL	FAULT		RTU	
OI_203A8	Dimminuter Status	DI	OFF	RUNNING		RTU	
OA_203A9	Dimminuter Failure	DI	NORMAL	FAULT		RTU	
LAL_203A5	Low Level Float Wet Well	DI	ALARM	NORMAL		RTU	
LAH_203A10	High Level Float Wet Well	DI	NORMAL	ALARM		RTU	
OI_203A11	Rain Gauge	DI	OFF	PULSE		RTU	
OI_203A4	Phase Monitor BYPASS	DI	OFF	ON		RTU	does not appear to be in use
EA_203B7	Shunt Trip Main Breaker Activated/UPS Not in service	DI	ALARM	NORMAL		RTU	
OC_203B1	Pump No. 1 Call to Start/Run	DO	OFF	RUN		RTU	Interposing Relay CR-B1
OC_203B2	Pump No. 2 Call to Start/Run	DO	OFF	RUN		RTU	Interposing Relay CR-B2
OC_203B3	Pump No. 3 Call to Start/Run	DO	OFF	RUN		RTU	Interposing Relay CR-B3
OC_203B5	Alarm Light	DO	OFF	ACTIVE		RTU	

DIVISION 15 MECHANICAL

SECTION 15051 PIPE AND PIPE FITTINGS - GENERAL STATEMENT

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. General:

1. Furnish all labor, materials, tools, equipment, and services for all pipe and pipe fittings as indicated in accordance with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.
4. See Division 1 for General Requirements.

B. Related specification sections include but are not limited:

1. 02615 – Ductile Iron Pipe and Fittings
2. 02617 – Installation and Testing of Pressure Pipe

1.02 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. Verify on shop drawings, dimensions, schedule of pipe, linings, coatings, fittings, hangers, supports, and miscellaneous appurtenances. When special fittings are necessary, verify locations of items and include complete details.

C. Yard piping drawings. Submit scaled drawings showing locations and dimensions to and from fittings, valves, structures, gates, and related appurtenances. Provide scaled drawings to a minimum scale of 1/8-inch equals 1-foot. Provide details to minimum scale of 1/8-inch equals 1-foot. Information shall include but not necessarily be limited to:

1. Dimensions of piping lengths
2. Invert or centerline elevations of piping crossings
3. Acknowledgment of bury depth requirements
4. Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
5. Line slopes and vents

D. Building piping diagrams. Submit sealed drawings showing locations and dimensions of all piping inside structures. Show all pipeline-mounted devices, connections to equipment, hangers and supports, anchors, and related appurtenances. Information shall include but not be limited to the following:

1. Dimensions of piping and end connections
2. Invert of centerline dimensions
3. Location and type of pipe supports and anchors
4. Locations of valves and valve operator type
5. Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.
6. Acknowledge valve and equipment tag numbers and instrument tag numbers.
7. Show provisions for expansion and contraction
8. Show line slopes and air release vents

E. Include on fabrication drawings location of jointed sections to permit maintenance of connected equipment and to permit removal of connected equipment without disturbance of main piping system.

F. Provide copies of any manufacturer's written directions regarding material handling, delivery, storage and installation.

G. As work progresses and again when work is complete, submit "As-Builts" of piping systems in project including project items and pre-existing items. Identify complete location, elevations, description of piping systems. Relate piping systems to identified structures and appurtenances. Submit four (4) copies.

H. Submit written verification of required pressure testing.

1.03 WARRANTY

A. Per General Condition Article 9, the Contractor shall provide a 3-year warranty from substantial completion.

PART 2 PRODUCTS

2.01 GENERAL PIPING SYSTEMS

A. Unless otherwise shown on drawings or drawing schedule, piping system materials, fittings, and appurtenances are subject to requirements of specific technical specifications and shall be as follows:

Service Category	Pipe Size Range in Inches	Piping System
RS –Raw Sewage	PIPE	
	4 to 48	Above ground – AWWA C115 and C151 Class 53 ductile iron pipe, Tnemec 431 Perma-Shield PL or Permox CTF lining, flanged joints
IR – Internal Recycle (Mixed Liquor)	4 to 12	Below ground – AWWA C150 and C151 ductile iron pipe, push-on joints, Tnemec 431 Perma-Shield PL or Permox CTF lining, 350 psi pressure class
	14 to 20	Below ground – AWWA C150 and C151 ductile iron pipe, Tnemec 431 Perma-Shield PL or

		Permox CTF lining, push-on joints, 250 psi pressure class.
PDFM – Plant Drain Force Main	24	Below ground – AWWA C150 and C151 ductile iron pipe, Tnemec 431 Perma-Shield PL or Permox CTF lining, push-on joints, 200 psi pressure class.
	30 to 54	Below ground – AWWA C150 and C151 ductile iron pipe, Tnemec 431 Perma-Shield PL or Permox CTF lining, push-on joints, 250 psi pressure class.
SN- Supernate	FITTINGS	
	4 to 48	Above ground – AWWA C110 or AWWA C153 compact ductile fittings, Tnemec 431 Perma-Shield PL or Permox CTF lining, flanged joints, 250 psi working pressure
RAS – Return Activated Sludge	54	Above ground – AWWA C110 or AWWA C153 compact ductile fittings, Tnemec 431 Perma-Shield PL or Permox CTF lining, flanged joints, 150 psi working pressure
	4 to 24	Below ground – AWWA C153 compact ductile iron fittings, Protecto Tnemec 431 Perma-Shield PL or Permox CTF lining, mechanical joints, 350 psi working pressure
TS – Thickened Sludge	30 to 42	Below ground – AWWA C110 or AWWA C153 compact ductile iron fittings, Tnemec 431 Perma-Shield PL or Permox CTF lining, mechanical joints, 350 psi working pressure
WAS - Waste Activated Sludge	48 to 54	Below ground – AWWA C110 or AWWA C153 compact ductile iron fittings, Tnemec 431 Perma-Shield PL or Permox CTF lining, mechanical joints, 150 psi working pressure
GR- Grit	PIPE / FITTINGS	
	4	Above ground- AWWA C115 and C151 Class 53 ductile iron pipe, glassed lined, flanged joints with long radius (LR), glassed lined, flanged fittings, 350 psi working pressure
PD – Plant Drain Gravity Sewer	PIPE	
	4 to 12	Below ground – AWWA C150 and C151 ductile iron pipe, 350 psi pressure class, push-on or mechanical joints, Tnemec 431 Perma-Shield PL or Permox CTF lining, flanged joints
D- Drain	14 to 18	Below ground – AWWA C150 and C151 ductile iron pipe, 250 psi pressure class, push-on or mechanical joints, Tnemec 431 Perma-Shield PL or Permox CTF lining, flanged joints
	FITTINGS	
	4 to 18	Below ground – AWWA C153 compact ductile iron fittings, 350 psi working pressure, Tnemec 431 Perma-Shield PL or Permox CTF lining, flanged joints, mechanical joints.

CLE - Clarifier Effluent EFF – Treated Effluent (Reclaimed Water Chlorinated) FW – Filter Water Effluent RCW – Reclaimed Water RJ – Reject SRCW – Stored Reclaimed Water SPW – Storage Pond Water	PIPE / FITTINGS	
	1 to 3	Above ground - SCH 80 PVC solvent weld
	PIPE	
	4 to 48	Above ground – AWWA C115 and C151 Class 53 ductile iron, cement-lined, flanged, AWWA C110 and C111 flanged ductile iron fittings, cement-lined
	4 to 12	Below ground – AWWA C150 and C151 ductile iron pipe, push-on or mechanical joints, cement-lined, 350 psi pressure class
	14 to 20	Below ground – AWWA C150 and C151 ductile iron pipe, cement-lined, push-on joints, 250 psi pressure class
	24	Below ground-AWWA C150 & C151 DIP cement-lined, push-on joints, 200 psi pressure class
	FITTINGS	
	4 to 24	Above ground – AWWA C110 or AWWA C153 compact ductile fittings, cement-lined, flanged joints, 250 psi working pressure
	4 to 24	Below ground – AWWA C153 compact ductile iron fittings, mechanical joints, 350 psi working pressure, cement-lined
	30 to 54	Below ground – AWWA C150 and C151 ductile iron pipe, cement-lined, push-on joints, 150 psi pressure class, AWWA C110 and C111 ductile iron fittings, mechanical joint, 250 psi working pressure, cement-lined
NaOCl (Sodium Hypochlorite - 12.5%)	PIPE / FITTINGS	
	½ to 3	Above ground – Schedule 80 PVC, threaded or solvent weld.
	½ - 3	Below ground – Schedule 80 PVC carrier pipe, Schedule 40 PVC containment pipe, threaded or solvent weld.
$(NH_4)_2SO_4$ (Liquid Ammonium Sulfate – 39%)	PIPE / FITTINGS	
	½ to 3	Above ground – Schedule 80 PVC, threaded or solvent weld.
	½ to 3	Below ground – ½" i.d. ChemFluor 367 tubing for carrier pipe, Schedule 40 PVC containment pipe, threaded or solvent weld.

EFF – Treated PW – Potable Water	PIPE / FITTINGS	
	½ to 3	Above ground – Schedule 80 PVC, Type K copper.
	½ to 3	Below ground – AWWA C901 HDPE tubing, DR-9, 200 psi working pressure.

PART 3 EXECUTION

3.01 DELIVERY, INSPECTION AND STORAGE

A. Inspect materials thoroughly upon arrival. Remove damaged or rejected materials from site.

B. Observe manufacturer's directions for delivery and storage of materials and accessories.

C. Store materials on-site in enclosures or under protective coverings above ground to keep them clean and dry.

3.02 HANDLING OF PIPE

A. Protect pipe coating during handling using methods recommended by manufacturer. Use of bare cables, chains, hooks, metal bars, or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

C. Erect piping to accurate lines and grades and support as required on drawings or described in specifications. When temporary supports are used, ensure that sufficient rigidity is provided to prevent shifting or distortion of pipe. Install expansion devices, as necessary, to allow expansion and contraction movements.

3.03 PIPING - GENERAL

A. Minimum bury. Unless otherwise shown on the drawings, provide a minimum of 36-inches earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions.

3.04 PIPING WITHIN BUILDINGS, STRUCTURES AND UNITS

A. Install piping in vertical and horizontal alignment as shown on drawings. Alignment of piping smaller than 4-inches may not be shown. However, install according to drawing intent and with ample clearance and allowance for:

1. Expansion and contraction
2. Operation and access to equipment, doors, windows, hoists, moving equipment

3. Headroom and walking space for working areas and aisles
4. Install vertical piping plumb and horizontal piping runs parallel with structure walls

B. Use methods of piping support as shown on the drawings. Where pipes run parallel and as same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.

C. Locate and size sleeves required for piping system. Arrange for chases, recesses, inserts, or anchors at proper elevation and location.

D. Install service piping to provide every plumbing fixture and equipment requiring potable water with suitable supply and soil or waste and vent connection as required by code. Consult manufacturer's data and large-scale details of rooms containing plumbing fixtures before roughing in piping. Plug or cap piping immediately after installation.

E. Use reducing fittings throughout piping systems. Bushings will not be allowed unless on PVC piping systems or specifically approved.

F. Provide drain pans and piping from items of equipment where condensation may occur. Run drain piping to nearest floor drain or rainwater downspout. Condensate drain piping shall generally be 1-inch except where otherwise indicated.

G. Soil, waste, vent and rainwater piping installation:

1. Install horizontal soil or waste lines with fall to produce flow rate of 2-feet per second or 1/8-inch per foot. Hold as close to construction as possible to maintain maximum headroom. Make changes of direction with 1/8 bends, and junctions with wye fittings. Use short wye fittings in vertical pipe only. Install handhold test tee at base of each stack. Install cleanouts at dead ends, at changes of direction, and at 50-foot intervals on horizontal runs. Where cleanouts occur in concealed spaces, provide with extensions to floors above or to wall as required.
2. Run vent stack parallel to each soil or waste stack to receive branch vents from fixtures. Each vent stack shall originate from soil or waste pipe at its base. Where possible, combine soil, waste, or vent stacks before passing through roof so as to minimize roof openings. Offset pipes running close to exterior walls away from such walls before passing through roof to permit proper flashing. Provide pipes passing through roofs with cast iron increases minimum of 12-inches below roof one size larger than pipe but in no case less than 4-inches. Terminate each vent with approved frostproof jacket.
3. Provide each vent pipe passing through roof with 4-lb sheet lead flashing consisting of 18 x 18-inch base with tubular vertical sleeve surrounding pipe with 1-inch minimum spacing and turning in 2-inches at top. Provide gasket seal between top and lead sleeve.

4. Carry vent stacks 4-inches and larger full size through roof. Extend vent stacks at least 12-inches above roofing.
5. Provide each roof drain with 4-lb sheet lead flashing 36 x 36-inch square clamped under flashing ring of drain.

H. Potable or service water piping installation:

1. Install drain tees with capped nipples of PIS brass 3-inches long at low points. If low points occur in concealed piping, provide approved flush access panel. These drains are not shown on drawings.
2. Slope water lines down to drain points not less than 1-inch in 60-feet.
3. Wherever threaded piping is installed, provide clean-cut tapered threads with ends thoroughly reamed after cutting to remove burrs. Pipe joint cement permitted only on external threads. For screwed nipples for connections to flush valves, lavatory supplies, and other equipment with threaded connections use iron, copper, or brass pipe.
4. Install ball, butterfly, gate, check, and plug valves where indicated or required to adequately service all parts of system and equipment. Unless otherwise indicated, install valves on each branch serving restroom. Install valve on inlet and outlet connections of heat exchangers and on other equipment connected to water lines.
5. Install union between valves and connections to each piece of equipment and install sufficient number of unions throughout piping system to facilitate installation and servicing. On copper pipe line, install wrought copper solder-joint copper to copper unions for lines 2-inches and smaller; for lines 2-1/2-inches and over, install brass flange unions.
6. Construct and equip plumbing fixtures and equipment with anti-siphon devices as to entirely eliminate any danger of siphoning waste material into potable water supply system.
7. Where exposed pipes 6-inches in size and smaller pass through floors, finished walls, or finished ceilings, fit with nickel or chrome-plated plates large enough to close hole completely around pipes. Secure plates to pipe by set screw in approved manner.
8. Size supply branches to individual fixtures as scheduled or indicated on drawings.
9. Install piping so as to be free to expand with proper loops, anchors, and joints with injury to system or structure.
10. Provide branches to wall hydrants or hose bibbs in exterior location with interior shutoff and drain valves.
11. Provide approved type vacuum breaker installations indicated or as required by Code.

3.05 PIPING OUTSIDE BUILDINGS AND STRUCTURES

A. Install piping as shown on drawings with ample clearance and allowance for expansion or contraction.

B. Install flexible joint within two (2) feet of point where pipe enters or leaves structure. Provide balance of piping with standard laying lengths and in accordance with drawings.

3.06 PIPE INTERSECTIONS WITH STRUCTURES AND UNITS

A. Enter and exit through structure walls by using wall seals specified or as shown on drawings.

3.07 EQUIPMENT PIPE CONNECTIONS

A. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.

B. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint. Provide tightening torque in accordance with manufacturer's recommendations.

C. Support and match flange face to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.

D. Permit piping connecting to equipment to move freely in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened. Align, level, and wedge equipment into place during fitting and alignment of connecting piping. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange. Realign as necessary, install flange bolts, and make equipment connection.

E. Provide utility connections to equipment shown on drawings, scheduled or specified.

F. Obtain rough-in data from approved shop drawings on equipment. Obtain rough-in data for relocating existing equipment and coordinate with Owner.

G. Unless otherwise specified, make piping connections to equipment, including but not limited to installation of brass and fittings, strainers, pressure-reducing valves, flow control valves, and relief valves provided with or as an integral part of equipment.

H. Furnish and install sinks, brass, fittings, strainers, pressure-reducing valves, flow control valves, pressure relief valves, and shock absorbers which are not specified to be provided with or an integral part of equipment.

I. For each potable or service water supply piping connection to equipment, furnish and install union and gate or angle valve. Minimum size to be 1/2-inch.

J. Furnish and install "P" trap for each waste piping connection to equipment if waste is connected directly to building sewer system. Size trap as required by Plumbing Code.

K. Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P" traps, miscellaneous traps, and miscellaneous brass through wall or floor and cap and protect until such time when later installation is performed. Run piping mains and branches in laboratory benches, built-in counters, and cabinet work if acceptable to Construction Manager.

3.08 ANCHORAGE AND BLOCKING

A. Block, anchor, or harness exposed piping subjected to internal pressure, in which mechanical, push-on, flexible, or similar joints are installed to prevent separation of joints.

B. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by internal pressure in buried piping tees, wye branches, plugs, or bends.

C. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall. Concrete blocks shall not cover pipe joints. Provide bearing area of concrete in accordance with drawing detail. In event that adequate support cannot be achieved against undisturbed soil, install restrained piping joints.

D. Provide reaction blocking, anchorages, or other supports for fittings as shown on drawings for piping installed in fills, unstable ground, above grade, or exposed within structures.

3.09 CLEANING

A. Clean interior of piping systems thoroughly before installing. Maintain pipe in clean condition during installation.

B. Before jointing pipe, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.

C. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.

D. At completion of work and prior to final acceptance, thoroughly clean work installed under these specifications. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing or from other causes. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.

3.10 PIGGING, FLUSHING AND CLEANING

A. All mains and distribution lines shall be pigged, cleaned and flushed to remove all sand and other foreign matter. The Contractor shall be responsible for developing a pigging and flushing plan to be submitted to the Engineer for

approval prior to pigging and flushing. The contractor shall dispose of all water used for pigging and flushing without causing a nuisance or property damage. Any permits required for the disposal of flushing water shall be the responsibility of the Contractor.

B. Flushing water used by the Contractor shall be taken from an approved metered source. The water utility will provide the meter and designate the source. Flushing water shall be at the Contractor's expense. Flushing water shall be potable water for potable water mains. RCW mains may be flushed with potable or reclaimed water.

C. The cleaning of the new piping system shall be accomplished by the controlled and pressurized passage of a series of hydraulic or pneumatic polyurethane plugs of varying dimensions, coatings, and densities; which shall be selected by the pipe cleaning Contractor. The Contractor shall provide a means to enter the pig into the system, control and regulate flow, monitor flows and pressures, and to remove the pig from the system. The contractor shall maintain a constant surveillance of the system and immediately report to the proper authority any inline problems encountered or any malfunctions discovered in the piping system. A record of pig models, sizes, styles, and other pertinent information shall be kept by the Contractor and turned over to the Owner.

3.11 TESTING AND INSPECTION

A. Upon completion of piping, but prior to application of insulation on exposed piping, test all piping systems. Utilize pressures, media and pressure test duration as specified on piping specification sheets and in conformance with Section 02617. Isolate equipment which may be damaged by the specified pressure test conditions. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates. Select each gage so that the specified test pressure falls within the upper half of the gage's range. Notify the Engineer 24 hours prior to each test.

B. Unless otherwise specified, completely assemble and test new piping systems prior to connection to existing pipe systems.

C. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.

D. Provide all necessary equipment and perform all work required in connection with the tests and inspections.

E. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

3.12 DISINFECTING POTABLE WATER PIPELINES

A. All as-builts of the subject potable water pipelines must be submitted to the Owner/Engineer prior to starting the bacteriological testing.

B. Prior to being placed in service, all potable water pipe lines shall be chlorinated in accordance with AWWA 651, "Standard Procedure for Disinfecting Water Main".

The procedure shall meet Health Department requirements. The location of the chlorination and sampling points shall be determined by the Engineer. Taps for chlorination and sampling shall be uncovered and backfilled by the Contractor as required.

C. The general procedure for chlorination shall be to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages through a tap at one end while water is being withdrawn at the other end of the line. The chlorine solution shall remain in the pipeline for a minimum of 24 hours.
Water for flushing, filling and disinfecting the new lines will be provided by the owner and must be obtained without contaminating existing pipe lines. Water obtained from existing pipe lines for this purpose shall pass through an approved air gap or backflow prevention device.

D. Following the chlorination period, all treated water shall be flushed from the lines at their extremities and replaced with water from the distribution system. Bacteriological sampling (taken by the Contractor and provided to an approved laboratory by the Contractor) and analysis of the replacement water shall then be made by an approved laboratory or the Health Department in full accordance with the AWWA Manual C651. The line shall not be placed in service until the requirements of the Florida Department of Environmental Protection (FDEP) and County Public Health Department are met. Results of the bacteriological tests together with certified as-builts must be submitted to the Health Department (FDEP) within 30 days of the tests.

E. Special disinfecting procedures when approved by the County may be used where the method outlined above is not practical.

3.13 LOCATION OF BURIED OBSTACLES

A. Furnish exact location of buried utilities encountered and any below grade structures. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants, and related fixed structures. Include such information as location, elevation, coverage, supports, and additional pertinent information which will be required by future contractors for replacement servicing, or adjacent construction around any buried facility.

B. Incorporate information to "As-Built Drawings".

3.14 SPECIAL REQUIREMENTS AND PIPING SPECIALTIES

A. Insulating joints: Provide insulating joints where dissimilar metals are joined together and where specifically indicated on drawings. Type of joint shall be as detailed and in accordance with the following requirements:

1. Insulating flanges: Provide each unit to consist of flat-faced rubber gaskets.
2. Insulating unions: Provide "dielectric" union by Epco or equal.
3. Insulating couplings: When joining larger diameter dissimilar metal pipe, use insulating coupling equal to Rockwell No. 416, Dresser Style 39, or equal. When pipes have different outside diameters, use insulating

reducing couplings equal to Rockwell No. 417, Dresser Style 39-62, or equal.

B. Dirt strainers:

1. Provide Y-type strainers to locations shown on drawings and/or scheduled.
2. Furnish composition bronze strainers rated for 150 psi working pressure at 450·F. Provide a 20-mesh monel screen. Install a threaded bronze plug in the blowoff outlet. Furnish threaded NPT end connections.
3. Subject to compliance with these specifications, furnish Mueller No. 351 strainers or equal.

C. Welding:

1. Have each welding operator affix an assigned symbol to all his welds. Mark each longitudinal joint at the extent of each operator's welding. Mark each circumferential joint, nozzle, or other weld in two places 180·F apart.
2. Use only certified welders meeting procedures and performance outlined in Section 9 of the ASME other codes and requirements per local building and utility requirements.
3. Have all welds conform to highest industrial practice in accordance with ANSI B31.3 and ANSI B31.1 or other codes and requirements per local building and utility requirements.

D. Protective coatings and linings:

1. Where coatings, linings, paint, tests and other items qualified in applications of service are stated, pipe and fittings shall be included in referenced conditions.
2. Where specified, provide coal-tar epoxy linings and coatings in accordance with AWWA C210 to a minimum thickness of 20 mils in not less than two coats.
3. Where specified, provide cement mortar lining in accordance with AWWA C205.
4. Where specified, provide Tnemec 431 Perma-Shield PL or Permox CTF lining.
5. Where specified, galvanize surface in accordance with hot-dip method using any grade of zinc acceptable to ASTM B6.
6. Where specified, field paint pipe in accordance with Section 09900 – Painting and Section 09902 – Painting.
7. Where specified, coat pipe 24-inch in diameter and smaller with extruded polyethylene coating equal to EnCoat.

    a) Where specified, line pipe with a blend of high-density and low density polyethylene powders complying with ASTM D1248 and uniformly fused and bonded to the pipe to a minimum thickness of 40 mils.

E. Underground alarming tape. Provide underground warning tape constructed of heavy gage 0.004-inch polyethylene film to identify all buried utilities except 3-inch and smaller irrigation pipe. Provide 6-inch wide tape as follows:

Film Legend	Film Color
Electric line below	Red
Telephone line below	Orange
Water line below	Blue
Sewer line below	Green
Nonpotable water below	Brown
Reclaimed water below	Purple

F. Install tape directly above each buried utility at a as shown on the Drawings.

END OF SECTION

SECTION 15211 BULKHEADS

PART 1 GENERAL

1.01 SCOPE. THIS SECTION COVERS STAINLESS BULKHEADS.

1.02 GENERAL.

A. The equipment provided under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer unless exceptions are noted by the engineer.

B. Bulkheads shall be supplied with all the necessary parts and accessories indicated on the drawings, specified or otherwise required for a complete, properly operating installation, and shall be the latest standard product of a manufacturer regularly engaged in the production of stop logs.

C. The bulkheads supplied under this section shall be Series 23 Stainless Steel Stop Logs as manufactured by Fontaine Aquanox.

1.03 QUALITY ASSURANCE

A. The manufacturer shall have experience in the production of substantially similar equipment and shall show evidence of satisfactory operation in at least 50 installations. The manufacturer's shop welds, welding procedures and welders shall be qualified and certified in accordance with the requirement of the latest edition of ASME, Section IX.

B. The fully assembled bulkhead shall be shop inspected before shipping.

1.04 SUBMITTALS

A. The manufacturer shall submit, for approval by the purchaser, drawings showing the principal dimensions, general construction and materials used in the gate and lift mechanism.

1.05 PERFORMANCE

A. LEAKAGE. Bulkheads shall be substantially watertight under the design head conditions. Leakage shall not exceed 0.1 gallon per minute of linear foot of seal, for the rated seating head.

B. DESIGN HEAD. For the purpose of these specifications, bulkheads shall be defined as meeting the leakage requirements maximum water level (height of stop logs in channel).

PART 2 MATERIALS AND CONSTRUCTION

2.01 BULKHEADS

A. GENERAL DESIGN. Stop logs shall be constructed entirely of stainless steel. All hardware shall be stainless steel.

B. FRAME. The frame shall be made of stainless steel channels. The frame shall be suitable for mounting on a concrete wall (CW), embedding in a channel (FE), or installation inside an existing channel (EC).

C. LOGS. The logs shall consist of a flat plate reinforced with formed plates or structural members to limit their deflection to 1/360 of the gate's span under the design head. The guide shall be of UHMWPE (ultra high molecular weight polyethylene).

D. SEALS. Seals shall be made of EPDM attached to the logs by means of a UHMWPE retainer guide. The bottom seal is attached to the log with a stainless steel retainer and seal on top of the log immediately underneath.

E. LIFTING DEVICE. When required, a stainless steel lifting device shall be supplied for each log width. The width of the lifting device shall be the same as the log channel. The lifting device shall be equipped with a device to allow releasing of the stop log from the operating floor. This device shall grab the log automatically.

2.02 MATERIALS

PART	MATERIAL
Frame, log, reinforcements bottom seal retainer	Stainless steel ASTM A-276, Type 304L or 316L
Guide	Ultra high molecular weight polyethylene (UHMWPE), ASTM D-4020
Seal	EPDM ASTM D-2000
Fasteners	ASTM F593 and F-594GR1 for type 304 and GR2 for type 316

3.01 EXECUTION

A. INSTALLATION. Stop logs and appurtenances shall be handled and installed in accordance with the manufacturer’s recommendations.

END OF SECTION

SECTION 15830 SUPPLY AND EXHAUST VENTILATION FANS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes all labor, materials, equipment, and incidentals required to install and test all related equipment necessary for two (2) fully operational supply fans and two (2) fully operational exhaust fans as shown on the Drawings and as specified herein.

B. CONTRACTOR shall provide supply and exhaust fans as described in this specification to provide complete functioning ventilation systems for the wet wells at Lift Station 1M and Lift Station 13A.

C. It is the intent of these Specifications that all supply and exhaust fan equipment called for under this Section shall be supplied by a single manufacturer.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 1 – General

B. Section 02050 - Demolition

C. Division 16 – Electrical

1.03 REFERENCES

A. ISO 1940-1973, “Balance Quality Grade Of G2.5”, ISO 1972, IEEE-841

B. ANSI/ASHRAE 51 and ANSI/AMCA 210 test codes

1.04 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. Submittals shall include the following:

1. Fan Catalog Cut-Sheets
2. Fan Installation Instructions
3. Fan Operation and Maintenance Manual

1.05 QUALITY ASSURANCE

A. To ensure quality, conformance, and reliability with regard to the manufacturing and production of the equipment, the manufacturer shall meet all requirements listed hereafter:

B. Manufacturer shall have a minimum of twenty (20) years' experience in the design and supply of supply and exhaust fans used for ventilation.

C. Supply and Exhaust Fans shall be 100% tested as required by the applicable standard. Testing records to be provided at time of equipment supply.

1.06 WARRANTY

A. The intake and supply fan manufacturer shall warrant the units to the Owner in writing against defects in workmanship and material covering parts and labor for a period of three (3) years from date of substantial project completion.

B. In the event a component fails to perform as specified or is proven defective in service during the warranty period, the manufacturer shall provide and install a replacement part without cost to the Owner.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Aerovent Model VP or approved equal

1. Supply Fan – Size 18D6 Direct Driven Hooded Roof Supply Fan rated for 4,300 cfm at 1/2" ESP
2. Exhaust Fan – Size 18D6 Direct Driven Upblast Roof Supply Fan rated for 4,300 cfm at 1/2" ESP

2.02 SUPPLY AND EXHAUST FAN DESIGN

A. GENERAL

1. Direct driven aluminum vane axial ventilation fan.

B. FAN HOUSING

1. Arranged for vertical upblast exhaust construction.
2. Fan housing shall be minimum 0.125" aluminum continuous welded seam construction.
3. Inlet and outlet flanges shall be continuously welded to fan casing constructed of heavy gauge aluminum angle rings.
4. Concentricity of fan casing shall be ensured through use of welding jigs and fixtures.

5. Guide vanes shall be integrally welded with the outer housing providing a substantial weldment.
6. Exhaust fan shall have a welded aluminum stack cap with 316 SS hardware and mechanically fastened gasketing.
7. Supply fan shall have an aluminum fabricated hood with aluminum birdscreen or fan propeller guard. Minimum hood size based on 500fpm supply velocity.
8. Fan curb cap shall be welded 0.125" aluminum with support gussets and 4" overlap on curb.
9. Curb cap dimension to match existing fans.

C. FAN PROPELLER

1. Propeller shall be vane axial style with heavy blade construction.
2. The propeller shall be of sand cast A319 aluminum alloy, solid one-piece construction and dynamically and statically balanced.
3. Secured to motor shaft with taper-lock bushing.
4. Fabricated aluminum shield shall be installed behind propeller hub to direct airflow around motor.
5. The propeller assembly shall be statically and dynamically balanced in accordance with ISO 1940-1973, "Balance Quality Grade of G2.5". In addition, the fan assembly shall be balanced after final assembly, in the fan casing, in accordance with ISO 1972.

D. MOTORS AND DRIVES

1. Fan motors shall be 230/460V, 3 Phase, 60 Hz and UL listed suitable for severe mill and chemical duty, TEFC, premium efficient with IEEE-841 rating. Fans shall be suitable for Class 1, Division 2 environment.
2. Motor speeds and HP:

    a. Supply: 1800 RPM, 2 HP
    b. Exhaust: 1800 RPM, 2 HP

3. Duplicate motor junction box shall be mounted on exterior of fan housing for electrical connection.
4. Duplicate motor nameplate shall be mounted on fan exterior.

E. FINISH

1. The units, after fabrication, shall be cleaned and aluminum welds shall be brushed with non-ferrous wire cleaning brush.
2. Fans shall be mill finished.

F. ACCESSORIES

1. 316SS Zerk fittings with flexible extended lube lines.
2. 316 SST nameplates and assembly hardware.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations.

3.02 TESTING AND CERTIFICATION

A. Fans shall be tested and certified in accordance with ANSI/ASHRAE 51 and ANSI/AMCA 210 test codes and guaranteed by manufacturer to deliver at rated published performance levels.

B. Fan sound level shall be less than 70dBA at 5'.

C. Test each unit prior to shipment

END OF SECTION

DIVISION 16 - ELECTRICAL

SECTION 16050 ELECTRICAL - GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, devices, equipment, appurtenances, and incidentals required for a complete electrical system as hereinafter specified and/or shown on the Contract Drawings. This work may necessarily include interfacing with and/or completely installing devices and/or equipment furnished under other sections of these Specifications.

B. It is the intent of these Specifications that the electrical system be suitable in every way for the service required. All materials and all work/labor which may be reasonably implied as being incidental to the requirements of this Section shall be furnished at no additional cost to the County.

C. All power interruptions to existing equipment shall be at the County's convenience. Each interruption shall have prior approval. Request(s) for power interruption(s) shall be made at least forty-eight (48) hours in advance.

D. The work shall include complete testing of all electrical components, including wiring.

E. All workmanship shall be of the highest quality. Substandard work will be rejected and it shall be replaced entirely at the CONTRACTOR's expense with no cost to the County.

F. It shall be the responsibility of each bidder or his authorized representative to physically visit the job site in order that he may be personally acquainted with the area(s), buildings and/or structures intended for use in the installation/construction under this Specification. The submittal of a proposal/bid by a bidder shall be considered evidence that he has complied with this requirement and accepts all responsibility for a complete knowledge of all factors governing his work. Therefore, failure to comply with this requirement of the Specifications will not be grounds for the successful bidder (CONTRACTOR) to request approval of change orders and/or additional monetary compensation.

1.02 TEMPORARY ELECTRICAL SERVICE

A. The CONTRACTOR shall make the requisite arrangements and acquire all necessary permits for securing temporary electrical power for his use in accordance with Section 01510 of these Specifications.

1.03 CODES, INSPECTIONS AND FEES

A. All materials and installations shall be in accordance with the National Electrical Code (latest edition) and the latest editions of all applicable national, state, county and local codes.

B. To the extent that any item is routinely tested and rated by the Underwriter's Laboratories, Inc., that item shall bear the U.L. label. Additionally, all items shall be manufactured to the applicable NEMA standards.

C. The CONTRACTOR shall make the necessary arrangements for obtaining all requisite permits and inspections and pay any applicable fees.

1.04 TESTS

A. CONTRACTOR shall employ a third party NETA certified testing firm to test all components of cables, MCC, VFD, Switchgear (MV & LV), MV Switches and Switchboards including power breakers (sec 7.6.1.1) per the latest version of **"Standard for Acceptance Testing Specification for Electrical Power Equipment and Systems" ANSI/NETA.** The CONTRACTOR shall test all items individually and as a system for proper operation. Test results for wire, breakers and grounding shall be provided to the ENGINEER for approval.

B. The CONTRACTOR shall, at his expense, make all the requisite repairs, adjustments and/or alterations to correct any shortcomings found as a result of the tests performed under Item 1.04.A above.

C. A representative of the County shall be present during all testing. The County shall be notified at least two (2) days prior to any testing.

1.05 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured. CONTRACTOR shall coordinate all penetrations with structural Engineer.

1.06 CUTTING AND PATCHING

A. All cutting and patching shall be done in a thoroughly workmanlike manner - i.e., care shall be taken when cutting not to damage or mar surrounding areas, and when patching to match the original finish as closely as possible while providing a watertight seal. Refer to Item 1.01.E above.

1.07 INTERPRETATION OF DRAWINGS

A. The layouts and arrangements as shown on the Contract Drawings are indicative of the physical arrangements desired; however, they are not intended to restrict the CONTRACTOR to accommodate the exact conditions as found in the field. Any deviations from the arrangements shown must be approved by the Engineer and the County prior to the final placement of the item(s) in question.

B. The Contract Drawings are not intended to show exact locations of conduit runs.

C. Circuit and conduit layouts shown are not intended to indicate the exact installation details. The CONTRACTOR shall furnish and install all requisite items, including all fittings, junction boxes, etc., to insure that the electrical system operates in conformance with the Specifications and the specific requirements of an individual piece of equipment.

D. Where circuits are shown as "home-runs", all necessary fittings and boxes shall be provided for a complete conduit installation.

E. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Contract Drawings.

F. Surface mounted items such as panelboards, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between the equipment and the mounting surface.

G. The County shall make the final decision in determining the exact location(s) and mounting height(s) of any item(s) or piece(s) of equipment in question.

H. All connections to equipment shall be made in accordance with the approved shop and manufacturer's drawings, regardless of the number of conductors shown on the Contract Bid Drawings.

I. The CONTRACTOR shall coordinate the work of the different trades in order to prevent interferences between conduit(s), piping and other non-electrical equipment. In case any interference develops, an authorized representative of the County shall decide which equipment, conduit(s) or piping must be relocated, regardless of which was installed first. Any such interferences shall be remedied solely at the CONTRACTOR's expense without any additional cost to the County.

1.08 EQUIPMENT SIZING AND HANDLING

A. The CONTRACTOR shall thoroughly check all entryways, doors, hallways, stairways, buildings and structures through which equipment must be transported to reach its final location.

B. If necessary for safe passage of the equipment, the manufacturer shall be required to ship his material in sections sized to pass through the restricted areas. This requirement holds even if such equipment sizing differs from the manufacturer's standard shipping section.

C. To the extent possible, the equipment shall be kept upright at all times. If equipment has to be tilted for ease of passage through restricted areas, the manufacturer shall provide specific handling instructions as well as any requisite bracing in order to assure both the functional integrity of the equipment and the validity of the equipment warranty.

1.09 SUBMITTALS

A. As specified under Section 01340 of these Specifications, the CONTRACTOR shall submit shop drawings and/or manufacturer's cut sheets for approval of all materials, equipment, devices, apparatus, and other items as required by the County.

1. Prior to 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 the Specifications

and Contract Drawings. This statement shall also list all discrepancies with the Specifications and Contract Drawings. Shop drawings not so checked and noted shall be returned unchecked by the County and the Engineer.

2. The County's and the Engineer's check shall be only for conformance with the design concept of the Project and compliance with the Specifications and Contract Drawings. The responsibility for, or the necessity of, furnishing materials and workmanship required by the Specifications and Contract Drawings which may not be indicated on the shop drawings is included under the work of this Section.
3. No material shall be ordered, no equipment manufacturing shall be started, nor shall any shop work/fabrication commence until the County and the Engineer have approved the shop drawings. Any deviation from this requirement of the Specifications shall be entirely at the risk and expense of the CONTRACTOR without any additional cost to the County.

B. Record Drawings: As the work progresses, the CONTRACTOR shall legibly record all field changes on a set of Contract Drawings. When the project is completed, the CONTRACTOR shall furnish the County with a complete set of reproducible "as-built" drawings.

1.10 MANUFACTURER'S SERVICES

A. The CONTRACTOR shall arrange for an authorized manufacturer's representative who shall be an experienced field service engineer to be present for the inspection, installation, testing, calibration, adjusting and start-up of any item(s) or piece(s) of equipment as deemed necessary by the County.

B. In addition to the duties of Item 1.11.A above, the manufacturer's representative shall also instruct the County's personnel in the proper operation and maintenance of the item(s) in question.

1.11 MATERIALS

A. All materials used shall be new, unused and as hereinafter specified. Where not specifically called out, all materials shall be of the very best quality of their respective kinds. Unless specifically otherwise approved in writing by the County, only material manufactured in the United States shall be used!

B. Where applicable, all materials and equipment shall conform with the requirements of Item 1.03.B above.

C. Electrical equipment shall at all times during construction be adequately protected against both mechanical injury and damage by water. Electrical equipment shall be stored indoors in dry shelters. Any damaged equipment shall be replaced by the CONTRACTOR at his own expense.

D. All items shall be manufactured from the materials specified - substitute materials will not be acceptable.

E. Only the specified manufacturer's equipment shall be used unless an "or

approved equal" is noted. The County and the Engineer shall be the determiners of what constitutes an "approved equal".

1.12 GUARANTEES AND WARRANTIES

A. All items furnished under the Electrical Specifications shall be guaranteed and/or warranted, in writing, against defects in materials, construction and workmanship as specified under Section 01740 of these Specifications.

END OF SECTION

SECTION 16062 LIGHTNING PROTECTION SYSTEM FOR STRUCTURES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. Contractor shall employ qualified Lightning Protection System Subcontractor to provide all labor, materials, equipment, services, and incidentals shown, specified, and required to furnish and install lightning protection systems for the new electrical building.
2. Protection area for lighting protection system is to be limited to the new electrical building.

B. Coordination:

1. Review installation procedures included under other Sections and coordinate installation of items to be installed with or before lightning protection systems.

C. Related Sections:

1. Section 16450, Grounding and Bonding for Electrical Systems.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. Lightning Protection Institute (LPI), LPI 175, Standard of Practice.
2. LPI 176, Standard of Materials.
3. NFPA 70, National Electrical Code.
4. NFPA 780, Standard for the Installation of Lightning Protection Systems.
5. UL 96A, Installation Requirements for Lightning Protection Systems.
6. UL 651, Schedule 40 and 80 PVC Conduit.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Lightning Protection System Subcontractor:

   a. Retain services of licensed and bonded Lightning Protection Installer (LPI) Subcontractor regularly engaged in providing Master Labeled lightning protection systems.

2. Subcontractor shall be LPI-certified Master Installer or Inspector.
3. Subcontractor shall be listed with UL.

B. Component Supply and Compatibility:

1. Obtain all materials equipment included in this Section regardless of component manufacturer from a single lightning protection system manufacturer.
2. Lightning protection system manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.
3. All components shall be specifically constructed for specified service conditions and shall be integrated into the overall system by lighting protection system manufacturer.

1.04 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Shop Drawings:

a. Complete scaled drawings showing proposed routing and layout of lightning protection system with installation details. Drawings shall include equipment connection details and downlead details.

2. Product Data:

a. Manufacturer's catalog cuts and technical information.
b. Technical specifications.

E. Informational Submittals: Submit the following:

1. Certificates:

a. Certificates of LPI code compliance provided by manufacturer, together with UL Master Label certificate or letter of finding.

2. Field Quality Control Submittals:

a. Master Installer or Inspector's final inspection report following installation.

3. Qualifications Statements:

a. Lightning protection system Subcontractor.

1.05 GUARANTEE

A. Guarantee:

1. Lightning protection system shall be guaranteed by lightning protection system manufacturer against defective parts and installation for three years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SYSTEM PERFORMANCE

A. System Description:

1. Each lightning protection system shall consist of a complete cable network on the roof or top of structure involving all air terminals, splices, and bonds with cable downleads routed concealed either directly in the building construction or in conduit to ground, and ground rods all connected together in an appropriate manner and certified by LPI to provide a zone of protection to entire building against lightning strikes, in accordance with NFPA 780.
2. Provide complete, certified lightning protection system. Provide bonding connections and miscellaneous items for complete system.

2.02 MANUFACTURERS

A. Manufacturers: Provide products of one of the following:

1. Heary Brothers Lightning Protection Company.
2. Thompson Lightning Protection, Inc.
3. Robbins Lightning Inc.
4. Or approved equal

2.03 MATERIALS

A. General:

1. Size materials in accordance with NFPA 780, UL 96A, and LPI 176.
2. Materials and equipment shall be labeled or listed by UL for use in Master Labeled lightning protection systems. Completed system shall conform to NFPA 70, NFPA 780, LPI 175, LPI 176, and UL96A.
3. Materials shall comply in weight, size, and composition for class of structure to be protected in accordance with the following:

    a. Use Class I materials for systems on structures not exceeding 75 feet in height.
    b. Use Class II materials for systems on structures exceeding 75 feet above grade.

4. Materials shall be corrosion-resistant, heavy-duty type. Unless otherwise specified, materials shall be Type 316 stainless steel, copper, or high

copper-content bronze castings. Bolts, screws, and hardware shall be Type 316 stainless steel.

5. Use aluminum materials in locations where system components are mounted on aluminum surfaces to avoid electrolytic corrosion of dissimilar metals.
6. Provide fittings, mounting bases, couplings, connectors, fasteners, and other system devices required for complete system.

B. Ground Rods: Comply with Section 16450, Grounding and Bonding for Electrical Systems.

C. Connection and Downlead Cables:

1. Cables shall be aluminum, except in connections to surfaces as required to prevent dissimilar metals reaction where copper shall be used.
2. Cable stranding, number and size shall be suitable for classification of structure to be protected.
3. Exposed ground cable shall be corrosion resistant.

D. Air Terminals:

1. Air terminals shall be stainless steel 3/4-inch diameter and minimum of 18 inches long.
2. Air terminals shall include a cast bronze point protector, stainless steel adapter, and copper base.

E. Non-Metallic Conduit and Fittings:

1. Non-metallic conduit shall be Schedule 80 PVC plastic, rated for 90 degrees C, conforming to UL 651.
2. Non-metallic fittings shall be of same material and manufacturer as base conduit. Provide cement for joining fittings to conduit. Fittings shall be by same manufacturer as base conduit.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine the conditions under which the Work will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install main conductors to provide two-way path from each air terminal horizontally or downward to connections with ground terminals.

B. Install conductors free of excessive splices and sharp bends. Conductor bends shall form an included angle of not less than 90 degrees and shall not have bend radius less than eight inches. Secure conductors to structure at intervals not exceeding three feet.

C. Provide one down conductor at upper and lower extremities connected to structural steel. Make connections to steel frame with bonding plates having eight square inches of contact, or by exothermic weld connections.

D. Provide air terminals at intervals not exceeding 20 feet around perimeter of structure. Air terminals shall project a minimum of 10 inches above the area protected.

E. Do not connect copper equipment to aluminum surfaces, except using bimetal transition fitting. Lead coating is unacceptable for bimetal transition.

F. Install roof penetrations using through-roof assemblies with solid bars and appropriate roof flashing. Conductors shall not pass directly through roof.

G. Grounded metal bodies shall be bonded to the system using bonding connections and fittings. When ground conductors are installed in conduit, conduit shall be non-metallic.

H. Bond building ground systems including electrical, communication, and telephone services and arresters.

I. Bond metal pipes and roof mounted metal structure to the roof ground loop or to downlead cables.

J. Provide ground electrodes for down conductor dedicated for lightning protection system and bond electrodes to building or structure grounding system. Connect down conductor to ground rod using high-strength, removable ground clamp. Provide bronze ground rod clamp having at least 1.5 inches of contact between rod and conductor, measured parallel to the axis of the rod, at ground test wells.

3.03 FIELD QUALITY CONTROL

A. Inspection:

1. During installation, lightning protection system shall be inspected by Master Installer or Inspector at several stages during installation in accordance with LPI requirements.
2. Do not conceal system components until inspection has been completed and successfully inspected, and observed by ENGINEER.
3. Upon completion of lightning protection system, arrange for final lightning system inspection and submit final inspection report to ENGINEER. Final lightning system inspection shall be performed by Master Installer or Inspector in accordance with LPI requirements.

END OF SECTION

SECTION 16075 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install identification for electrical apparatus and electrical Work. All manufactured equipment shall have nameplates in accordance with drawing naming conventions.

B. Related Sections:

1. 16120 Wires and Cables.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:

1. NEC Article 110, Requirements for Electrical Installation.
2. NEC Article 210, Branch Circuits.
3. NEC Article 215, Feeders.
4. NEC Article 504, Intrinsically Safe Systems.
5. NEC Article 700, Emergency Systems.
6. NEC Article 701, Legally Required Standby Systems.
7. NEC Article 702, Optional Standby Systems.
8. 40 CFR 1910.145 (OSHA) – Specification for Accident Prevention Signs and Tags.
9. NFPA 70E, Electrical Safety in the Workplace.
10. NFPA 79, Electrical Standard for Industrial Machinery.

1.03 SUBMITTALS

A. Submit shop drawings and product data as described in Division 1 and following:

1. Shop Drawings: Submit the following:

a. Complete description and listing of proposed electrical identification and electrical identification devices for associated equipment or systems.
b. Conduit and wire identification numbering system and equipment signage.

2. Product Data:

a. Manufacturer’s literature, cut sheets, specifications, dimensions and technical data for all products proposed under this Section.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Engraved Identification Devices (Nameplates and Legend Plates):

1. Nameplates: (To be put on all manufactured equipment including panelboards, disconnects, control cabinets, junction and terminal boxes 12" and larger.)

a. Laminated thermoset plastic, 1/16-inch thick, engraved condensed block black lettering on white background, square corners, and beveled front edges, or match existing. Nameplate shall have glued backing with stainless screws in each corner. Provide sufficient spacing for mounting screws.
b. Size: As required.
c. Letter Size: Minimum 3/16-inch.
d. Nameplates one-inch or less in height shall have one mounting hole at each end. Nameplates greater than one-inch in height shall have mounting holes in the four corners.

2. Legend Plates:

a. Legend plates for pushbuttons, pilot lights, selector switches, and other panel-mounted devices shall be large size with dimensions of approximately 2-7/16 inches wide by 2-13/32 inches tall (similar to Allen Bradley large automotive size), plastic, custom engraved with black letters on white background.

1) Provide standard-size legend plates where devices are mounted on motor control centers and motor controllers and spacing of devices precludes using automotive-size legend plates.

b. Lettering size and line weight shall be the same for all legend plates on the same panel or enclosure. Maximum size shall be 1/4-inch and minimum size shall be 1/8-inch.

B. Safety Signs and Voltage Markers:

1. Provide high voltage signs for equipment operating over 600 volts.
2. High-Voltage Safety Signs for Outdoor Applications:

a. Products and Manufacturers: Provide one of the following:

1) B-120-45471 by Brady.
2) Or approved equal.

b. Unless otherwise shown or indicated, high voltage safety signs shall be not less than 10 inches high by 14 inches wide, of fiberglass reinforced plastic, and shall comply with 40 CFR 1910.145. Signs shall resist fading from exposure to temperature

extremes, ultraviolet light, abrasive, and corrosive environments, and shall read, “DANGER – HIGH VOLTAGE – KEEP OUT”

c. Mounting hardware shall be Type 316 stainless steel.

3. Cable Tray Safety Signs:

a. Products and Manufacturers: Provide one of the following:

1) B-302-86139 by Brady.
2) Or approved equal.

b. Cable tray safety signs shall be pressure-sensitive vinyl conforming to 40 CFR 1910.145, 5 inches by 3.5 inches in size, and shall read, “DANGER – HIGH VOLTAGE”

c. Low voltage safety signs shall be pressure-sensitive vinyl complying with 40 CFR 1910.145, five inches by 3.5 inches in size, and shall read, “DANGER – 480 VOLTS”

4. Low-Voltage Safety Signs:

a. Products and Manufacturers: Provide one of the following:

1) B-302-86060 by Brady.
2) Or approved equal.

b. Low voltage safety signs shall be pressure-sensitive vinyl complying with 40 CFR 1910.145, five inches by 3.5 inches in size, and shall read, “DANGER – 480 VOLTS”.

5. Low-Voltage Markers:

a. Products and Manufacturers: Provide one of the following:

1) CV442xx by Brady.
2) Or approved equal.

b. Low voltage markers shall be either pressure-sensitive vinyl or vinyl cloth with black lettering on orange background and shall read, “120 VOLTS”, “208 VOLTS”, “120/208 VOLTS”, or “240 VOLTS” as required.

C. Arc-flash Safety Signs:

1. Products and Manufacturers: Provide one of the following:

a. Brady.
b. Or approved equal.

2. Warning signs shall be adhesive-backed polyester.
3. Warning signs shall read, “Warning – Arc Flash and Shock Hazard”. Appropriate PPE Required. Arc flash warning signs shall indicate the

flash protection boundary, incident energy in calories per square centimeter, hazard level, description of required protective clothing, shock hazard, limited approach boundary, restricted approach boundary, prohibited approach boundary, and equipment name.

D. Voltage System Identification Directories:

1. General:
   a. Directories shall be laminated thermoset plastic, 1/16-inch thick, engraved block black letters on white background, square corners, and beveled front edges.
   b. Directories shall identify all voltage systems within building or structure.
   c. Directories shall list the colors that identify ungrounded and grounded conductors of each system.
   d. Colors shall be in accordance with Section 16120, Wires and Cables
   e. Example Directory Text:

Voltage System Identification		
System	**A, B, C**	**Neutral**
277/480	Brown, Orange, Yellow	Gray
120/208	Black, Red, Blue	White
CONTROL	**COLOR**	**REMARKS**
120V	Yellow	External Powered
24VDC	Blue	Discrete Signal
120V	Red	Powered from PLC
24VAC	Orange	Discrete Signal

2. Large directories for rooms shall have text height not less than 1/2-inch.
3. Small directories for equipment shall have text height of not less than 1/4-inch.

E. Conduit Labels:

1. Products and Manufacturers: Provide one of the following:

   a. Stainless Steel Tags and Strapping by Brady.
   b. Or approved equal.

2. Tags shall be engraved or stamped with ID designation consisting of conduit designation number indicated on drawings and as outlined in Section 3.01, F. Verify conduit numbers match numbers shown on drawings. Same number on both ends of conduit.
3. Utilize stainless steel strapping with a minimum of 32 mil thickness to securely attach conduit labels to conduits.

F. Wire Identification:

1. Heat Shrinkable Wire and Cable Labeling System:

a. Products and Manufacturers: Provide one of the following:

1) ID Pro Plus WMS-xxx- by Brady.
2) No equal.

b. White heat-shrinkable irradiated polyolefin shrink-on sleeves. Labels shall be thermal printed. Labels shall be not less than one inch wide. Verify wire numbers match drawing numbers, same number on each end of wire.

2. Wrap-Around Wire and Cable Labeling System:

a. Products and Manufacturers: Provide one of the following:

1) ID Pro Plus WMS-xxx by Brady.
2) No equal.

b. Self-laminating white/transparent self-extinguishing vinyl strips. Length shall be sufficient to provide at least 2.5 wraps. Labels shall be thermally printed and not less than two inches wide. Verify wire numbers match drawing numbers, same number on each end of wire.

G. Detectable Underground Warning Tape:

1. Products and Manufacturers: Provide one of the following:

a. Indentoline by Brady.
b. Or approved equal.

2. Material: Polyethylene or polyester with detectable metal core and polyester underlaminate.
3. Width: Two inches.
4. Color and Labeling: Yellow or red with permanently imprinted black letters: “CAUTION – Buried Electric Line”, repeated continuously over full length of tape.

H. Thermal Printing System:

1. Utilize thermal transfer process to provide non-smearing labels and markers.
2. Wire and Cable Markers:

a. Portable, Products and Manufacturers: Provide one of the following:

1) ID Pro Plus by Brady.
2) No equal.

b. Desktop, Products and Manufacturers: Provide one of the following:

1) BB72 by Brady.
2) Or approved equal.

3. Cable Markers:

a. Portable, Products and Manufacturers: Provide one of the following:

1) ID Pro Plus by Brady.
2) No equal.

b. Desktop, Products and Manufacturers: Provide one of the following:

1) BBP72 by Brady.
2) No equal.

2.02 FABRICATION

A. Engraved Identification Devices (Nameplates and Legend Plates):

1. Nameplate and legend plate text is preliminary and subject to change pending final review and approval of nomenclature by ENGINEER after start-up and testing. Verify device name plate matches drawing device name and/or number.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide electrical identification in accordance with manufacturer recommendations and as required for proper identification of equipment and materials.

B. Engraved Identification Devices (Nameplates and Legend Plates):

1. Unless otherwise indicated in the Contract Documents, attach permanent nameplates with permanent adhesive and with 3/16-inch diameter, round head, stainless steel machine screws into drilled and tapped holes.
2. Provide nameplate with 1.5-inch high letters to identify each console, cabinet, panel, or enclosure as shown or indicated.
3. Provide nameplates for field-mounted motor starters, disconnect switches, manual starter switches, pushbutton stations, and similar equipment operating components, which shall describe motor or equipment function and circuit number.
4. Provide nameplates with 1/2-inch high letters to identify each junction and terminal box shown or indicated.
5. On switchgear, provide nameplates for each main and feeder circuit including control fuses, and for each indicating light and instrument.

a. Provide nameplate with 1.5-inch high letters giving switchgear designation, voltage rating, ampere rating, short circuit rating, manufacturer's name, general order number, and item number.
b. Identify individual door for each compartment with nameplate giving item designation and circuit number.

6. Motor Control Centers:

a. Provide nameplate with 1.5-inch letters with motor control center designation.
b. Identify individual door for each unit compartment with nameplate identifying controlled equipment.

7. Except conduit, all electrical appurtenances including lighting panels, convenience outlets, fixtures, and lighting switches, shall be provided with nameplates indicating appropriate circuit breaker number(s).

8. Push Buttons:

a. Provide legend plates for identification of functions.
b. Provide nameplates for identification of controlled equipment.
c. Provide red buttons for stop function.
d. Provide black buttons for other functions.

9. Pilot Lights:

a. Provide legend plates for identification of functions.
b. Provide nameplates for identification of controlled equipment.
c. Shall have lens colors as shown or indicated.

Where no color is indicated, provide the following lens colors:

Color	Legend
Red	Running, Open
Green	Stopped, Closed
Amber	Alarm
Blue	Power
White	Status

10. Selector Switches:

a. Provide legend plates for identification of functions.
b. Provide nameplates for identification of controlled equipment.

11. Panel Mounted Instruments:

a. Provide nameplates for identification of function.

12. Interiors of Cabinets, Consoles, Panels, Terminal Boxes, and Other Enclosures:

a. Provide nameplates for identification.
b. Provide each item inside cabinet, console, panel, terminal box, or enclosure with laminated plastic nameplate as shown on approved Shop Drawings and CONTRACTOR's other submittals. Install nameplates with adhesive.
c. Interior items requiring nameplates include:
1) Terminal blocks and strips.
2) Bus bars.
3) Relays.
4) Rear of face-mounted items.
5) Rear of door-mounted items.
6) Interior mounted items that require identification when mounted externally.

d. Circuit Breaker Directory:

1) Provide engraved laminated plastic directory listing function and load controlled for each circuit breaker within panel used for power distribution.

13. Re-label existing equipment whose designation have changed.

C. Safety Signs and Voltage Markers:

1. Provide safety signs and voltage markers on and around electrical equipment as shown or indicated.

a. Install rigid safety signs using stainless steel fasteners.
b. Clean surfaces before applying pressure-sensitive signs and markers.

2. Provide cable tray safety signs on both sides of cable trays at maximum intervals of 20 feet. Install signs on side rails of tray as acceptable to ENGINEER.

a. Cable trays that contain conductors greater than 208 volts and less than 600 volts shall be labeled with low voltage safety signs.
b. Cable trays that contain conductors of 120/208 volts shall be labeled with low voltage markers.
c. Do not label cable trays that contain only instrument signal cables.
d. Label cable trays that contain intrinsically safe wiring or cables in accordance with NEC Article 504.

4. Install low voltage safety signs on equipment doors that provide access to uninsulated 480-volt conductors, including terminal devices.
5. Install low voltage markers on each terminal box, safety disconnect switch, and panelboard installed, modified, or relocated as part of the Work and containing 120/208 volt conductors.

D. Voltage System Identification Directories

1. Provide voltage system identification directories as required by NEC Article 210 and NEC Article 215.
2. Provide in each electrical room voltage system identification directory mounted on wall or door at each entrance to room.
3. For panelboards, switchboards, motor control centers, and other branch circuit or feeder distribution equipment that are not located in electrical rooms, provide voltage system identification directory mounted on equipment.

    a. Directories shall be affixed using epoxy glue. Screws or bolts shall not penetrate equipment enclosures.
    b. Directories shall be readily visible and not obscure labels and other markings on equipment.

E. Arc-flash Safety Signs:

1. Provide arc-flash safety signs as required by NEC Article 110.

2. Provide signs for switchboards, panelboards, motor control centers, and industrial control panels. Provide signs for control panels that contain 480 volt equipment. Provide arc flash warning signs on other equipment where the incident energy is greater than 1.2 calories per square centimeter.

F. Conduit Labels:

1. Provide conduits with conduit labels unless otherwise shown or indicated.
2. Do not label flexible conduit.
3. Do not label exposed single conduit runs of less than 25 feet between local disconnect switches and their associated equipment.
3. Conduit labels shall indicate the following information:

    a. Contract Number: Alphanumeric, three or four digits, as applicable.
    b. Conduit Number: Alphanumeric as shown on the Drawings, as assigned by CONTRACTOR for unlabeled conduits, and in accordance with approved submittals.

4. Conduits that contain intrinsically safe wiring shall have an additional pipe marker provided that has blue letters on white background and reads, “INTRINSICALLY SAFE WIRING”.

    a. Install intrinsically safe pipe markers in accordance with NEC Article 504 along entire installation. Spacing between labels shall not exceed 25 feet.

5. Provide conduit labels at the following locations:

    a. Where each conduit enters and exits walls, ceilings, floors, or slabs.
    b. Where conduit enters or exits boxes, cabinets, consoles, panels, or enclosures, except pull boxes and conduit bodies used for pull boxes.

c. At maximum intervals of 50 feet along length of conduit.

7. Orient conduit labels to be readable.

G. Wire and Cable Identification:

1. Color-coding of insulated conductors shall comply with Section 16120, Wires and Cables, Section 16123, Medium Voltage Cable.
2. Use heat-shrinkable wire labels where wire or cable is terminated. Use wrap-around labels where wire or cable is to be labeled but is not terminated.
3. Do not provide labels for the following:

   a. Bare (uninsulated) conductors, unless otherwise shown or indicated as labeled.

4. Provide wire and cable labels for the following:

   a. New, rerouted, or revised wire or cable.
   b. Insulated conductors.
   d. Wire and cable terminations:

      1) Wire labels shall be applied between 1/2-inch and one inch of completed termination
      2) Apply cable labels between 1/2-inch and one inch of cable breakout into individual conductors.

         a) Label individual conductors in a cable after breakout as specified for wires.

   e. Wire or cable exiting cabinets, consoles, panels, terminal boxes, and enclosures.

      1) Label wires or cables within two inches of entrance to conduit.

   f. Wire or cable in junction boxes and pull boxes

      1) Label wires or cables within two inches of entrance to conduit.

   g. Wire and cable installed in cable tray.

      1) Wire and cable shall have labels at maximum intervals of 20 feet.

   h. Wire and cable installed without termination in electrical manholes.

      1) Wire and cable shall have wrap-around labels applied within one foot of exiting manhole.

i. Vendor supplied equipment wire and cable

1) Wire and cable shall have wire numbers on all wires.

5. Wire and Cable Identification System:

a. Wire and cable labels shall be imprinted with an identifying designator.

1) Wire and cable extending between two devices or items and that does not undergo a change of function shall be identified by a single unique designator as specified below. Vendor O&M and panel drawings shall reflect field wire numbering.

b. Field Wiring:

1) Wire or cable designator shall consist of

a) Three left-most characters shall consist of the Contract number under which wiring or cable was installed.

b) Between designations of contract, terminal, and equipment, the group of characters shall be separated by an asterisk (*), a plus sign (+) or a hyphen (-). Do not use other punctuation symbols in a wire designator.

c) Remaining characters shall be alphanumeric.

(i.) Fifth thru Seventh characters for wires coming from control panel or PLC cabinet to the field, wire number shall match Vendor panel terminal block numbers and have instrument or equipment designation and number. EX. 870-001-FIT-001, 870-001-PUMP-1
(ii.) For field wiring at instrument or equipment, fifth thru seventh number shall have terminal block number of control enclosure or terminal box and name of control enclosure or terminal box. EX. 870-001-PLC-7, 870-001-MCC-7

d) Numbering shall reflect actual designations used in the Work and shall be documented in record documents.

c. Cabinet, Console, Panel, and Enclosure Wiring, Internal:

1) New Cabinets, Consoles, Panels, and Enclosures:

a) Wire and cable inside cabinets, consoles, panels, and enclosures shall have designators as shown on the Drawings or be assigned a ten-character designator equivalent to field wire designator, with the exception that Drawing number shall be fifth thru seventh number and terminal block number shall be ninth thru eleventh number. EX. 870-E21-013-UPS.

2) Modified Cabinets, Consoles, Panels, and Enclosures:

a) New or rerouted wire or cable in existing cabinets, consoles, panels, and enclosures shall be labeled as shown on the Drawings or be assigned a ten-character designator equivalent to field wire designator, with the exception that Drawing number shall be fifth thru seventh number and terminal block number shall be ninth thru eleventh number. EX. 870-E23-001-HVAC.

H. Terminal Strip Labeling:

1. Label panel side of terminal to match panel wire number.
2. Label field side of terminal to match field wire number. Terminal number shall not include the Contract number.

END OF SECTION

SECTION 16110 CONDUITS AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish and install the conduits, fittings, devices and appurtenances as hereinafter specified and/or as shown on the Contract Drawings. This specification applies to both low and medium voltage systems.

1.02 SUBMITTALS

The requirements of Section 01340 and Section 16050 shall be met.

1.03 APPLICATIONS

A. Except where otherwise shown on the Contract Drawings, or hereinafter specified, all wiring shall be run in rigid conduits.

B. Rigid aluminum conduits (RAC) shall be used at all locations aboveground and within structures and buildings, except where otherwise shown on the Contract Drawings.

C. Rigid aluminum conduits shall be used at all locations for shielded instrumentation/ control and communication wiring, except where otherwise shown on the Contract Drawings.

D. Schedule 40 PVC conduits shall be used for all power and 120V instrumentation/control wiring when used in concrete steel reinforced ductbanks and in-slab applications except where otherwise shown on the Contract Drawings. Provide conduit spacers by “Carlon” or approved equal, every 6 feet or less to hold separation of conduits.

E. Schedule 80 PVC shall be used for all power and instrumentation/control wiring in direct bury ductbank applications except where otherwise shown on the Contract Drawings. Provide conduit spacers by “Carlon” or approved equal, every 6 feet or less to hold separation of conduits.

F. Schedule 80 PVC conduits shall be used in highly corrosive areas such as chemical storage areas, digesters, fluoride storage and handling areas, etc.

G. All conduits of a given type shall be the product of one manufacturer.

H. Except where otherwise shown on the Contract Drawings, or hereinafter specified, all boxes shall be metal.

I. Surface and flush mounted switch, receptacle and control station boxes shall be 316 Stainless Steel.

J. Devices designated as NEMA Type 4 shall be 316 stainless steel, gasketed.

K. Devices designated as NEMA Type 4X shall be 316 stainless steel, gasketed, except as otherwise shown on the Contract Documents.

L. Combination expansion-deflection fittings shall be used where conduits cross structural expansion joints or as recommended by manufacturer for ambient conditions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Rigid Conduit

1. Rigid aluminum conduit shall be Aluminum as manufactured by Allied Tube & Conduit, Patriot Aluminum Products or approved equal.
2. PVC Sch 80 & 40 conduit as manufactured by Carlon, Heritage Plastics or approved equal.

B. Liquidtight, Flexible Conduit

1. Liquidtight, flexible metal conduits shall be Sealtite, Type UA, as manufactured by Anaconda, American Flexible Conduit Co., Inc., or approved equal.
2. Liquidtight, flexible non-metallic conduits shall be Carflex Liquidtight Flexible Non-Metallic Conduit as manufactured by Carlon, or approved equal.

C. Rigid Conduit Fittings

1. Rigid Aluminum Conduit Fittings:

   a. Aluminum elbows, bends, sweeps, nipples, couplings, etc., approved equal.

2. Rigid Non-Metallic Conduit Fittings: PVC elbows, bends, sweeps, nipples, couplings, device boxes, etc., shall be Plus 80 fittings as manufactured by Carlon, or approved equal.

D. Flexible Conduit Fittings

1. Flexible Metal Conduit Fittings: Fittings used with flexible metal conduit shall be of the screw-in type as manufactured by Thomas and Betts Company, or approved equal.
2. Flexible Non-Metallic Conduit Fittings: Fittings used with flexible non-metallic conduit shall be Carflex Liquidtight Non-metallic Fittings as manufactured by Carlon, or approved equal.

E. Flexible Couplings: Flexible couplings shall be as manufactured by Crouse-Hinds, Appleton Electric Company, or approved equal.

F. Wall Seals: Wall sleeves shall be used for all wall penetrations and conform to area classifications. Conduit wall seals shall be type "WSK" as manufactured by the O.Z. Electrical Manufacturing Company, or approved equal.

G. Expansion Fittings: Combination expansion-deflection fittings shall be type "XD" as manufactured by Crouse-Hinds, or approved equal.

H. Boxes

1. Device Boxes

a. Flush mounted wall device boxes shall be galvanized pressed steel as manufactured by the Raco Manufacturing Company, or approved equal.
b. Surfaced mounted wall device boxes shall be cast or malleable iron as manufactured by Crouse-Hinds, Appleton Electric Company, or approved equal.
c. Flush mounted in-floor device boxes shall be cast metal, shall be watertight, shall have adjustable cover frames, and shall be as manufactured by Russell & Stoll Company, Steel City Electric, or approved equal.

2. Other Boxes

a. Terminal boxes, junction boxes, pull boxes, etc., except as otherwise specified and/or shown on the Contract Drawings, shall be PVC or 316 S.S.
b. The boxes shall have continuously welded seams and shall be ground smooth.
c. The box bodies shall be flanged, shall be not less than 14-gauge metal, and shall not have holes or knockouts.
d. The box covers shall be not less than 12-gauge metal, shall be gasketed, and shall be fastened to the box bodies with stainless steel screws.

I. Conduit Mounting Devices: Hangers, rods, channel, backplates, clips, straps, beam clamps, etc., shall be 316 stainless steel as manufactured by Unistrut Corp., or approved equal.

J. Fixture Support System

1. The fixture support system shall be the channel type and shall be furnished complete with all requisite mounting hardware and appurtenances.
2. The channel, mounting hardware and related appurtenances shall be 316 stainless steel.
3. The fixture support system shall be as manufactured by the Unistrut Corp., or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. No conduit smaller than 3/4-inch electrical trade size shall be used nor shall either 1-1/4-inch conduit or 3-1/2-inch conduit be used. Minimum size underground, under slab or in-slab shall be 1-inch.

B. No wires shall be pulled until the individual conduit runs are complete in all details. Additionally, each conduit shall be cleaned and reamed and certified clear of all burrs and obstructions before any wire is pulled.

C. The ends of all conduits shall be tightly capped to exclude dust and moisture during construction.

D. Conduits shall be supported at intervals of 8-feet or less, as required to obtain a rigid installation. For flexible conduit supports shall be in accordance with NEC 2014 350.30, A.

E. Exposed conduits shall be run parallel with and/or perpendicular to the surrounding surface(s). No diagonal runs will be allowed.

F. Single conduits shall be supported by one-hole pipe clamps in combination with one-screw backplates to provide space between the conduits and the mounting surface.

G. Multiple horizontal runs of conduits shall be supported by trapeze type hangers (channel) suspended by threaded rod, 3/8-inch minimum diameter.

H. Multiple vertical runs of conduits shall be supported by structurally mounted channel in combination with conduit clamps.

I. Conduit support devices shall be attached to structural steel by welding or beam or channel clamps as indicated on the Contract Drawings.

J. Conduit support devices shall be attached to concrete surfaces by "spot type" concrete inserts.

K. Conduits terminating in steel interior boxes shall have double locknuts and insulating bushings. Exterior conduits installed in boxes shall have sealed conduit hubs when penetrating in the top or side.

L. Conduits terminating in gasketed enclosures shall be terminated with sealed conduit hubs weather interior or exterior.

M. Conduit wall seals, waterproof type, shall be used at all locations where conduits penetrate walls.

N. Liquidtight, flexible conduit - metal or non-metallic as shown on the Contract Drawings - shall be used for all motor terminations and for all connections/terminations where vibration is anticipated.

O. Flexible couplings shall be used in hazardous locations for all motor terminations and for all connections/terminations where vibration is anticipated.

P. Conduit stubouts for future construction shall be capped at both ends with threaded PVC conduit caps.

Q. The cement used for PVC conduit installations shall be as manufactured by Carlon, or approved equal.

R. Provide grounding type bushings for a conduit entering control panels.

S. Rigid aluminum conduits entering manholes and/or below grade pull boxes shall be terminated with grounding type bushings which shall be connected to a 3/4-inch by 10-foot long driven ground rod with No. 6 AWG bare copper wire.

T. Rigid aluminum conduit shall be used for all risers. The underground portion of the riser and a 6-inch section of the riser immediately above the ground or slab/floor level shall be painted with a bitumastic coating. All below grade conduit sweeps shall be metallic with bitumastic coating. No aluminum conduit is to come into direct contact with concrete or earth.

3.02 GUARANTEES AND WARRANTIES

The Contractor shall guarantee and warrant all materials and labor provided under this Section in accordance with Section 01740 and Section 16050 of these Specifications.

END OF SECTION

SECTION 16120 WIRES AND CABLES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install all wires, cables and appurtenances as described hereinafter and/or as shown on the Contract Drawings.

B. Testing of all cables per section 3.02.

1.02 SUBMITTALS

A. The requirements of Section 01340 and Section 16050 shall be met.

B. Samples of the actual wires and cables proposed for use shall be submitted for approval. There shall be a sample for each size and type of wire and cable proposed for use. The samples shall be of sufficient length to show the maximum rated voltage, insulation type and class, conductor size, the manufacturer's name, trademark or identifying logo, and the U.L. listing number.

C. The wires and cables as approved for use shall be compared with the wires and cables actually installed. If any unapproved wires and cables are installed, they shall be removed and replaced solely at the Contractor's expense with no additional cost to the County.

D. NETA Testing Form, in accordance with the ANSI/NETA Standard for Acceptance Testing Specifications.

1.03 APPLICATIONS

A. The wire for lighting and receptacle circuits shall be type THHN/THWN, stranded.

B. The wire for all power circuits and motor leads shall be type THHN/THWN, stranded.

C. Single conductor wires for control, indication and metering shall be type THHN/THWN, No. 14 AWG, stranded.

D. Multiconductor control cable shall be No. 14 AWG, stranded.

E. The wire for process instrumentation shall be No. 16 AWG, stranded.

F. Power cables to process equipment driven from Variable Frequency Drives shall be multi-conductor VFD cable with an overall metallic shield.

G. All wiring in tray cable shall be rated as such, with UV resistive outer jacket.

1.04 MINIMUM SIZES

A. Except for control and signal leads, no conductor smaller than No. 12 AWG shall be used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wire and cables shall be made of annealed, 98% conductivity, soft drawn copper conductors.

B. All conductors shall be stranded except that the uninsulated copper grounding conductors shall be solid.

2.02 600 VOLT WIRE AND CABLE

A. Type THHN/THWN insulation shall be used for all 600 Volt wires and cables. The insulation shall be a flame-retardant, heat-resistant thermoplastic, and shall have a nylon, or equivalent, jacket.

B. The 600 Volt wires and cables including VFD, shall be as manufactured by Anixter, Rome Cable, Southwire, or approved equal.

2.03 INSTRUMENTATION AND CONTROL WIRING

A. Process instrumentation wiring shall be No. 16 AWG stranded twisted pair, 600 Volt, cross-linked polyethylene insulated, aluminum tape shielded, PVC jacketed. Multiconductor cables with individually twisted pairs shall be installed where shown on the Contract Drawings.

B. Multiconductor control cables shall be No. 14 AWG, stranded, 600 Volt, cross-linked polyethylene insulated, PVC jacketed.

C. Instrumentation and control wiring shall be as manufactured by Belden, Alpha, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Wires and cables shall be sized as shown on the Contract Drawings and/or, where applicable, sized to match existing wiring.

B. All conductors shall be carefully handled to avoid kinks or damage to the insulation.

C. Lubricants or pulling compounds shall be used to facilitate wire pulling. Such lubricants/compounds shall be U.L. listed for use with the insulation specified.

D. Use pulling means - fish-tape, cable, rope, basket weave wire/cable grips, etc. - which will not damage the wire/cable insulation or the raceway. Cable puller must have tension gauge for monitoring stress.

E. All wire and cable shall be installed from terminal to terminal with no splicing at any intermediate point, unless approved by Engineer.

F. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only instrumentation cables. Instrumentation cables shall be separated

from control cables in manholes.

G. Shielding on instrumentation cables shall be grounded at the transmitter end only.

H. All new wires and cables shall be continuous and without splices between points of connection to equipment terminals. However, the County will permit a splice provided that the length between the connection points exceeds the greatest standard shipping length available from the submitted manufacturer and no other manufacturer acceptable to the County is able to furnish wires or cables of the required length.

I. All 600 volt wire and cable connections shall be made using compression type connectors. Insulated connectors shall be used for all terminations. The connections shall be made so that both the conductivity and the insulation resistance shall be not less than that of the uncut conductor.

J. All wires shall be numbered at both ends and at all intermediate junction points. Screw type terminations shall be made with forked tongue (spade), self-insulated, crimp terminals. All other wire terminations shall be made on appropriate terminal strips.

3.02 TESTS

A. Upon the completion of the pulling-in of and prior to the terminating/connecting of the 600 Volt wiring, all wires shall be individually checked and tested for continuity and short circuits, and each wire/cable shall be “Meggered” to check insulation resistance. The test voltage shall be not less than 1000 Volts DC for one minute, per NETA Acceptance Testing Standards. For units with solid-state components or control devices that cannot tolerate the applied voltage, follow the manufacturer’s recommendation. Three (3) copies of these test results shall be submitted to the County.

B. An authorized representative(s) of the County shall witness all testing. The County shall be notified at least two (2) days in advance of the testing.

C. Any faulty conditions and/or shortcomings found during the testing shall be corrected at no cost to the County. However, a retest to demonstrate compliance shall be conducted before any hook-ups or terminations are made. Any such requisite retesting shall be witnessed by an authorized representative(s) of the County.

3.03 GUARANTEES AND WARRANTIES

A. The Contractor shall guarantee and warrant all materials and labor provided under this Section in accordance with Section 01740 and Section 16050 of these Specifications.

END OF SECTION

SECTION 16134 EXPANSION DEFLECTION FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install conduit expansion and deflection fittings.

B. Related Sections:

1. Section 16050, General Provisions for Electrical Systems.
2. Section 16110, Conduits and Fittings.
3. Section 16505, Hangers and Supports for Electrical Systems.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. UL 514B, Conduit, Tubing, and Cable Fittings.
2. UL 467, Grounding and Bonding Equipment.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:

1. NEC Article 300, Wiring Methods.

1.04 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Shop Drawings:

a. Listing of locations where fittings are required.

2. Product Data:

a. Manufacturer's literature and technical information for expansion and deflection fittings proposed for use.

PART 2 PRODUCTS

2.01 MATERIALS

A. Products and Manufacturers: Provide one of the following:

1. Type DX for expansion/deflection or AX for expansion only, by O-Z Gedney Company.
2. Type XD for expansion/deflection or XJ for expansion only, by Crouse Hinds Company.
3. Type DF for expansion/deflection or XJ for expansion only, by Appleton Electric Company.
4. Or equal.

B. Cast gray iron alloy or bronze end couplings, malleable iron, or hot-dipped galvanized body, stainless steel clamps and tinned copper braid bonding jumper. Fitting shall be watertight, corrosion-resistant, UL-listed, and compatible with the conduit system.

C. Features:

1. Expansion/Deflection Fittings:

a. Axial expansion or contraction up to 3/4-inch.
b. Angular misalignment up to 30 degrees.
c. Parallel misalignment up to 3/4-inch.

2. Expansion Fittings:

a. Expansion/Contraction: Eight-inch total movement.

D. Expansion/Deflection fittings shall comply with UL 514B and UL 467.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which the Work will be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install fittings in accordance with NEC, ANSI or local Laws and Regulations.

B. Provide expansion fittings on exposed conduit runs crossing structural expansion joints and where necessary to compensate for thermal expansion and contraction. Provide expansion fittings on exposed conduit runs exceeding 200 feet.

C. Provide expansion/deflection fittings on embedded conduit runs crossing structural expansion joints. Provide fittings above waterstops.

D. Unless specifically shown or indicated otherwise, when crossing structural expansion joints larger than one inch, provide expansion fitting together with expansion/ deflection fitting. Install fittings on each conduit run in accordance with manufacturer's recommendations to accommodate additional movement necessary.

E. Provide expansion/deflection fittings for underground conduit runs at penetrations of buildings, manholes, handholes, and outdoor concrete equipment pads.

F. Where required in non-metallic conduit and duct systems, provide rigid metal conduit nipples and metal rigid-to-PVC adapters for connection to fittings. Ensure that joints exposed to water or other liquid are made watertight.

END OF SECTION

SECTION 16135 PULL, JUNCTION AND TERMINAL BOXES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install pull, junction, and terminal boxes.

B. Related Sections:

1. Section 16050, General Provisions for Electrical Systems.
2. Section 16075, Identification for Electrical Systems.
3. Section 16505, Hangers and Supports for Electrical Systems.

1.02 REFERENCES

A. Standards referenced in this Section are.

1. AASHTO, Standard Specifications for Highway Bridges.
2. UL 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. NEC Article 314, Outlet, Device, Pull and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures.

1.04 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Product Data:

a. Manufacturer's technical information for pull, junction, and terminal boxes proposed for use.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pull, Junction, and Terminal Boxes:

1. General – Applicable to All Boxes:

a. Description and Performance Criteria:

1) Provide pull, junction, and terminal boxes rated at not less than NEMA 12. Boxes shall be appropriate for each location in accordance with NEMA requirements and as required for area classifications specified in NFPA 820 and contract drawings.
2) For flush-mounted pullboxes in slabs or pavement potentially subject to vehicular traffic, boxes and covers shall be constructed for H-20 loading in accordance with AASHTO Standard Specifications for Highway Bridges.

b. Manufacturers: Provide products of one of the following:

1) Appleton Electric Company.
2) Crouse-Hinds Company.
3) Hoffman Engineering Company.
4) Or equal.

c. Materials: Pull boxes embedded in concrete slabs shall be cast iron.
d. Terminal strips and terminal blocks in terminal boxes shall be mounted on terminal box sub-panels.
e. Identification: Boxes shall be identified in accordance with Section 16075, Identification for Electrical Systems.

2. Materials and Construction – Dusty Locations:

a. Material: Welded and galvanized sheet steel of USS gage.
b. Gasket: Oil-resistant gasket.
c. Access: Lift-off hinges and quick-release latches.
d. Material Thickness:

1) Boxes with dimension two feet and smaller shall be 14-gage.
2) Boxes with dimension between two and three feet shall be 12 gage.
3) Boxes with dimension of three feet or more in any direction shall be 10-gage.

3. Materials and Construction - Wet, Corrosive, or Hazardous Locations:

a. Rating:

1) Pull boxes in wet, corrosive, or outdoor areas shall be NEMA 4X.
2) Boxes for areas classified as hazardous locations, where required by NEC, shall be explosion-proof and comply with

UL 886.

b. Material:

1) Cast gray iron alloy with hot-dip galvanized finish, or cast malleable iron bodies and covers.
2) Large boxes not generally available in cast iron construction shall be copper-free aluminum alloy or Type 316 stainless steel, as required by location.
3) In corrosive locations, where the conduit system is PVC-coated, boxes shall be cast metal with factory-applied 40-mil PVC coating, Type 316 stainless steel, or non-metallic thermoplastic or fiberglass reinforced plastic material.

c. Gasket:

1) Provide neoprene gaskets for wet and corrosive locations.
2) Gaskets shall be an approved type designed for the purpose. Improvised gaskets are not acceptable.

d. Access: Stainless steel cover bolts.

e. Features:

1) External mounting lugs.
2) Drilled and tapped conduit holes.
3) Boxes where conduits enter building or structure below grade shall have 1/4-inch drain hole at bottom of the box.
4) Provide threaded connections for explosion proof boxes.

B. Terminal Blocks:

1. Products and Manufacturers: Provide one of the following:

a. Allen-Bradley Company, Bulletin, Model 1492.
b. General Electric Company, Model CR151K.
c. Or Approved equal.

2. Material and Construction:

a. NEMA-rated nylon modular terminal blocks.
b. 600-volt rated.
c. Control and alarm circuit terminals shall be screwed type with permanently affixed numeric identifiers beside each connection.
d. Power terminals shall be copper and rated for the circuit ampacity.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work.

Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Mount boxes so that sufficient access and working space is provided and maintain clearance of not less than 1/4-inch from walls.

B. Securely fasten boxes to walls or other structural surfaces on which boxes are mounted. Provide independent supports that comply with Section 16505, Hangers and Supports for Electrical Systems, where boxes will not be mounted on walls or other structural surface.

C. Install pull boxes where shown or indicated, and provide pull boxes where one or more of the following conditions exist:

1. Conduit runs containing more than 270-degrees of raceway bend.
2. Conduit runs exceeding 200 feet in length.

D. Provide removable, flame-retardant, insulating cable supports in boxes with any dimension exceeding three feet.

E. Field-apply PVC touch-up to scratched PVC boxes damaged during installation. Touch-up work shall be in accordance with manufacturer's recommendations and instructions.

F. Size junction, pull, and terminal boxes in accordance with NEC Article 314 and manufacturer guidelines.

G. Provide terminal blocks in boxes where shown and where cable terminations or splices are required.

END OF SECTION

SECTION 16136 OUTLET BOXES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install outlet boxes for mounting wiring devices and lighting fixtures.

B. Related Sections:

1. Section 16050, Electrical – General Provisions
2. Section 16075, Identification for Electrical Systems.
3. Section 16141, Low-Voltage Receptacles.
4. Section 16142, Snap Switches.
5. Section 16505, Hangers and Supports for Electrical Systems.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:

1. NEC Article 314, Outlet, Device, Pull and Junction Boxes; Fittings; and Handhole Enclosures.
2. NEC Article 501, Class I locations.
3. UL 514A, Metallic Outlet Boxes.
4. UL 514B, Fittings for Conduit and Outlet Boxes.

1.03 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Product Data:

a. Manufacturer's technical information for outlet boxes proposed for use.

PART 2 PRODUCTS

2.01 MATERIALS

A. Device Boxes:

1. Manufacturers: Provide products of one of the following:

a. Crouse-Hinds Company.
b. Appleton Electric Company.
c. Or equal.

2. Material:

a. In Wet Locations: Cast gray iron alloy or cast malleable iron with zinc electroplate finish, or aluminum bodies consistent with conduit material.
b. In Dusty Locations: Zinc-coated sheet steel or aluminum bodies consistent with conduit material.
c. Where conduit is installed concealed, boxes shall include suitable extension rings and covers, as required.
d. Where used with PVC-coated conduit system, boxes shall include factory applied 40-mil-thick PVC coating.
e. Cast boxes shall be hub-type and include external mounting lugs.
f. Metallic outlet boxes shall comply with UL 514A.
g. Fittings for outlet boxes shall comply with UL 514B.

3. NEMA rating of box shall be as required for area classifications specified in Section 16050, General Provisions for Electrical Systems.

4. Cover Plates:

a. Type 302 stainless steel alloy for indoor finished areas.
b. Plates in corrosive locations shall include factory-applied 40-mil PVC coating.
c. Stainless steel screws and hardware.
d. For receptacle and switch cover plates, comply with Section 16141, Low-Voltage Receptacles, and Section 16142, Snap Switches.

B. Flexible Fixture Hangers:

1. For Class I, Division 1 Hazardous Areas:

a. Product and Manufacturers: Provide one of the following:

1) Type EFH by Crouse-Hinds.
2) Or equal

b. Materials:

1) Iron alloy with electro-galvanizing and aluminum acrylic paint.
2) Products shall have brass bellows and stainless-steel spring.
3) Product shall be capable of 15-degree swing from perpendicular in all directions.
4) Product shall allow fixtures to be pendant-hung in accordance with NEC Article 501.130(A)

2. For Class I, Division 2 Hazardous Areas:

a. Product and Manufacturers: Provide one of the following:

1) Type AHG by Crouse-Hinds.
2) Or Approved equal

b. Materials:

1) Malleable iron top section and removable malleable iron bottom fixture support assembly with electro-galvanizing and aluminum acrylic paint.
2) Include vapor-tight cushion to support fixture stem.
3) Provide neoprene diaphragm to exclude moisture and dirt from conduit system.
4) Provide with manufacturer's neoprene gasket between fixture hanger and box.
5) Product shall be capable of eight-degree swing from perpendicular in all directions, before and after coating.
6) Product shall allow fixtures to be pendant-hung in accordance with NEC Article 501.130 (B).

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Fasten boxes rigidly and neatly to supporting structures.

B. Securely fasten equipment to walls or other surfaces on which materials or equipment is mounted. Provide independent supports complying with Section 16505 Hangers and Supports for Electrical Systems, where boxes are not mounted on walls or other surface capable of supporting the materials or equipment.

C. For units mounted on masonry or concrete walls, provide suitable 1/2-inch spacers to prevent mounting back of box directly against wall.

D. Leave no open conduit holes in boxes. Close unused openings with capped bushings.

E. Label each circuit in boxes and identify each circuit in accordance with Section 16075, Identification for Electrical Systems.

F. Install outlet boxes in accordance with NEC Article 314.

END OF SECTION

SECTION 16137 UNDERGROUND DUCTBANKS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install underground ductbanks.

B. Coordination:

1. Ductbank routing on the Drawings is diagrammatic. Coordinate installation with piping and other underground facilities and locate ductbanks clear of interferences.
2. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before underground ductbank Work.
3. Notify other contractors in advance of installing underground ductbanks to provide other contractors with sufficient time for installing items included in their contracts that will be installed with or before underground ductbank Work.

C. Related Sections:

1. Section 02220, 02221, Excavations, Trenching and Backfilling
2. Section 03300, Cast-in-Place Concrete.
3. Section 16075, Identification for Electrical Systems.
4. Section 16110, Conduits and Fittings
5. Section 16134, Expansion/Deflection Fittings.
6. Section 16450, Grounding and Bonding for Electrical Systems

1.02 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Shop Drawings:

a. Layouts showing proposed routing of ductbanks and locations of manholes, handholes, and areas of reinforcement.
b. Profiles of ductbanks showing crossings with piping and other underground facilities.
c. Typical cross sections for each ductbank.

E. Informational Submittals: Submit the following:

1. Special Procedure Submittals:

a. Installation procedures.

2. Field Quality Control Submittals:

a. Field test report.

F. Closeout Submittals: Submit the following:

1. Record Drawings:

a. Include actual routing of underground ductbank runs on record documents in accordance with Section 01720, Project Record Documents.

PART 2 PRODUCTS

2.01 MATERIALS

A. Duct: Provide conduit and fittings in accordance with Section 16110, Conduits and Fittings. Conduit types shall be as follows:

1. Schedule 40 PVC conduits for steel reinforced concrete ductbanks.
2. Schedule 80 PVC conduits for direct buried ductbanks.

B. Backfill: Provide backfill, including select backfill, in accordance with Section 02221.

C. Reinforcing: Provide Ductbank reinforcing in accordance with Section 03300, Cast in Place Concrete.

D. Concrete: Provide ductbank concrete in accordance with Section 03300, Cast-in-Place Concrete.

E. Grounding: Provide ground cable in accordance with Section 16450, Grounding and Bonding for Electrical Systems.

F. Conduit Spacers: Conduit spacers shall be nonmetallic, interlocking type to maintain spacing between conduits. Provide spacers suitable for all conduit types used in multiple sizes. Carlon or approved equal.

G. Duct Sealing Compound:

1. Products and Manufacturers: Provide one of the following:

a. 0-Z/Gedney, Type DUX.
b. Or approved equal.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Excavation and Backfilling:

1. Provide excavation and backfilling for ductbank installation in accordance with Section 02221.
2. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material, or other materials that can damage or contribute to corrosion of ducts or cables, or prevent adequate compaction of backfill.

B. Ductbank Layout:

1. Top of ductbank concrete shall be a minimum of 2.0 feet below grade, unless shown or indicated otherwise on the Contract Drawings or Engineer approved.
2. Slope ductbank runs for drainage toward manholes and away from buildings with slope of approximately 3 inches vertical per 100 feet of run.

C. Ductbank Assembly:

1. Assemble ductbanks using non-magnetic saddles, conduit saddles by Carlon or approved equal every six feet. Saddle to provide minimum two-inch concrete separation between outer surfaces of each conduit. Provide side forms for each ductbank.
2. Make bends with sweeps of not less than 4 foot radius or 5.0 degree angle couplings.

D. Concrete Placing:

1. Provide minimum 4 inch concrete covering on each side, top, and bottom of concrete envelopes around conduits. Concrete covering shall be as shown or indicated on the Contract Drawings.
2. Provide red dye in concrete for easy identification during subsequent excavation; all concrete in entire ductbank, including top and bottom, shall be dyed.
3. Firmly fix conduits in place during concrete placing. Carefully place and vibrate concrete to fill spaces between conduits.

E. Conduit Transitions:

1. Conduit installations shall be watertight throughout entire length of ductbank.

2. Transition from non-metallic to rigid aluminum conduit where ductbanks enter structure walls and slabs.
3. Terminate conduits with insulated grounding bushings.
4. Continue conduits inside buildings in accordance with Section 16110, Rigid Conduits, and as shown or indicated in the Contract Documents.
5. If ducts are not concrete-encased, provide expansion and deflection fittings in accordance with Section 16134, Expansion/Deflection Fittings.
6. Plug and seal empty spare conduits entering structures. Conduits in use entering structures shall be sealed watertight with duct sealing compound.

F. Ductbank Reinforcing:

1. Provide reinforcing for all ductbanks:
2. Install ductbank reinforcement as shown or indicated on the Contract Drawings.
3. Provide minimum of 2 inches and maximum clearance of 4 inches from bars to edge of concrete encasement.

G. Connections to Structures:

1. Firmly anchor ductbanks to structure walls or slabs. Epoxy-grout ductbank rebar into structure concrete to eliminate sheer forces between ductbank and structure wall concrete.
2. Ductbank penetrations through structure walls shall be watertight.

H. Grounding:

1. Provide bare stranded copper ductbank ground cable in each ductbank envelope. Make ground electrically continuous throughout entire ductbank system.
2. Connect ground cable to building and station ground grid or to equipment ground buses. Also, connect ground cable to steel conduit extensions of underground ductbank system.
3. Provide ground clamp and bonding of each steel conduit extension to maintain continuity of ground system.
4. Terminate ground cable at last manhole or handhole for outlying structures.

H. Detectable Underground Warning Tape:

1. Provide detectable underground warning tapes complying with Section 16075, Identification for Electrical Systems, over the full length of each underground ductbank.
2. Install warning tapes approximately 12 inches below grade.
3. Provide multiple tapes across the width of each ductbank. Locate center of a warning tape above each edge of ductbank, and at intervals across top width of ductbank so that clear space between tapes does not exceed 6 inches.

J. Reused Existing Ducts:

1. Pull rag swab through duct to remove water and to clean conduits prior to installing new cable.
2. Repeat swabbing until all foreign material is removed.
3. Pull mandrel through duct, if necessary, to remove obstructions.

K. Conduit Spacing

1. Provide PVC or Nylon conduit spacers minimum 6 feet apart in all ductbanks.
2. Do not use metal tie raps to hold conduit in place. Use only nylon tie raps for anchoring of conduit in ductbank.

END OF SECTION

SECTION 16139 CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install cable trays.

B. Coordination:

1. Coordinate installation of cable trays with piping, ductwork, lighting fixtures and other systems and equipment. Locate cable trays clear of interferences.
2. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before cable tray Work.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. NEMA VE 1, Metal Cable Tray Systems.
2. ANSI / ASQC Q9001-2000 (ISO 9001 Compliant)
3. ASME NQA-1-2004
4. ANSI N45.2

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with electrical code in effect at the Site and the following:

1. NEC Article 392, Cable Trays.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:

1. Product Data:

a. Manufacturer's technical information for cable tray materials and system proposed for use.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers: Provide products of one of the following:

1. B-Line Series 46 by Eaton
2. Series 7D64 Cope Cable Tray Systems
3. Or approved equal

B. Cable Tray System:

1. Type: Ventilated bottom cover, rungs welded to side rails.
2. Material: Aluminum.
3. Rung Spacing: Nine inches on centers.
4. Inside Depth: Six inches or as otherwise shown or indicated.
5. Radius: Six inches to two feet as shown, indicated, or required.
6. Width: Six inches to three feet as shown, indicated, or required.
7. Support Span: Not to exceed twenty feet, unless otherwise shown or indicated by manufacturer.
8. Loading Capacity: NEMA 20C minimum. 100lbs/ft @ 20' span,
9. Splice plates shall be the bolted type made as indicated below for each tray type. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray. Hardware shall be Type 316 stainless. Minimum
10. Cable tray system shall comply with NEC Article 392 and NEMA VE1.
11. Cable Tray Conduit Clamps: Furnish as required, as follows:

    a. Non-corrosive Locations: Provide B-Line Catalog Number 9ZN-1158, or equal.
    b. Corrosive Locations: Provide B-Line Catalog Number 9F Series non-metallic, or equal

12. Cable tray supports: Shall be placed so that the support spans do not exceed maximum span indicated on drawings of manufactures recommendations. Refer to drawing details for supports.
13. Barrier Strips: Provide full length dividers to separate 480V, 120V, 24V and analog cables. At horizontal tee and cross intersections, cable runs that are separated with a standard Barrier Strip should be separated vertically and with a solid barrier. The construction of the vertical separation shall include raised sides to retain the top layer(s) of cable, slots for attachment of cable ties, and smooth edges to protect cable jackets.
14. Accessories - special accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, etc.
15. Cable Tray Covers:
    Indoors – Vented covers with standard cover clamp. Spaced 4' max
    Outdoors – Vented with heavy duty rap around cover clamps. Spaced 2' max per cover.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Installation, General:

1. Install cable trays in accordance with Laws and Regulations, and manufacturer's instructions and recommendations. Provide complete cable tray system prior to installing cables.
2. Install cable trays exposed and in accessible locations.
3. Ground cable tray system components.
4. Where required, connect conduit to cable tray using cable tray conduit clamps.
5. Divided cable runs shall be kept separate at horizontal intersections with a solid barrier. Provide barrier strips in cable trays to isolate instrumentation and communication cables from 120VAC and greater power and control wiring.

3.03 TESTING

A. Test cable trays to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance.

END OF SECTION

SECTION 16141 LOW VOLTAGE RECEPTACLES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install low-voltage receptacles.

B. Related Sections:

1. Section 16050, General Provisions for Electrical Systems.
2. Section 16075, Identification for Electrical Systems.
3. Section 16136, Outlet Boxes.

A. Standards referenced in this Section are:

1. UL 498, Standard for Attachment Plugs and Receptacles.
2. UL 514D, Cover Plates for Flush-Mounted Wiring Devices.
3. UL 943, Standard for Ground-Fault Circuit-Interrupters.
4. UL 1010, Standard for Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.
5. UL 1449, Standard for Surge Protective Devices.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:

1. Americans with Disabilities Act.
2. NEC Article 406, Receptacles, Cord Connectors, and Attachment Plugs (Caps).

1.03 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Product Data: Manufacturer's technical information for receptacles and cover plates proposed for use.

PART 2 PRODUCTS

2.01 MATERIALS

A. Receptacles:

1. Grounding receptacle, 2-pole, 3-wire, NEMA 5-20R configuration, ivory color.

    a. Single:

        1) Products and Manufacturers: Provide one of the following:

            a) HBL5361I by Hubbell, Inc.
            b) 5361-I by Pass & Seymour.
            c) Or equal.

    b. Duplex:

        1) Products and Manufacturers: Provide one of the following:

            a) HBL5362I by Hubbell, Inc.
            b) PS5362-I by Pass & Seymour.
            c) Or equal.

    c. Weather-resistant Duplex:

        1) UL-listed as weather-resistant.
        2) Products and Manufacturers: Provide one of the following:

            a) HBL5362IWR by Hubbell, Inc.
            b) WR5362-I by Pass & Seymour.
            c) Or equal.

2. Corrosion-resistant grounding receptacle, 2-pole, 3-wire, yellow color.

    a. Single, 125-volt, 20 ampere, NEMA 5-20R configuration:

        1) Products and Manufacturers: Provide one of the following:

            a) HBL53CM61 by Hubbell, Inc.
            b) CR6301 by Pass & Seymour.
            c) Or equal.

    b. Duplex, 125-volt, 20 ampere, NEMA 5-20R configuration:

        1) Products and Manufacturers: Provide one of the following:
            a) HBL53CM62 by Hubbell, Inc.
            b) CR6300 by Pass & Seymour.
            c) Or equal.

    c. Single, 125-volt, 30 ampere, NEMA 5-30 configuration:

1) Products and Manufacturers: Provide one of the following:

a) HBL9308 by Hubbell, Inc.
b) 3802 by Pass & Seymour.
c) Or equal.

2. Grounding receptacle, 2-pole, 3-wire, 250-volt, 20 ampere, NEMA 6-20 configuration, brown color.

a. Single:

1) Products and Manufacturers: Provide one of the following:

a) HBL5461 by Hubbell, Inc.
b) 5871 by Pass & Seymour.
c) Or equal.

b. Duplex:

1) Products and Manufacturers: Provide one of the following:
a) HBL5462 by Hubbell, Inc.
b) 5862 by Pass & Seymour.
c) Or equal.

4. Provide Type 302 stainless steel cover-plate conforming to UL 514D. Provide weatherproof-while-in-use cover where shown on the Contract Drawings as “WP” or “WPU”, and provide where receptacles are located in wet or corrosive location.
5. Receptacles shall comply with UL 498.

E. Receptacles for Hazardous Locations:

1. Material: Factory-sealed receptacle suitable for installation in Class I, Group D hazardous locations. Copper-free aluminum receptacle and cover with cast gray iron alloy or cast malleable iron mounting box with zinc electroplate finish. Receptacle rated at 20 amperes, 125 to 250 volts AC, 2-wire, and 3-pole. Provide matching plug for each receptacle.
2. Receptacles for hazardous locations shall conform to UL 1010.
3. Products and Manufacturers: Provide one of the following:

a. Series CPS by Crouse-Hinds Company.
b. Type CPS by Appleton Electric Company.
c. Or equal.

F. Ground Fault Interrupting Receptacles:

1. Duplex grounding receptacle, 2-pole, 3-wire, NEMA 5-20R configuration, 125-volt AC, 20 amperes, gray color with ground fault circuit interrupting (GFCI) protection.

2. Ground fault interrupting receptacles shall comply with UL 943.
3. Provide Type 302 stainless steel cover-plate conforming to UL 514D. Provide weatherproof-while-in-use cover where shown on the Contract Drawings as “WP” or “WPU”, and provide where located in wet or corrosive location.

4. Products and Manufacturers: Provide one of the following:

    a. GFR5362SGY by Hubbell, Inc.
    b. 2091-GRY by Pass & Seymour.
    c. Or equal.

5. Weather-resistant Ground Fault Interrupting Receptacles

    a. Products and Manufacturers: Provide one of the following:

        1) 2095TRWRGRY by Pass & Seymour.
        2) Or equal.

C. Surge Suppression Receptacles:

1. Duplex grounding, surge suppression receptacle, two-pole, three-wire, NEMA 5-20R configuration 125-volt AC, 20 amperes, blue color, capable of absorbing transient surge of 6,000 volts minimum. Receptacle shall include power-on indicator light.
2. Surge suppression receptacles shall comply with UL 1449.
3. Provide Type 302 stainless steel cover-plate conforming to UL 514D. Provide weatherproof-while-in-use cover when shown on the Drawings as “WP” or “WPU”, and provide where located in a wet or corrosive location.
4. Products and Manufacturers: Provide one of the following:

    a. HBL5362SA by Hubbell, Inc.
    b. 5362BLSP by Pass & Seymour.
    c. 5380-GY by Leviton Manufacturing Company.
    d. Or equal.

E. Weatherproof Covers:

1. Where receptacles are installed in damp locations as defined in area classification portion of Section 16050, General Provisions for Electrical Systems, provide receptacles as specified in Paragraphs 2.1.A through 2.1.D of this Section, as applicable, with weatherproof covers as specified below.
2. Provide covers that are UL-listed weatherproof and suitable for use in damp locations in accordance with NEC 406.
3. Material:

    a. Gasketed spring door type for wet and corrosive locations. Plates in corrosive locations shall have factory-applied 40-mil PVC coating.
    b. Stainless steel screws and hardware.

4. Products and Manufacturers: Provide one of the following:

    a. Hubbell, Inc.
    b. Crouse-Hinds Company.
    c. Appleton Electric Company.
    d. Or equal.

F. Weatherproof-While-in-Use Covers:

1. Where receptacles are shown on the Contract Drawings as “WP” or “WPU”, and where receptacles are installed in wet locations as defined in area classification portion of Section 16050, General Provisions for Electrical Systems, provide receptacles as specified in Paragraphs 2.1.A through 2.1.D of this Section, as applicable, with weatherproof-while-in-use covers as specified below.

2. Provide covers that are UL-listed, weatherproof while receptacle is in use, and are of ultraviolet-resistant construction suitable for outdoor use in accordance with NEC 406.

3. Material:

    a. Non-metallic box with hinged, non-metallic cover.
    b. Sealing gaskets between box and cover.
    c. Stainless steel screws and hardware.
    d. Color: Gray finish

4. Products and Manufacturers: Provide one of the following:

    a. TayMac Corporation.
    b. Pass and Seymour Type WIU
    c. Or equal.

G. Power Receptacles: 480-volt interlocked receptacle with enclosed safety switch service outlet. Provide service outlets, quantity as shown or indicated, for portable equipment.

1. Material: Copper-free aluminum enclosures with operating handle NEMA 4, with gasketed, hinged door.
2. Switch: Heavy duty, 3-pole, with visible blades, quick make-a-break mechanism with reinforced, positive-pressure-type blade and fuse clips. Switch shall be mechanically interlocked with receptacle. Switch cannot be closed until plug is fully inserted and plug cannot be withdrawn or inserted unless switch is open.
3. Receptacle: Single ground receptacle, 3-wire, 4-pole, 600-volt, (--1--) amp. Provide 2 matching plugs.

    a. Products and Manufacturers: Provide one of the following:

        1) Type WSR, and Type APS plugs by Crouse-Hinds Company.
        2) Or equal.

H. Power and Special Receptacles: Provide receptacles with number of poles and voltage and current rating as shown or indicated. Coordinate with equipment plugs. Provide matching plug for each receptacle.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Non-hazardous Locations: Install receptacles at locations shown, in outlet or device boxes in accordance with Section 16136, Outlet Boxes.

B. Hazardous Locations: Install receptacles in rigid metallic conduit systems.

C. Install receptacles with ground pole in the down position.

D. Mount receptacles 18 inches above finished floor in non-hazardous locations and 4.5 feet above finished floor in hazardous locations, in accordance with the Americans with Disability Act, unless otherwise shown or indicated in the Contract Documents.

E. Mount receptacles 18 inches above finished floor in non-hazardous locations and 4.5 feet above finished floor in hazardous locations, unless otherwise shown or indicated in the Contract Documents.

F. Install in conformance with NEC Laws and Regulations.

G. Identification:

1. Identify each conductor with circuit number and lighting panel number in accordance with Section 16075, Identification for Electrical Systems.
2. Identify each receptacle with permanent phenolic tag. Tags shall include circuit number and lighting panel number.

END OF SECTION

SECTION 16142 SNAP SWITCHES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install snap switches for lighting and other systems.

B. Related Sections:

1. Section 16075, Identification for Electrical Systems
2. Section 16136, Outlet Boxes.

1.02 REFERENCES

A. Standards referenced in this Section are listed below:

1. UL 20, General Use Snap Switches.
2. UL 894, Switches for Use in Hazardous (Classified) Locations.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements

1. Americans with Disabilities Act

1.04 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Product Data: Manufacturer's technical information for switches proposed for use.

PART 2 PRODUCTS

2.01 MATERIALS

A. Switches for Non-Hazardous Locations:

1. Single pole AC toggle switch, quiet type, 120/277-volt AC, 20 amperes, Ivory, specification grade.

a. Products and Manufacturers: Provide one of the following:

1) Catalog No. 1221-I, by Harvey Hubbel, Inc.
2) Catalog No. 1991-I, by Arrow-Hart, Inc.
3) Catalog No. 20AC1-I, by Pass & Seymour
4) Or equal.

2. Single pole, three-way AC toggle switch, quiet type, 120/277-volt AC, 20 amperes, Ivory, specification grade.

a. Products and Manufacturers: Provide one of the following:

1) Catalog No. 1223-I, by Harvey Hubbell, Inc.
2) Catalog No. 1993-I, by Arrow-Hart, Inc.
3) Catalog No. 20AC3-I, by Pass & Seymour
4) Or equal.

3. Two-pole AC toggle switch, quiet type, 120/277-volt AC, 20 amperes, Ivory, specification grade.

a. Products and Manufacturers: Provide one of the following:

1) Catalog No. 1222-I, by Harvey Hubbel, Inc.
2) Catalog No. 1992-I, by Arrow-Hart, Inc.
3) Catalog No. 20AC2-I, by Pass & Seymour
4) Or equal.

4. Switches in non-hazardous areas shall be UL-listed in accordance with UL 20.

B. Switches for Hazardous Locations:

1. Material: Factory sealed tumbler switch suitable for installation in Class I, Group D hazardous locations. Cast gray iron alloy or cast malleable iron body and cover with zinc electroplate finish. Switch rated at 20 amperes, 120/277-volt AC.
2. Switches in hazardous areas shall be UL-listed in accordance with UL 894.

3. Products and Manufacturers: Provide one of the following:

a. Series EDS by Crouse-Hinds Company.
b. Type EDS by Appleton Electric Company.
c. Or equal.

C. Switch Covers:

1. Indoor covers shall be Type 304 stainless steel.
2. Outdoor, wet, or corrosive location covers shall be weatherproof and corrosion resistant.

D. Key Operated On-Off Switches:

1. Key operated switches shall be complete with legend plate and NEMA 4 enclosure and two keys for each switch.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install switches at locations as shown or indicated in the Contract Documents in outlet or device boxes, in accordance with Section 13136, Outlet Boxes.

B. Mount wall switches 4.0 feet above finished floor, and in accordance with the Americans with Disability Act, unless otherwise noted.

C. Identify each conductor with circuit number and lighting panel number. Identification shall be in accordance with Section 16075, Identification for Electrical Systems.

END OF SECTION

SECTION 16143 DISCONNECT SWITCHES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install disconnect switches.

B. Related Sections:

1. Section 16050, General Provisions for Electrical Systems.
2. Section 16075, Identification for Electrical Systems.
3. Section 16142, Snap Switches.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. UL 98, Enclosed and Dead-Front Switches.
2. NEMA KS 1, Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
3. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. NEC Article 404, Switches.
2. Disconnect switches shall bear the UL label.

1.04 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Shop Drawings:

a. Listing of each switch to be furnished, including location, rating, and NEMA enclosure type for each.

2. Product Data:

a. Manufacturer's technical information for disconnect switches proposed for use.

B. Maintenance Material Submittals: Submit the following:

1. Extra Stock Materials:

a. Furnish one set of spare fuses for each fused disconnect switch to be installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Provide products of one of the following:

1. Square-D Company.
2. Eaton/Cutler Hammer.
3. Siemens.
4. Or approved Equal

2.02 MATERIALS

A. Service Disconnect Switches:

1. Type: Fused, heavy-duty, single throw, quick-make, quick-break mechanism, visible blades in "OFF" position and safety handle.
2. Rating: Voltage, current and short circuit ratings and number of poles as shown or indicated on the Contract Drawings. Switch shall bear UL label indicating suitability for use as service equipment and shall comply with UL 98, NEMA KS 1, and NEMA 250.

B. Single Throw, Circuit Disconnect Switches:

1. Type: Fused or unfused, horsepower rated, heavy-duty, single throw, quick- make, quick-break mechanism, visible blades in the "OFF" position and safety handle.
2. Rating: Voltage and current ratings and number of poles as required for motor or equipment circuits being disconnected. Switches shall bear a UL label and shall comply with the requirements of UL 98, NEMA KS 1 and NEMA 250.

C. Double Throw Safety Switches:

1. Type: Unfused, double throw with center "OFF" position, quick-make, quick-break mechanism, visible blades in the "OFF" position, and safety handle.
2. Rating: Voltage and current ratings and number of poles as required for circuits being disconnected. Switches shall bear UL label and shall comply with UL 98, NEMA KS 1, and NEMA 250.

D. Disconnect Switches for 120-volt, Single-phase Circuits:

1. Refer to Section 16142, Snap Switches.

E. Enclosures: NEMA rating shall be as required for area classifications specified in Section 16050, General Provisions for Electrical Systems or as shown on drawings.

F. Identification:

1. Identify enclosures in accordance with Section 16075, Identification for Electrical Systems.
2. Provide nameplate to identify the equipment served by disconnect switch and associated source of power.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed Install equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.

B. Securely fasten equipment to walls or other structural supports on which they are mounted. Provide independent stainless steel supports where no wall or other structural surface exists. Mount disconnect enclosures at a height not exceeding six feet.

C. Provide suitable 1/4-inch spacers to prevent mounting enclosure directly against walls with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.

B. Securely fasten equipment to walls or other structural supports on which they are mounted. Provide independent stainless steel supports where no wall or other structural surface exists. Mount disconnect enclosures at a height not exceeding six feet.

C. Provide suitable 1/4-inch spacers to prevent mounting enclosure directly against walls.

END OF SECTION

SECTION 16160 PANELBOARDS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install panelboards. Panels to be part of an integrated system of transformer and panelboards unless otherwise shown.

B. Related Sections:

1. Section 16050, Electrical – General Provisions
2. Section 16075, Identification for Electrical Systems
3. Section 16271, Dry Type Low Voltage Distribution Transformers
4. Section 16289, Surge Protective Devices

1.02 REFERENCES

A. Standards referenced in this Section are:

1. NEMA PB 1, Panelboards.
2. UL 67, Panelboards

1.03 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

1. Shop Drawings: Listing of panelboards to be furnished with identification of their proposed location, and all electrical characteristics, including number and rating of branch circuit breakers and enclosure type.

2. Product Data: Manufacturer's technical information for panelboards proposed for use, including product literature and specifications. Indicate options and features to be provided.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements; Comply with the following:

1. NEC Article 408, Switchboards and Panelboards.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Packing:

a. Inspect prior to packing to assure that assemblies and components are complete and undamaged.
b. Protect mating connections.
c. Cover all openings into enclosures with-vapor inhibiting, water-repellent material.

2. Deliver materials and equipment to Site to ensure uninterrupted progress of the Work. Deliver anchorage materials to be embedded in concrete in ample time to prevent delaying the Work. Upon deliver, check materials and equipment for evidence of water that may have entered equipment during transit.
3. Comply with Div. 1, Product Delivery Requirements.

B. Storage and Protection:

1. Store panelboards in a clean, dry location with environmental controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.

PART 2 PRODUCTS

2.01 RATING

A. All panelboards shall be rated for the intended voltage, current, number of phases, number of wires and number of poles as shown or indicated on the Contract Drawings.

B. Panelboards shall be U.L. listed.

2.03 CONSTRUCTION

A. General Panelboard Requirements

1. Interiors

a. Interiors shall be completely factory assembled with main breakers, bus bars, branch circuit breakers, wire connectors, etc.
b. All wire connectors, except screw terminals, shall be of the anti-turn solderless type.
c. All wire connectors shall be suitable for use with copper wires of the size(s) indicated on the Contract Drawings.
d. Branch circuits shall be arranged using double row construction except where narrow column panels are called for on the Contract Drawings.
e. Branch circuits shall be numbered by the panelboard manufacturer.
f. Interiors shall be so designed that circuits may be changed without machining, drilling or tapping; without disturbing adjacent units; and without removing the main bus connectors.
g. Interiors shall be durably marked by the manufacturer with the voltage, current rating and number of phases for which the panelboards are designed. The markings, which shall be visible after installation without disturbing the interior parts or wiring, shall

also include the manufacturer's name or trademark.

h. All current carrying parts, including cross connectors, shall be copper.

2. Bus Bars

a. The bus bars for the mains shall be sized as shown on the Contract Drawings.
b. Both a full-capacity neutral bus and a separate ground bus shall be provided. Neutral bus bars shall have a suitable lug for each outgoing feeder requiring a neutral connection.
c. Phase bus bars shall be full height without reduction.
d. Bus bar taps for panelboards with single pole branches shall be arranged for sequence phasing of the branch circuit devices.
e. Bus bars shall be braced to conform to industry standards for short circuit stresses in panelboards.

3. Circuit Breakers

a. The panelboards shall be equipped with circuit breakers, main and branch, with trip settings as shown on the Contract Drawings.
b. The circuit breakers shall be of the molded case, bolt-on type with the number of poles as shown on the Contract Drawings.
c. Circuit breakers used in 120/240 Volt and 120/208 Volt panelboards shall have a minimum interrupting rating of 10,000 Amperes RMS symmetrical.
d. Three-pole circuit breakers used in 480 Volt panelboards shall have a minimum interrupting rating of 14,000 Amperes RMS symmetrical.

4. GFCI (Ground Fault Circuit Interrupter)

a. GFCI units shall be provided for all circuits where shown on the Contract Drawings.
b. The GFCI units shall be 1-pole, 120 Volt, molded case, bolt-on circuit breakers incorporating a solid-state ground fault interrupter circuit which shall be insulated and isolated from the breaker mechanism.
c. The GFCI units shall be U.L. listed Class A, Group I devices (5 milliamp sensitivity, 25 millisecond trip time), and shall have an interrupting capacity of 10,000 Amperes RMS symmetrical, unless otherwise noted.

5. Enclosures, Covers and Trim

1. The enclosures shall be of the NEMA Type (1, 3R, 4, 4X, 12), material (code gauge steel, stainless steel, fiberglass), and mounting configuration (flush, surface) as shown on the Contract Drawings.
2. Enclosures shall be of sufficient size to provide a minimum 4-inch gutter space on all sides. At least four (4) interior mounting studs shall be provided for each enclosure. Enclosures shall be furnished without conduit knockouts. Enclosures shall have hinged doors which cover all circuit breaker handles.

3. Stainless steel enclosures and covers shall have a natural metal finish. Enclosures and covers shall be joined together with a concealed piano type stainless steel hinge. Conduit openings in the enclosures shall be field drilled and, if applicable, tapped.
4. Fiberglass enclosures and covers shall be the manufacturer's standard color. Enclosures and covers shall be joined together with a concealed piano type stainless steel hinge. Conduit openings in the enclosures shall be field drilled and, if applicable, tapped.
5. Code gauge steel enclosures and covers shall be galvanized steel finished as per Item 2.03.E.7 below. Enclosures and covers shall be joined together with a concealed piano type hinge. Conduit openings in the enclosures shall be field punched.
6. Code gauge steel enclosures shall have panel trims of code gauge sheet steel. Trims for flush mounted enclosures shall overlap the enclosures by at least 3/4-inch all around. Surface mounted enclosures shall have trims the same height and width as the enclosures. Trims shall be fastened to the enclosures with quarter-turn clamps or screws.
7. All interior and exterior surfaces of the panelboards, enclosures and trims shall be properly cleaned, painted with a rust inhibitor (two coats), and over-coated with ANSI Z55.1, No. 61 light gray paint. The finish paint shall be of a type to which field applied paint will adhere.
8. The inside surface of each cover shall have a directory frame with a transparent cover and a directory card.
9. Covers shall have semi-flush type cylinder locks and catches, except that covers over 48-inches in height shall have vault handles and 3-point catches, complete with lock, arranged to fasten at top, bottom and center. Two (2) keys shall be furnished for each lock and all locks shall be keyed alike.

B. Power Distribution Panelboards:

1. Manufacturers: Provide Products of one of the following:

1. 120/240 Volt and 120/208 Volt panelboards shall be type NQOD with QOB bolt-on circuit breakers as manufactured by Schneider Electric/Square D Company, or approved equal.
2. 480 Volt panelboards shall be the I-Line type as manufactured by Schneider Electric/Square D Company, or approved equal.

C. Lighting Control Panelboards:

1. Manufacturers: Provide products of one of the following:

a. Panelboards designated as including lighting power and control circuitry shall be of the type PowerLink as manufactured by Schneider Electric/Square D Company, or approved equal.

2. General: Unit shall consist of a panelboard with remotely operated circuit breakers, controller, power supply, and other ancillary devices as required for a complete and operational system.

3. Provide outdoor light-level sensor suitable for remote installation in an exposed wet environment. Device shall communicate with controller to provide

D. Integrated Panelboard and Transformer:

1. Products and Manufacturers: Provide products of one of the following:

a. Mini Power Zone by Schneider Electric/Square D Company.
b. Mini Power Center by Eaton/Cutler-Hammer.
c. Panel Tran by Acme Electric Corporation.
d. Or approved alternate.

2. General: Unit shall consist of encapsulated dry type transformer, primary and secondary main circuit breakers, and secondary panelboard all in one enclosure.

3. Transformer Rating: Transformer portion shall comply with Section 16271, Dry-type Low-Voltage Distribution Transformers. KVA, primary voltage, secondary voltage, frequency and number of phases shall be as shown or indicated on the Drawings

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected

3.02 INSTALLATION

A. Surface mounted panelboards shall be installed using spacers so that there is an air space between the enclosure and the mounting surface.

B. Unless otherwise shown on the Contract Drawings, the tops of the enclosures shall be mounted at a height of 6-feet above the floor. The enclosures shall be properly aligned, true-and-square, and shall be adequately supported independently of the connecting conduits.

C. All panelboard wiring shall be neatly formed, grouped, laced, and identified to provide a neat and orderly appearance.

D. The Contractor shall type on the directory card the description/use of each active circuit. "Spare" shall be indicated in erasable pencil!

3.02 TESTS

A. Each individual circuit breaker, including the main breaker and the GFCI breaker(s), shall be tested for proper operation under the appropriate overload/ground fault conditions.

3.03 GUARANTEES AND WARRANTIES

A. The Contractor shall guarantee and warrant all materials and labor provided under this Section in accordance with Section 01740 and Section 16050 of these Specifications.

END OF SECTION

SECTION 16271 DRY-TYPE LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified, and required to furnish and install dry type low-voltage distribution transformers.

B. Related Sections:

1. Section 16050, General Provisions for Electrical Systems.
2. Section 16075, Identification for Electrical Systems.
3. Section 16160, Panelboards.
3. Section 16450, Grounding and Bonding for Electrical Systems.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. NEMA ST-20, Dry Type Transformers for General Applications.
2. NEMA TP-1, Guide for Determining Energy Efficiency for Distribution Transformers.
3. NEMA TP-2, Standard Test Method for Measuring the Energy Consumption for Distribution Transformers.
4. UL 1561, Dry Type General Purpose and Power Transformers.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. NEC Article 450, Transformers and Transformer Vault (Including Secondary Ties).

1.04 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Shop Drawings:

a. Schedule of transformers to be furnished with ratings and other required technical data.

b. Proposed location for each transformer, including pad layout, dimensions, and appurtenances.

2. Product Data:

a. Supplier's technical information for transformers proposed for use.

PART 2 PRODUCTS

2.01 MATERIALS

A. Dry Type Two-Winding Transformer:

1. Type: Dry type, air cooled, low temperature rise. Transformers 15 kVA and larger shall be energy efficient, complying with NEMA TP-1 Class 1 efficiency levels. Transformers less than 15 kVA shall be general purpose.
2. Rating: KVA, primary voltage and connection, secondary voltage and connection, frequency and number of phases shall be as shown on the Drawings.
3. Insulation: Insulation and average winding temperature rise (in a 40 degree C maximum ambient) for rated kVA per the following table. Energy efficient transformers shall be capable of 15 percent continuous overload at 150 degrees C temperature rise.

kVA Rating	Insulation Class (degrees C)	Temperature Rise (degrees C)
1 to 15 kVA	150	80
25 to 500 kVA	180	115

4. Winding Taps, Transformers 15 kVA and Less: Two 5-percent below rated voltage, full capacity taps on primary winding.
5. Winding Taps, Transformers 25 kVA and Larger: Two 2-1/2-percent above rated voltage and four 2-1/2+ percent below rated voltage, full capacity taps on primary.
6. Basic impulse level shall be 10 kV.
7. Sound Level: NEMA ST-20 standard.
8. Enclosure: UL listed for the application.
9. Identification: Identify transformers in accordance with Section 16075, Identification for Electrical Systems, with the transformer number and voltages, connection data, kVA ratings, impedance, and overload capacity.
10. Transformers shall comply with NEMA ST-20, NEMA TP-1, NEMA TP-2, and UL 1561.
11. Transformers shall bear the label of the Underwriters' Laboratories, Inc.

B. Non-Linear Load, K Factor Rated Transformer:

1. K Factor rated transformers shall meet the requirements specified in this Section for dry-type two-winding transformers and, in addition, the following:

a. Type: 100 percent non-linear rated, specifically designed to handle non-linear loads with double size neutral. Transformer shall include an electrostatic shield grounded to the transformer core.
b. UL K Factor: K = 13.
c. Impedance: Three percent minimum, five percent maximum.

C. Dry Type Buck and Boost Transformer:

1. Buck and boost transformers shall meet the requirements specified in this Section for dry-type two-winding transformers, except as specified below:

a. Insulation and average winding temperature rise for rated kVA as follows:

kVA Rating	Insulation Class (degree C)	Temperature Rise (degree C)
0.25 to 2 kVA	150	80
3 to 7.5 kVA	180	115

D. Dry Type Shielded Isolation Transformer:

1. Shielded isolation transformers shall meet the requirements specified in this Section for dry-type two-winding transformers, except as specified below:

a. Transformers shall be provided with quality, full width electrostatic shields in a maximum effective coupling capacitance between primary and secondary of 33 picofarads. With transformers connected under normal, loaded operating conditions, the attenuation of line noise and transients shall equal or exceed the limits listed in the table in Paragraph 2.1.D.1.b of this Section:.
b. Common mode noise attenuation:

Frequency	Attenuation
0 to 1.5k Hz	120 db
1.5 k Hz to 10k Hz	90 db
10 k Hz to 100k Hz	65 db
100 k Hz to 1M Hz	40 db

c. Transverse mode noise attenuation:

Frequency	Attenuation
1.5 to 10k Hz	52 kb
10 to 100k Hz	30 db
100k to 1M Hz	30 db

d. Provide electrostatic shield between the primary and secondary winding and grounded to the transformer core.
e. Isolate core and coil from enclosure using vibration absorbing mounts.

E. Manufacturers: Provide products of one of the following:

1. Square D Company.
2. Or approved equal.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine the conditions under which the dry type transformers are to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install transformers on walls or floors at locations shown. Install floor mounted transformers on raised concrete bases. Provide sufficient access and working space for convenient and safe operation and maintenance.

B. Mount transformers so that vibrations are not transmitted to the building structural parts and other equipment. Make connections to transformers with flexible conduit.

C. Adjust tap settings to provide proper voltage at panelboards.

D. Install dry type transformers in conformance with governing codes and manufacturer's instructions and recommendations, and the Contract Documents.

END OF SECTION

SECTION 16289 SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install surge protective devices (SPD).
2. SPDs furnished under this Section shall be ANSI/UL 1449 Type 2 integrating both surge suppression and high-frequency noise filtering suitable for use on low-voltage distribution systems.

B. Related Sections:

1. Section 16050, General Provisions for Electrical Systems.
2. Section 16440, Switchboards.
3. Section 16423, Motor Control Centers.
4. Section 16160, Panelboards.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ANSI/UL 1449, Surge Protective Devices.
2. IEEE C62.11, Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV)
3. IEEE C62.41, Recommended Practice on Surge Voltages in Low-voltage AC Power Circuits.
4. IEEE C62.45, Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1,000 V and Less) AC Power Circuits.
5. UL 1283, Electromagnetic Interference Filters.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Shall have at least five years of experience manufacturing and servicing products substantially similar to those required and shall be able to submit documentation of at least five installations in satisfactory operation for at least five years each.

B. Component Supply and Compatibility:

1. Obtain all products included in this Section regardless of component manufacturer from a single SPD manufacturer.
2. SPD manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.
3. Components shall be suitable for the specified service conditions and shall be integrated into overall assembly by SPD manufacturer.

C. Regulatory Requirements: Comply with the following:

1. NEC 110.9, Requirements for Electrical Installations, Interrupting Rating.
2. NEC 240.21, Overcurrent Protection, Location in Circuit.

1.04 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Shop Drawings:

a. Electrical and mechanical drawings for each type of unit, showing electrical ratings, dimensions, mounting provisions, connection details, and layout diagrams.
b. Components list and nameplate schedule.
c. Summary sheets with schedules of equipment.

2. Product Data:

a. Manufacturer’s technical information, including catalog information.
b. Manufacturer's technical specifications with assembly and component ratings.

E. Informational Submittals: Submit the following:

1. Certifications:

a. Certification that SPD devices comply with standards referenced in this Section.

2. Source Quality Control Submittals:

a. Report of results of testing and inspections performed at manufacturer’s shop.

3. Supplier Reports:

a. Submit written report of results of each visit to Site by Supplier’s service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.

4. Qualifications Statements:

a. Manufacture, when requested by ENGINEER.

F. Closeout Submittals: Submit the Following

1. Operations and Maintenance Data:

a. Submit in accordance with Section 01730, Operating and Maintenance Data.
b. Include acceptable test reports, maintenance data and schedules, description of operation, wiring diagrams, and list of spare parts recommended for one year of operation with current price list.

2. Warranty Documentation: Submit example warranty at time of shipment of the equipment. Include final warranty accepted by ENGINEER in the operations and maintenance manual for the equipment.

1.05 STORAGE, AND HANDLING.

A. Delivery:

1. Upon delivery, check for evidence of water that may have entered equipment during transit.

B. Storage:

1. Store SPD equipment in a clean, dry location with controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.
2. Protect equipment from corrosion and deterioration.

1.06 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive Owner of other rights or remedies Owner may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under the Contract Documents. The obligations of Contractor under the Contract Documents shall not be limited in any way by the provisions of the specified special warranty.

B. Special Warranty on Materials and Equipment:

1. Provide manufacturer's written warranty, running to the benefit of Owner, agreeing to correct, or at option of Owner, remove or replace materials or equipment specified in this Section found to be defective during a period of five years after the date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Provide equipment of one of the following:

1. Schneider Electric/Square-D Company.
2. Eaton/Cutler-Hammer.

3. General Electric.
4. Or approved equal.

2.02 EQUIPMENT

A. General:

1. SPD shall be modular, high-energy, parallel design with fast-acting transient voltage suppression using metal oxide varistors. Equipment shall provide noise attenuation with electromagnetic interference filter.

2. SPD shall comply with requirements of the following:

   a. ANSI/UL 1449.
   b. UL 1283.
   c. IEEE C62.11, IEEE C62.41 and IEEE C62.45.

3. SPD shall be suitable for operation under the following environmental conditions:

   a. Relative Humidity: Zero to 95 percent, non-condensing.
   b. Frequency: 47 to 63 Hertz.
   c. Temperature: Zero to 149 degrees F.

4. SPD operating voltage and IEEE C62.41 and IEEE C62.45 Category A, B, and C application environments shall be suitable for the associated SPD location(s) shown or indicated on the Drawings.

5. SPD shall be suitable for internal and external mounting. Where shown on the Drawings, SPD shall be factory-mounted and integrated into distribution equipment specified under the following Sections:

   a. Section 16050, General Provisions for Electrical Systems.
   b. Section 16423, Motor Control Centers.
   c. Section 16160, Panelboards.

B. SPD shall include a surge suppression path for each mode as required for the system configuration shown on the Drawings. Each mode shall be individually fused and equipped with thermal cutouts. SPD short-circuit rating shall be 200 kA. Protection modes shall include, to the extent applicable, the following:

1. Line-to-line.
2. Line-to-neutral.
3. Line-to-ground.
4. Neutral-to-ground.

C. SPD shall include electromagnetic interference/radio frequency interference (EMI/RFI) noise rejection filter with attenuation up to 30 dB from 10 kHz to 100 MHz.

D. SPDs and components in the operating path shall have maximum continuous operating voltage greater than 115 percent of nominal system operating voltage.

E. ANSI/UL 1449 minimum withstand rating shall be 20 kA per pole, and ANSI/UL 1449 voltage protection rating for SPD shall not exceed the following:

Modes	208Y/120	480Y/277
L-N,L-G, N-G	800	1200
L-L	1200	2000

F. SPD surge capacity based upon IEEE C62.41 location category shall, as a minimum, be the following:

Category	Application	Per Phase	Per Mode
C	Service entrance	240 kA	120 kA
B	High exposure locations (distribution equipment)	160 kA	80 kA
A	Branch locations	120 kA	60 kA

2.03 ACCESSORIES

A. Provide SPD equipped with the following accessories:

1. Surge counter with display for indicating the number of surges detected.
2. LED indicators for monitoring device status.
3. Audible alarm and silence switch for indicating an inoperative condition.
4. Dry contacts, “Form C”, for remote annunciation of unit status.
5. Indicators, counter, alarm, and silence switch shall be visible and accessible from front of the SPD. When SPD is integral to switchgear, motor control center, panelboard, or other equipment, indicators, counter, alarm, and silence switch shall be visible and accessible from front of the equipment in which the SPD is installed.

2.04 SOURCE QUALITY CONTROL

A. Perform manufacturer’s standard factory tests on equipment. Tests shall be in accordance with IEEE C62.45 and ANSI/UL 1449.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which materials and equipment will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install SPD at locations shown on the Drawings in accordance with equipment manufacturer’s recommendations, Laws, and Regulations, and the Contract Documents.

B. Conductor length between suppressor and connection point shall be as short and as straight as possible.

END OF SECTION

SECTION 16370 VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Work Included in this Section: The CONTRACTOR shall provide all the required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, and test equipment for furnishing, installation, adjustment, and full test loading of all the electrical work shown on the Drawings and included in these Specifications.

B. This equipment is to be installed in a prefabricated electrical building by the building manufacturer with exterior connections by CONTRACTOR. Coordinate equipment installation with VFD and building provider.

C. Variable Frequency Drives and enclosures shall be floor mounted standalone enclosures provided by manufacturer with all appurtenances included. Enclosure to be NEMA 1 gasketed. No third-party assemblies accepted.

D. Variable frequency drives shall be 480V, 3-phase, 60Hz, 6-pulse drives with 5% line to operate at these locations, with these horsepower's. Each station shall have three pumps each.

LS 1M – 200Hp @ 220 amps (Nameplate Data) – Existing Flygt Pumps
LS 12A – 150Hp – New Flygt Pumps – Coordinate with Specification 11210
LS 13A – 250Hp @ 284 amps (Nameplate Data) – Existing Flygt Pumps

E. MANUFACTURER to coordinate with pump supplier for incorporating all pump controls and pump protection. Refer to Specification 11310 for more information. CONTRACTOR to oversee and be responsible for such coordination.

1.02 DRIVE APPLICATION

A. The variable frequency drives will be used to control the speed of NEMA B design induction motors for dry submersible centrifugal pump in wastewater pumping station. Refer to pump specification 11310 for more information.

1.03 DRIVE PARAMETERS

A. The variable frequency drives shall be designed and sized for the loads intended, shall not exceed their full-rated capacity when the driven pumps are operating at maximum capacity, shall not overload under any operating condition of the pumps, and shall be provided with an integral bypass motor starter package.

1.04 SPARE PARTS

A. As a minimum, each of the variable frequency drives shall be furnished with the following spare parts:

1. One (1) circuit board of each type used.

2. Three (3) spare bulbs of each type and size used.
3. Three (3) lens caps of each color and size used.
4. Three (3) sets of power fuses and circuit breakers.
5. Three (3) sets of control fuses.
6. One (1) enclosure cooling fan.

1.05 MANUFACTURER'S QUALIFICATIONS

A. The variable frequency drives shall be the products of a single manufacturer who has been in the business of designing and manufacturing variable frequency drives for a period of at least ten (10) years.

B. The manufacturer shall have a factory authorized representative (s) and/or a certified repair shop(s) staffed with factory trained service personnel capable of providing installation and start-up assistance, routine and 24-hour emergency repair services (including parts), and training for the County's personnel in operating and maintenance procedures associated with the specific variable frequency drives furnished.

C The manufacturer shall offer both standard and extended period service contracts as part of his normal operating policy.

1.06 MANUFACTURER'S REPRESENTATIVE

A. A factory trained authorized representative(s) of the manufacturer shall be available to perform the following functions:

1. Provide installation assistance to the County's personnel on an "as needed" basis, one (1) scheduled day minimum.
2. Provide checkout and start-up services as well as conduct the final acceptance tests, two (2) scheduled days.
3. Provide training for the County's personnel in the proper operation and maintenance techniques to be used with the specific VFD's furnished, two (2) scheduled days.

B. The manufacturer shall include in his bid sufficient funds to cover all the costs (travel, meals, lodging) associated with providing the services listed in Item 1.06.A.1, 2 and 3 above.

1.07 SUBMITTALS

A. Within three (3) weeks of receiving the order, the manufacturer shall furnish the County with certified dimension prints which clearly show the nameplate data and outline dimensions.

B. Prior to start of manufacture of the variable frequency drives, the manufacturer shall submit sets of drawings which shall include, but not necessarily be limited to, enclosure drawings showing the location of both internally and externally mounted components, master wiring diagrams showing all interconnections to the discrete component level, elementary or control schematics including coordination with other external control devices operating in conjunction with the variable frequency drives, and outline drawings with sufficient details to allow for locating conduit stub-ups and

field wiring.

C. Failure to comply with Item 1.07.B above shall be entirely at the manufacturer's risk. Any changes required as a result of the County's review will be solely at the manufacturer's expense with no cost to the County.

1.08 WARRANTY

A. The manufacturer shall warrant that the variable frequency drives shall be free from defects in all materials and workmanship for a period of two (2) years from date of final acceptance.

B During the Warranty period, any and all covered defects shall be corrected by the manufacturer solely at his own expense with no cost to the County.

PART 2 PRODUCTS

2.01 VARIABLE FREQUENCY DRIVES

A. GENERAL

1. The variable frequency drives shall be the adjustable frequency (AF), variable torque (VT), pulse width modulated (PWM) type designed to provide continuous speed adjustment of 3-phase NEMA B squirrel cage induction motors, inverter duty rated.
2. The adjustable frequency drives (VFD's) shall be designed and rated for the horsepower (HP) and at full-load current (Amps), at rated speed (RPM) of the motors actually supplied.
3. The VFD's shall be furnished in NEMA Type 1 gasketed floor-mounted enclosures. The enclosures shall be forced air ventilated using door-mounted fans. Fan installation shall include cleanable, reusable air filters.
4. IEC Reduced Voltage Bypass Starter for emergency operation or for VFD Maintenance.

B. CONSTRUCTION

1. The VFD's shall be microprocessor based solid state devices consisting of three (3) basic sections:

    a. A rectifier section to change the constant frequency AC input voltage to a DC voltage. A full wave rectifier shall be used to prevent input line notching. Internal fast acting semiconductor fuses shall be installed to preclude the necessity for having external AC line fuses.
    b. A DC bus/link section to interconnect the rectifier section and the inverter section. A DC line reactor and capacitors shall be used to smooth the DC bus/link operation, improve displacement power factor, lower harmonic distortion, and eliminate the need for an isolation transformer.
    c. An inverter section to convert the DC voltage to a variable frequency AC voltage. Insulated gate bipolar transistors (IGBT's) shall be used as output switching devices to allow "trip-less" operation, reduce

motor noise, provide smoother motor operation, assure reliable and safe shutdowns under fault conditions, and increase drive efficiency; specifically, SCR's, GTO's, and Darlington Transistors are not acceptable as switching devices under this Specification.

2. The VFD's shall be capable of operating from a 3-phase input voltage of 480 Volts ±10% over a frequency range of 0-63 Hertz while providing a constant volts per Hertz excitation to the motors.
3. The VFD's shall have a one minute overload rating of 150%, minimum.
4. The VFD's shall employ surface mount technology for reduced size, high reliability, ease of maintenance, and resistance to vibration.
5. The VFD's shall incorporate full internal protection against short circuits, ground faults, over- and under voltage, over- and undercurrent, and temperature extremes.
6. The VFD's shall contain an adjustable electronic motor overload (I^2t) circuit to eliminate the need for an external motor overload relay.
7. The VFD's shall utilize advanced diagnostic techniques to simplify trouble shooting and correcting problems.
8. The VFD's shall have a minimum drive efficiency of 97% at full speed and full load.
9. The VFD's shall have a minimum fundamental power factor of 0.98 at all speeds and loads.
10. The VFD's shall be able to operate under the following environmental conditions without modification or derating:

    a. Temperature: 0 to 40ºC.
    b. Altitude: Up to 3,300' above sea level.
    c. Humidity: O to 95%, non-condensing.

11. The VFD's shall be UL listed and shall comply fully with the applicable standards and provisions of ANSI, NEMA, IEEE, IEC, and NEC, latest revisions.

C. FEATURES

1. The VFD's shall, as a minimum, have the standard features and adjustments listed below:

    a. The VFD's shall have the same customer interface regardless of horsepower rating, including keypad, digital display, and user connections. The keypad and the digital display shall be accessible without opening the main door of the drive enclosures.
    b. Hand-Off-Auto door mounted function switch. In Hand, local control via potentiometers In Auto, remote control via existing Data Flow Telemetry device.
    c. Door mounted By-Pass switch to engage bypass soft start and isolate VFD.
    d. The keypad shall be the seven (7) button touch type and shall be used for start-up, for setting all parameters, for stepping through the displays and menus, and for local control, including speed adjustments.

e. In addition to the keypad speeds adjustment provisions, the VFD's shall also be furnished with a manual speed adjustment potentiometer. The potentiometer shall be accessible without opening the main door of the drive enclosures.

f. The digital display shall be the LCD alphanumeric type with 40-character, 2-line capability. The LCD display shall be backlit to provide easy viewing at any angle in any light condition. The display shall have adjustable contrast.

g. The display shall utilize plain English - i.e., all set-up parameters, indications, faults, warnings, and other such information must be displayed in words for easy user understanding; specifically, alphanumeric code numbers requiring memorization, cross-reference tables, or manuals for interpretation will not be acceptable under this Specification.

h. The VFD's shall incorporate pre-programmed application macros for ease of start-up. To reduce programming time, the macros shall provide one command operation to reprogram all parameters and user interfaces for a particular application.

i. The VFD's shall provide a user selectable option of either displaying a fault or running at a preset speed if a reference input is lost.

j. The VFD's shall be capable of a "flying start" into a rotating load and accelerating to set-point without safety tripping or damage to the drives or driven equipment.

k. The user terminal strip shall be isolated from both the line and ground.

l. The VFD's shall have the ability to automatically restart after an overcurrent, overvoltage, under voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable. If the time between reset attempts is greater than zero, the time remaining until reset occurs shall count down on the display to warn an operator that a restart will occur.

m. The VFD's shall be equipped with an automatic extended power loss ride-through circuit which will utilize the inertia of the load to keep the drive powered. Minimum power loss ride-through shall be one-cycle, based on full load and no inertia. Removing power from the motor will not be an acceptable method of increasing power loss ride-through under this Specification.

n. The VFD's shall be optimized for a 3 kHz carrier frequency to reduce motor noise.

o. The VFD's shall incorporate the following three (3) separate current limit circuits to provide "trip free" operation:

    1) A slow current regulation limit circuit which shall be an adjustable percentage of the VFD's variable torque current rating, minimum setting of 125%. This adjustment shall be made via the keypad and shall be displayed in actual amperes, not as a percentage of full load.
    2) A rapid current regulation limit circuit which shall be an adjustable percentage of the VFD's variable torque current rating, minimum setting of 170%.
    3) A current switch-off limit circuit which shall be a fixed

percentage of the VFD's variable torque current rating, minimum setting of 255% instantaneous.

n. In addition to any items listed above, the VFD's shall, as a minimum, contain the following built-in software features:

1) Automatic slip-compensation for maintaining motor speed under varying load conditions.
2) A motor under-load function to protect the pumps.
3) Starting torque up to 180% of full load torque.
4) User selectable manual or automatic IR compensation for torque increases over a selected frequency range.
5) Five (5) adjustable/selectable critical frequency lock-out bands to avoid load resonance points during ramp-up or ramp-down.
6) Two (2) acceleration and two (2) deceleration ramps, adjustable from 0.1 seconds to 1800 seconds.
7) Three (3) adjustable S-curve acceleration and deceleration patterns.
8) User selectable linear, squared, or automatic control of the Volts-per-Hertz shape to assure maximum energy efficiency.
9) Precise full range frequency resolution adjustable in 0.01 Hertz increments.
10) Integral kilowatt-hour and elapsed-time displays.
11) Integral PI and sequential control functions.
12) Hand-Off-Auto function switch. In Hand, local control via pushbuttons and potentiometer in addition to the integral keypad. In Auto remote control via existing Data Flow Telemetry device.

o. The VFD's shall have seven (7) programmable preset speeds as well as unidirectional rotation and coast-to-a-stop features.
p. The VFD's shall have two (2) programmable analog inputs capable of accepting either a current or a voltage signal. Inputs shall be filtered and shall have adjustable gain and offset.
q. The VFD's shall have six (6) programmable digital inputs.
r. The VFD's shall have two (2) programmable analog outputs proportional to the chosen reference (frequency, motor speed, etc.).
s. The VFD's shall have three (3) programmable digital outputs. Outputs must be true Form C relays; specifically, open collector outputs will not be acceptable under this Specification.
t. The VFD's shall be equipped with an ethernet port capable of communicating with external PLC's, DCS's, DDC's, and touch-screen graphic operator panels via Modbus TCP/IP.
u. The VFD's digital display shall contain, as a minimum, the following information shown in complete English words; specifically, alphanumeric code numbers requiring memorization, cross-reference tables, or manuals for interpretation will not be acceptable under this Specification:

Output Frequency	DC Bus Voltage
Output Voltage	Heat sink Temperature
Motor Speed	Analog Input Values
Motor Current	Keypad Reference Values
Calculated Motor Torque	Elapsed Time
Calculated Motor Power	Kilowatt-hours

v. The VFD's shall, as a minimum, incorporate the following protective circuits which, in the case of a protective trip, shall stop the drive and announce the fault condition in complete English words; specifically, alphanumeric code numbers requiring memorization, cross-reference tables, or manuals for interpretation will not be acceptable under this Specification:

1) Overcurrent: Trip set at 315% instantaneous (225% RMS) of the VFD's variable torque current rating.
2) Overvoltage: Trip set at 130% of the VFD's rated voltage.
3) Under voltage: Trip set at 65% of the VFD's rated voltage.
4) Over temperature: Trip set at +70ºC or +85ºC dependent upon drive furnished.
5) Ground Fault: Both "running" and "at start".
6) Adaptable Electrical Motor Overload (I^2t): Motor protection shall be based on motor speed and load; specifically, circuits which are not speed dependent will not be acceptable under this Specification.
7) RTD analog input motor winding and pump bearing protection module with thermal bias. Provide Solcon model TPR6-14-2-M with a Modbus RTU to Ethernet/IP conversion gateway, or as otherwise shown on contract drawings.

w. The VFD's shall incorporate a parameter lock feature which will prevent unauthorized personnel from altering the drive parameters without entering a programmable password or combination number. The parameter lock shall also be settable to a digital input.

D. FACTORY INSTALLED OPTIONS

1. In addition to the Hand-Off-Auto switch and speed potentiometer mentioned hereinabove, the VFD's shall include the following factory installed options:

a. IEC Reduced Voltage Bypass Starter for emergency operation or VFD Maintenance. This Bypass system shall be able to effectively isolate the VFD for removal.
b. Circuit Breaker: The circuit breaker shall be the thermal magnetic, thru-the-door interlock type, pad lockable in the Off position.
c. 115 VAC Control Transformer and Terminal Board: A terminal board shall be provided for convenient connection of all field control wiring, including all drive inputs and outputs and 115 VAC start input. A control transformer, 150 VA minimum, shall also be included.
d. Numbered Wires: All internal drive wires shall be numbered at both ends to facilitate maintenance and trouble shooting.

e. LED Push-to Test pilot lights for “RUN” (red), “OFF” (green), “VFD FAULT” (amber) and “Control Power ON” (white), “In Bypass” (Blue).

E. MANUFACTURERS:

a. Manufactured by Fuji Electric.
b. No approved equal.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. Prior to assembly in the VFD’s, all printed circuit boards shall be thoroughly factory tested and given a minimum eight (8) hour burn-in.

B. After assembly, the drives shall be given a minimum eight (8) hour load test using a driven motor. The load shall be continuously cycled from no-load to full rated load to induce maximum stress and thermal variations in the drive components.

C. During the load test, the major drive parameters (input volts, output volts, output current, output speed, output frequency, percent load, etc.) shall be recorded and a copy of the test results shall be reviewed by the County prior to the shipment of the VFD’s. Similarly, any failure(s) of the drives during the load test shall be recorded, analyzed, corrected, and reported to the County before shipment of the VFD’s.

3.02 SHIPPING

A. The VFD’s shall be so packaged for shipment that they are maximally protected from both physical and environmental damage.

B. The VFD’s shall be transported to the County's job sites utilizing the manufacturer's customary method of shipment.

3.03 INSTALLATION

A. The VFD’s shall be installed by the CONTRACTOR personnel in accordance with the recommendations and procedures set forth in the installation manual furnished by the manufacturer.

3.04 CHECKOUT AND START-UP

A. Prior to start-up, a factory trained representative(s) of the manufacturer shall be on hand to assure that the VFD’s have been properly installed and that all field wiring is correctly terminated.

B. After checkout, the manufacturer's representative(s) shall then conduct a certified factory start-up using procedures and forms established by the manufacturer of the VFD’s.

C. A copy of the certified start-up form(s) for each drive shall be provided to the County, and a copy shall be kept on file by the manufacturer.

3.05 FIELD TESTING

A. After satisfactory completion of the checkout and start-up procedures, the manufacturer's representative(s) shall begin an eight (8) hour acceptance test using actual plant loads.

B. Any and all short-comings discovered and/or failures occurring during the acceptance test shall be remedied by the manufacturer solely at his own expense with no cost to the County.

C. Any time after four (4) hours of acceptance testing, the County may, at his option, curtail further testing and take acceptance of the VFD's.

3.06 TRAINING

A. As set forth in Items 1.05.B and 1.06.A above, a factory trained authorized representative(s) of the manufacturer shall be available at such a time(s) and place(s) established by the owner to train the County's personnel in the proper operation and maintenance procedures required by the specific VFD's furnished.

3.07 WARRANTY

A. The manufacturer shall furnish to the County a written warranty which complies with the requirements set forth in Item 1.08 above.

END OF SECTION

SECTION 16410 – ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 REQUIREMENT SUMMARY

A. Contractor shall furnish, install, connect, test, and place in satisfactory operating condition, ready for service, all Enclosed Circuit Breakers where indicated on the Contract Documents and as specified herein or required for proper operation of the installation. The scope of work installing Enclosed Circuit Breakers and associated devices shall be considered a part of this Section. All hardware, bolts, clamps, and fittings required for the installation of Enclosed Circuit Breakers shall be furnished and installed by the Contractor

B. Enclosed Circuit Breakers to be furnished and installed for this Project shall be the product of manufacturers who have been in the business of manufacturing this equipment for a minimum of twenty-five years (25YR).

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of Division 16 and those Project Documents referenced herein shall be applied.

B. Related Specification Sections include but not limited to:

1. Division 2 – SITE CONTRUCTION

2. Section 16120, Wires and Cables

3. Section 16505, Hangers and Supports For Electrical Systems

1.03 REFERENCES

A. Enclosed Circuit Breakers shall comply with the following applicable codes and standards as well as any others within the specifications and Contract Documents. In the event of any conflict between these codes, regulations, standards, and Contract Documents, the most restrictive shall apply.

B. Codes and Standards

1. National Electric Manufacturers Association (NEMA)

a. NEMA 250 Enclosures for Electrical Equipment

b. NEMA AB1 Molded Case Circuit Breakers

2. National Electric Installation Standards (NEiS)

a. Project applicable standards and recommendations

3. National Fire Protection Association (NFPA)

a. 70 National Electric Code (NEC).

b. 70E Standard for Electrical Safety in the Workplace

c. 79 Electrical Standard for Industrial Machinery

4. Underwriters Laboratories Inc (UL)

a. UL 489 Molded Case Circuit Breakers and Enclosures.

1.04 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 26 Sections as required per Specification Sections:

1. 01340 SUBMITTAL PROCEDURES

B. Shop Drawings

1. Contractor shall submit for approval Shop Drawings prepared in accordance with Specification Section 01340 and as required by other Sections of the Specifications.

2. All shop drawings shall be reviewed and approved by the Engineer before procurement or fabrication of material and equipment.

3. Submit five (5) copies of Product Data and Shop Drawings for equipment and component devices. Include time-current curves of circuit breaker trip units.

4. Include dimensional outline drawings; conduit entrance locations and requirements; voltage rating, continuous and short-circuit current ratings; cable terminal sizes and temperature ratings.

1.05 DELIVERY, STORAGE AND HANDLING

A. Enclosed Circuit Breakers and associated components shall be handled and stored in accordance with manufacturer's instructions and recommendations.

B. Inspect and report concealed damage to carrier within their required time period. Owner is not responsible for damages incurred during shipping, handling and storage.

C. Store in a clean, dry space. an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

1.06 OPERATION AND MAINTENANCE MANUALS

A. Furnish five (5) copies of recommended maintenance procedures and intervals. Include spare parts data listing; source and current prices of replacement parts and supplies.

B. Furnish Time-Current curves for each circuit breaker unit utilized for the Project. Time-Current curves shall be first generation originals on full size ANSI B 11IN by 17IN paper.

1.07 WARRANTY

A. Manufacturer shall warrant Enclosed Circuit Breakers to be free from defects in materials and workmanship for the lesser of one (1) year from date of installation or eighteen (18) months from date of purchase.

1.08 IDENTIFICATION

A. Enclosed Circuit Breakers shall be identified with the equipment tag number indicated on the Contract Documents and the accepted shop drawings. Nameplate(s) shall be securely affixed in a conspicuous place on Enclosed Circuit Breakers. Nameplates shall be furnished and installed as required Specification Section(s):

1. Section 16075, Identification For Electrical Systems

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Enclosed Circuit Breakers shall be provided by one of the manufacturers listed:

1. Eaton Power and Industrial

2. General Electric Company

3. Siemens Power USA

4. Square D / Schneider Electric USA

5. Approved Equal

2.02 PROTECTIVE DEVICES

A. The Enclosed Circuit Breaker protective device shall be a Molded Case Circuit Breaker (MCCB) with inverse time and instantaneous tripping characteristics

B. MCCB shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the MCCB shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of arc chutes.

C. MCCB shall have a minimum symmetrical interrupting capacity as indicated on the Contract Documents.

D. MCCB with 15A less than or equal to 200A frames shall be provided with fixed thermal-magnetic trip units.

E. MCCB with 225A less than or equal to 400A frames shall be provided with field-changeable, field-adjustable thermal-magnetic trip units with inverse time-current characteristics. Trip mechanisms shall be provided with the following trips:

1. Instantaneous

2. Long Time

3. Short Time

F. MCCB with 400A and greater frames shall be provided with microprocessor-based RMS sensing trip units with features noted on the drawings. Trip mechanisms shall be provided with the following trips:

1. Instantaneous

2. Long Time Pickup

3. Long Time Delay

4. Short Time Pickup

5. Short Time Delay

6. I2t function

7. Ground Fault Pickup

8. Ground Fault Delay

G. Circuit breakers for HVAC and refrigeration unit equipment shall be listed by UL as Type HCAR.

2.03 ACCESSORIES

A. Provide accessories as indicated on the Contract Drawings.

B. Shunt Trip Device: Coil rated for [120] [___] volts, [AC] [DC].

C. Undervoltage Trip Device: Coil rated for [120] [___] volts, [AC] [DC].

D. Auxiliary Contacts: Rated at [120] [___] volts, [___] amperes, [AC] [DC]. Contacts on an auxiliary switch; operation is designated “a” if open when the main circuit breaker contacts are open and “b” if closed when the main circuit breaker contacts are closed.

E. Alarm Switch: Rated at [120] [___] volts, [___] amperes, [AC] [DC]. Alarm switch shall operate upon the tripping of the circuit breaker. Contacts on an auxiliary switch; operation is designated “a” if open when the main circuit breaker contacts are open and “b” if closed when the main circuit breaker contacts are closed.

F. Auxiliary Switch: Rated at [120] [___] volts, [___] amperes, [AC] [DC]. Switch shall be interlocked with the main circuit breaker contacts.

G. Electrical Operator: Rated for [120] [___] volts, [AC] [DC].

H. Neutral Bus, insulated from enclosure: [____] Ampere rating.

2.04 ENCLOSURES

A. Provide Enclosed Circuit Breaker enclosures for those locations as indicated on the Contract Documents and as described below:

1. NEMA 1 surface or flush-mounted general-purpose enclosures intended for indoor use.

2. NEMA 12 dust-tight enclosures intended for indoor use to provide protection against circulating dust, falling dirt and dripping non-corrosive liquids.

3. NEMA 3R rain-tight enclosures intended for outdoor use in damp locations or to provide protection against rain.

4. NEMA 4/4X watertight stainless steel intended for indoor or outdoor use to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from corrosive agents

5. NEMA 7, Class I, Group C and D hazardous location cast aluminum intended for indoor use in locations classified as Class I, Group C and D as defined in the National Electrical Code

6. NEMA 9, Class II, Groups E, F and G hazardous location cast aluminum intended for indoor use in locations classified as Class II, Groups E, F and G as defined in the National Electrical Code

B. Provide a factory installed ground termination block sized for the grounding conductor as indicated on the Contract Documents.

C. Provide operator handle mechanisms that are padlockable in the OFF position. In the case of electrically operated breakers, provide a permanently installed device for padlocking in the OFF position.

D. Enclosed Circuit Breakers shall have nameplates that contain a permanent record of catalog number and maximum rating.

E. Enclosures shall be finished using the manufacturer's standard process and shall be ANSI 61 gray color unless otherwise noted on the Contract Documents.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Enclosed Circuit Breakers shall be mounted 60IN to top of enclosure above the finished floor, finished concrete or finished grade at the equipment height where appropriate, or as shown in the Contract Documents.

B. Enclosed Circuit Breakers shall not be mounted to any hand-rail, safety rail stair-well, ladder-well or like structure that is designed for life-safety use. A minimum of 4IN shall be maintained from all life-safety structures and any edge of Enclosed Circuit Breakers.

C. Contractor shall provide and install supports and/or support structures such as equipment racks to mount all Enclosed Circuit Breakers.

D. Contractor shall furnish and install accessories as required or shown in the Contract Documents.

3.02 FIELD QUALITY CONTROL

A. Contractor shall comply with those requirements and procedures per Specification Section:

1. 16050. 1.04 – TESTING

3.03 PROJECT CLOSE OUT

A. All exterior and interior surfaces of the Enclosed Circuit Breakers shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same paint coating as approved by the manufacturer for touch-up work.

B. Interiors of Enclosed Circuit Breakers shall be free of debris to include cleaning of wire/cable pulling compounds. The use of compressed air systems is not acceptable.

END OF SECTION

SECTION 16423 MOTOR CONTROL CENTERS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install motor control centers. This equipment is to be installed in a prefabricated electrical building by the building manufacturer with exterior connections by CONTRACTOR. Coordinate equipment installation with MCC and building provider.

2. Wiring shall conform to Section 16120, Wires and Cables.

B. The CONTRACTOR shall provide the coordination:

1. To properly size circuit breakers, starters, and control power transformers, obtain motor nameplate data on equipment being furnished under this and other contracts as required.
2. To properly size control power transformers, obtain data on motor space heater and other accessories.
3. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before motor control center Work.

C. Related Sections:

1. Section 16075, Identification for Electrical Systems.
2. Section 16120, Wires and Cables
3. Section 16215, Electrical Power Distribution Studies.
4. Section 16289, Surge Protective Devices

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ANSI/IEEE C37.2, Electrical Power System Device Function Numbers and Contact Designations.
2. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.
3. NEMA ICS 18, Motor Control Centers.
4. NEMA ICS 1, Industrial Controls and Systems: General Requirements.
5. UL 845, Motor Control Centers.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Shall have not less than twenty years' experience in the United States of producing equipment substantially similar to that required and shall be able to submit documentation of not less than five installations in satisfactory operation for at least five years each.

2. Independent Field Testing Firm:

    a. Retain an independent testing firm to perform field acceptance testing of motor control centers.
    b. Testing firm and its assigned personnel shall be experienced in inspecting and testing motor control centers.
    c. Testing firm shall be a member company of NETA.

B. Component Supply and Compatibility:

1. Obtain materials and equipment included in this Section, regardless of component manufacturer, from one motor control center equipment manufacturer.
2. Motor control center equipment manufacturer shall review and approve, or shall prepare, all Shop Drawings and other submittals for components furnished under this Section.
3. Equipment shall be specifically constructed for specified service conditions. Equipment and components shall be integrated into overall motor control center equipment system by motor control center equipment manufacturer.

C. Regulatory Requirements: Comply with the following:

1. NEC Article 430, Motors, Motor Circuits, and Controllers.

1.04 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Shop Drawings:

    a. Outline and summary sheets with schedules of equipment in each unit.
    b. One-line diagrams indicating circuit breaker sizes, bus rating, motor controller ratings, and other pertinent information to demonstrate compliance with the Contract Documents.
    c. Unit control schematic and elementary wiring diagrams showing numbered terminal points and interconnections to other units.

2. Product Data:

    a. Manufacturer specifications, cut sheets, dimensions, and technical data for all components, materials, and equipment proposed for use.

3. Testing Plans, Procedures, and Testing Limitations:

    a. Not less than 30 days prior to actual factory testing, submit proposed testing methods, procedures, and apparatus.
    b. Not less than 30 days prior to actual field testing, submit proposed testing methods, procedures, and apparatus.

E. Informational Submittals: Submit the following:

1. Supplier Instructions:

    a. Instructions for shipping, storing and protecting, and handling the materials and equipment.
    b. Installation data for the equipment, including setting drawings, templates, and directions and tolerances for installing anchorage devices.
    c. Instructions for start-up and troubleshooting.

2. Source Quality Control Submittals:

    a. Reports of completed factory testing, including procedures used and test results.

3. Site Quality Control Submittals:

    a. Reports of completed field testing, including procedures used and test results.

4. Supplier Reports:

    a. Submit written report of results of each visit to Site by Supplier's service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.

5. Qualifications Statements:

    a. Independent testing firm.
    b. Manufacturer, when requested by ENGINEER.

F. Closeout Submittals: Submit the following:

1. Operations and Maintenance Data:

    a. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules,

description of operation, and spare parts information.

b. Manuals shall include record drawings of control schematics, including point-to-point wiring diagrams.

c. Comply with Section 01730, Operating and Maintenance Data.

G. Maintenance Material Submittals: Furnish the following:

1. Spare Parts:

a. Furnish, tag, and box for shipment and long-term storage the following spare parts and special tools for each motor control center lineup furnished:

Item	Quantity per Switchgear Lineup Furnished
1) Starters and feeder breakers	Quantities and sizes as shown on drawings
2) Fuses	Six of each type and size used
3) Auxiliary control relays	Two, with at least two normally open and two normally closed contacts
4) Control power transformers	Two of each size used
5) Indicating lamps	Twelve
6) Covers for indicating lamps	Six of each color used
7) Starters: Contact kits for Size 1 motor starter	Two sets
8) Starters: Contact kits for Size 2, Size 3, and Size 4 motor starters	One set of each size

b. Furnish a list of additional recommended spare parts for an operating period of one year. Describe each part, the quantity recommended and current unit price.

1.05 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Packing:

a. Inspect prior to packing to assure that assemblies and components are complete and undamaged.

b. Protect mating connections.

c. Indoor containers shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

d. Cover all openings into enclosures with-vapor inhibiting, water-repellent material.

2. Upon delivery, check materials and equipment for evidence of water that may have entered equipment during transit.

3. Handling:

a. Lift, roll or jack motor control center equipment into locations shown.
b. Motor control centers shall be equipped to be handled by crane. Where cranes are not available equipment shall be suitable for placement on rollers using jacks to raise and lower the groups.

B. Storage and Protection:

1. Store motor control center equipment in a clean, dry location with controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Provide equipment by one of the following:

1. Schneider Electric/Square D Company.
2. No equal.

2.02 MATERIALS

A. General: Motor control center lineups shall comply with NEMA ICS 18 and be provided as shown with the following ratings:

1. Service: Voltage rating and number of wires shall be as shown or indicated on the Drawings. Motor control center shall operate from a three-phase, 60 Hertz system.
2. Wiring: NEMA Class II, Type B.
3. Enclosure: NEMA 1 with gaskets on all doors.
4. Interrupting Capacity Rating: Motor control center shall have an interrupting capacity rating as shown or indicated on the Drawings. Devices shall be suitable for minimum rating indicated.
5. Motor control center lineups shall be UL-rated as suitable for service entrance where shown or indicated on the Drawings and as required.

B. Construction: Provide equipment with the following:

1. Totally-enclosed structure, dead front, consisting of nominal 20-inch deep, 20-inch wide, 7.5-feet high vertical sections bolted together to form a unit assembly.
2. Vertical sections shall have side sheets extending the full height and depth of section.
3. Removable lifting angles for each shipping section.
4. Two removable floor sills for mounting.
5. Horizontal wireways top and bottom, isolated from horizontal bus and readily accessible.

a. Wireway openings between sections shall have rounded corners and rolled edges.

6. Isolated vertical wireways with cable supports, accessible through hinged doors, for each vertical section.

    a. Wireway shall be separate from each compartment and remain intact when compartment is removed.

7. All-metal non-conducting parts electrically continuous.
8. Comply with NEMA ICS 18.

C. Bus System:

1. Rating: Bus bracing and bus current capacities as shown or indicated on the Drawings.
2. Bus bars shall be tin-plated, copper-rated, and comply with UL heat rise standards.
3. Bus bar connections shall be easily accessible with simple tools.
4. Main Horizontal Bus:

    a. Continuous, edge-mounted, and isolated from wireways and working areas.
    b. Mount the bus in vertical center of motor control center to provide easy access and even heat distribution.
    c. Bus shall be supported, braced, and isolated by high-strength, non-tracking, FRP material.

5. Vertical Bus:

    a. Continuous, and isolated by glass polyester barrier.
    b. Rated for 300 amperes continuous minimum, and at least equal to full-load rating of all installed units in the associated stack.

6. Grounding Bus: Full length mounted across the bottom, drilled with lugs of appropriate capacity as required.
7. Neutral Bus: Insulated, continuous through control center for four-wire services, drilled with lugs of appropriate capacity as required.

D. Unit Compartments:

1. Provide individual front door for each unit compartment. Fasten door to stationary structure, instead of the unit itself, so that door can be closed when unit is removed.
2. Starter and feeder unit doors interlocked mechanically with unit disconnect device to prevent unintentional opening of door while energized and unintentional application of power while door is open, with provisions for releasing interlock for intentional access and application of power.
3. Padlocking arrangement permitting locking disconnect device in the “OFF” position with at least three padlocks with door closed or open. Equip unit disconnect devices located in the top compartment, compartment sized 12 inches or higher, with extender handle complying with UL 845. Extender handle shall allow disconnect operating handle to

be located above NEC's height limitation of six-feet, seven-inches above floor.

4. Equip compartments as shown or indicated on the Drawings:

    a. Blank compartments, unused space, and compartments shown or indicated on the Drawings as "SPACE" shall have bus covers and be complete with necessary hardware for future installation of a plug-in unit.
    b. Provide shutters for each compartment that automatically open when unit is inserted and automatically close when unit is removed.

5. Provide wiring and device identification:

    a. Identify compartment doors, devices, and field wiring in accordance with Section 16075, Identification for Electrical Systems.
    b. Identify internal control conductors with permanent wire markers. Each wire shall be identified by a unique number attached to wire at each termination point.
    c. Identify internal control devices with permanent markers. Each device shall be identified by a unique number attached to each device.
    d. Numbering system for each wire and control device shall be identified on the wiring diagrams in the Shop Drawings and shall reflect the actual designations used in the Work.

6. NEMA 1 minimum motor starter size. Starter units completely draw out type in Sizes 1 and 2 and draw out type after disconnecting power leads only in Sizes 3 and 4.
7. Motor starters shall be NEMA-rated and include magnetic contactor, with encapsulated magnet coils. Wound coils are unacceptable. Control shall be 120 Vac unless indicated otherwise.

    a. Starters shall be full-voltage non-reversing unless shown or indicated otherwise on the Drawings.
    b. Reversing Starters:

        1) Single-speed, full-voltage with two contactors and extra interlocking contacts.

    c. Reduced Voltage Solid-State Starter:

        1) General:

            a) Provide solid-state, step-less, current limiting, soft-start, motor controllers (RVSS) as shown or indicated on the Drawings.
            b) RVSS shall be three-phase type and shall include an overload relay and at speed isolation contactor.
            c) Provide NEMA rated full voltage By-Pass contactor as shown on drawings.

c) Provide subsystems that will protect RVSS from damage due to phase loss, over-current and over-voltage.
d) Current Rating: 115 percent of motor nameplate rated current, continuous, minimum.

2) Required Features:

a) Adjustable current limit of not more than 250 percent of motor nameplate full-load current throughout entire motor acceleration period including first three cycles of voltage waveform from instant start signal is engaged.
b) Adjustable voltage acceleration, from two to 30 seconds. Acceleration shall be continuous not in steps.
c) Adjustable voltage deceleration, from two to 30 seconds. Deceleration should be continuous, not in steps.
d) Phase loss detection.
e) PUSH-TO-TEST LED diagnostic indicators.
f) Static over-current and over-voltage trip.
g) Phase reversal, line or fuse loss, and under-voltage protection.
h) Power unit over temperature protection.
i) Motor inverse time overload protection.
j) Input line transient over-voltage protection.

3) Enclosure:

a) Cooling fans, if required, shall incorporate anti-friction bearings and internal impedance type motor protection.
b) If cooling fans are used, enclosure for that section shall be NEMA 12 FVF, or NEMA 12 EFVFF force ventilated with filters, in accordance with NEMA ICS 1-110, installed by motor control center manufacturer.

4) On start-up, start driven equipment at zero current and allow driven equipment to accelerate to maximum speed without exceeding the set current limit.
5) On normal shutdowns, ramp driven equipment down at set deceleration rate that is non-regenerative for motor prior to shutdown.
6) On emergency shutdowns, remove power to motor.
7) Diagnostic LEDs: Provide LED (Push to Test) on unit front that indicate the following:

a) Control power on.
b) Motor power on.
c) Motor running.

d) Motor fault.
e) High Pressure
f) RVSS fault.

8) Control Outputs:

a) Control output shall be electrically isolated, dry, normally open SPDT contacts, rated 10 amps at 120 vac.
b) Provide the following control outputs:

i. Motor running.
ii. Motor stopped
iii. Motor fault.(Overtemp)
iv. High Pressure
v. RVSS fault.

8. Overload Relays: Provide an overload relay for each motor starter. Overload relays shall be in accordance with the following:

a. Electronic Overload Relays: Relays shall be electronic type. Electronic relays shall be multi-function, adjustable, current sensing, type, and include overload, phase-unbalance, phase-loss, and equipment type ground fault in one package.
c. Each overload relay shall be manual reset type and shall include provisions for resetting by an insulating button on front of starter unit door.
d. Each overload relay shall include a normally-open auxiliary contact for remote alarm purposes.
e. Size each overload relay for full-load amperes and service factor of actual motors installed.

9. Individual control power transformers for all starters, capacity as required for all control circuit devices, 150 VA minimum, Class A insulation, two primary fuses, 120-volt secondary, one secondary fuse, and the other secondary leg grounded.
10. Motor horsepower shown are preliminary. Circuit breaker trips and starter overload heaters to be coordinated with the actual equipment installed.
11. Auxiliary contacts, relays, timers as required for specified control functions and those shown on Drawings.
12 Starter devices, including spare contacts, shall be wired to numbered terminal blocks.
13. Terminal blocks for field connections to unit compartments shall be plug-in/pull-apart type. Terminals shall be fully accessible from the front. Terminals shall be mounted near the front of vertical wireway.
14. Control devices shall be 600-volt heavy duty, NEMA A600. Relays shall have convertible contacts. Pilot devices shall be oil tight. Pilot lights shall be transformer type with six-volt secondary. .
15. Feeder Circuit Breakers: LSI adjustable electronic trip thermal magnetic type 100% Rated.

a. Circuit breakers of 100 amp frame or less shall be 100% rated mounted in a dual mount compartment (two breakers in one space factor) or shall mount in one-half space factor, unless otherwise shown or indicated on the Drawings.

16. Motor Starter Circuit Breakers: Magnetic trip only motor circuit protectors.
17. Provide the following diagrams and tables inside of door for each compartment:

    a. Elementary wiring diagram.
    b. Table of overload heater sizes with correct heater highlighted.
    c. Table of motor circuit protector settings with correct setting highlighted.

18. Where shown or indicated on the Drawings incorporate solid state protective relaying package (SSPRP) into motor starter for motor protection. Unit shall incorporate the ANSI/IEEE C37.2 device function numbers and selectable indications and communication modules indicated below:

    a. Product and Manufacturer:

        1) GE MultiLin SR469.
        2) Or MCC manufacturers equal.

    b. Motor Protection Device Functions:

        1) Stator winding over-temperature (Device 49).
        2) Short circuit (Device 50).
        3) Motor overload (Device 49/50/51).
        4) Locked rotor - multiple start (Device 48).
        5) Phase reversal (Device 46).
        6) Ground fault (Device 50G/51G).
        7) Mechanical jam.
        8) Unbalance/negative sequence currents (Device 46).
        9) Undercurrent (Device 37).
        10) Motor bearing over-temperature (Device 38).
        11) Thrust bearing over-temperature (Device 38).
        12) Over-voltage (Device 59).
        13) Undervoltage (Device 27).
        14) Voltage sequence (Device 47).
        15) Main trip and lockout output relay (Device 86).
        16) Alarm output relay (Device 74).

    c. Selectable Indications:

        1) Average motor current.
        2) Average motor temperature.
        3) Motor current for each of the three phases.
        4) Motor temperature readout for six winding RTDs.
        5) Motor thrust-bearing temperature readout for two bearing RTDs.

6) Ground fault current.
7) Percent of motor capacity used.
8) Line-to-line and line-to neutral voltages, all three phases.
9) Average 15-minute kVA.
10) Average 15-minute kW.
11) Average 15-minute kVAR.
12) Maximum percent full load current since initial startup.
13) Hottest RTD and temperature since initial startup.
14) Highest percent current unbalance since initial startup.
15) Highest ground fault current since initial startup.
16) Highest motor bearing temperature since initial startup.
17) Highest load bearing temperature since initial startup.
18) Maximum line voltage since start.
19) Minimum line voltage since start.
20) Number of motor starts attempted.
21) Number of motor starts completed.
22) Hours of operation.
23) Number of trips from each of ten protective functions.
24) All measured values at the time of a motor trip.
25) Values that have been loaded for system inputs and trip points.

d. Communication Module: RS232 capable of uploading all the above protective function attitudes and the above-listed selectable indications upon being queried by a host PLC connected via RS232 communication port.

19. Main and Tie Circuit Breakers: 100% rated, LSIG Electronic trip, thermal magnetic, molded case type, unless shown or indicated otherwise. Mains to have maintenance switch to limit Arcflash exposure.

Where shown or indicated, equip main and tie breakers with PLC and relay interlocking. Interlocking shall allow only two of the three breakers to be closed at a time.

2.03 MAIN METERING DEVICE

A. Provide a main meter device as shown or indicated on the Drawings.

1. Microprocessor based monitoring device shall include complete electrical metering in one package. Device shall include self-contained potential transformers and self-protected internal fuses.
2. Device shall have Ethernet output capabilities and imbedded webpages for communication to SCADA. Provide all gateway equipment as necessary.
3. Device shall be mounted on compartment door to allow operations and maintenance personnel access to meter menu and display.
4. Device shall include trend analysis, event logging, and recording. Device shall also include the following direct-reading metered values:

a. Volts: 0.2 percent accuracy.
b. Amperes: 0.2 percent accuracy

c.	Watts, Vars and VA:	0.5 percent accuracy
d.	Power Factor:	1.0 percent accuracy
e.	Frequency:	0.05 percent accuracy
f.	Watt, and VA Hours:	0.5 percent accuracy
g.	Var Hours:	1.0 percent accuracy
h.	Watt, Var and VA Demand:	0.4 percent accuracy
i.	THD-Voltage:	50th harmonic
j.	THD-Current:	50th harmonic
k.	Individual Ampere Harmonics:	50th harmonic
l.	Individual Voltage Harmonics:	50th harmonic

5. Metering device shall have the following additional features:

    a. Trend analysis that displays minimum and maximum values for each metered parameter with date and time of each occurrence.
    b. Input range of device shall accommodate external current transformers with ranges from 100/5 to 5000/5 and potential transformers from a ratio of 120:120 to 500,000:120. Three current transformers suitably rated shall be included.
    c. Alarm contacts rated five amps at 120 VAC.
    d. Three analog outputs programmable to reflect the metered parameters, except kilowatt hours and kilovar hours.
    e. Communication capability, using RS-485, Modbus RTU Protocol.

6. Control power shall be drawn from monitored incoming AC line. Device shall have non-volatile memory and not require battery backup. During power failure, device shall retain preset parameters.

2.04 SURGE PROTECTIVE DEVICES

A. Provide a surge protective device in accordance with Section 16289, Surge Protective Devices, for each motor control center bus shown on the Drawings. Surge protective devices shall be included and factory-mounted within the motor control center by motor control center manufacturer. Surge protective device monitoring and display shall be visible from the motor control center front.

2.05 SOURCE QUALITY CONTROL

A. Prior to shipping, perform factory tests on motor control centers. Tests shall include manufacturer's standard tests and the following:

1. Physical inspection and checking of components.
2. Mechanical operation and device functionality tests.
3. Primary, control, and secondary wiring hi-pot tests.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which Work is to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install materials and equipment at locations shown or indicated on the Drawings. Install equipment on concrete bases in accordance with the Contract Documents and manufacturer's recommendations and instructions.

B. For installations against masonry walls, provide an insulation board, 1/4-inch minimum thickness, between motor control center and wall for corrosion protection. Trim board neatly within outline of motor control center.

C. Openings in top or side of motor control centers for other than conduit entrance are not allowed.

D. Bundle cable circuits together within enclosures and identify with durable tag secured to cabling twine.

E. Set motor circuit protectors at lowest setting that allows motor starting without nuisance tipping.

F. Verify that wiring diagrams on inside of door of each compartment reflect the circuitry actually provided and that correct overload heater size and motor circuit protector setting are noted.

G. Install in conformance with manufacturer's recommendations, Laws and Regulations, and the Contract Documents.

H. Connections to existing facilities shall be in accordance with Section 01730, Coordination with Owner's Operations.

3.03 FIELD QUALITY CONTROL

A. Site Tests:

1. Perform field testing and inspection of motor control centers. Inspect and test each motor control center after installation. Testing and inspection shall be in accordance with the manufacturer's recommendations and the Contract Documents, and be performed by manufacturer's factory-trained representative, Inform OWNER and ENGINEER when equipment is correctly installed, prior to testing. Do not energize equipment without permission of OWNER.
2. Test Equipment, Calibration and Reporting: All test equipment, instrument calibration and test reports shall be in accordance with ANSI/NETA ATS.
3. Perform the following minimum tests and checks before energizing equipment:

    a. Verify all overload and device settings.
    b. Inspect mechanical and electrical interlocks and controls for proper operation.
    c. Check tightness of bolted connections.
    d. Measure insulation resistance of each bus section, phase-to-phase and phase-to-ground.

e. Measure insulation resistance of each starter, phase-to-phase and phase-to-ground.
f. Measure insulation resistance of each control circuit with respect to ground.
g. Perform other tests recommended by equipment manufacturer.

4. Perform acceptance testing of motor control centers. Inspect and test each motor control center. Testing and inspection shall be performed by the independent testing firm, after completion of field testing specified in Paragraph 3.3.A.3 of this Section.

a. Visual and Mechanical Inspection: Perform inspection of each motor control center in accordance with ANSI/NETA ATS. Inspection shall include:

1) Inspect for proper anchorage, damage, and grounding.
2) Verify all overload and device settings.
3) Check tightness of bolted connections.

5. Electrical Tests: Perform electrical testing of each motor control center in accordance with ANSI/NETA ATS. Testing shall include:

1) Measure insulation resistance of each bus section, phase-to-phase and phase-to-ground.
2) Measure insulation resistance of each starter phase-to-phase and phase-to-ground.
3) Measure insulation resistance of each control circuit with respect to ground.
4) Test motor overload units by current injection.
5) Perform operational tests by initiating control devices for proper operation.
6) Perform contact resistance test and insulation resistance test for each circuit breaker.
7) Determine long-time, short-time, and instantaneous pick-up and delay as required.

B. Manufacturer's Services: Provide a qualified, factory trained serviceman to perform the following:

1. Supervise unloading and installation of equipment.
2. Instruct CONTRACTOR in installing equipment.
3. Inspect, test, and adjust equipment after installation and ensure proper operation.
4. Instruct operations and maintenance personnel in operation and maintenance of the equipment.
5. Manufacturer's technician shall make visits to the Site as follows:

a. First visit shall be for supervising unloading and handling of equipment and for instructing CONTRACTOR in proper equipment installation, and assisting in installing equipment. Technician shall train installing personnel in advance in proper handling and rigging of equipment. Minimum number of hours on-Site: 2 hours.

b. Second visit shall be for checking completed installation, start-up of system; and performing field quality control testing. Technician shall test the system as specified in Article 3.3.A of this Section. Technician shall operate and test the system in the presence of ENGINEER and verify that equipment complies with the Contract Documents and manufacturer's requirements. Technician shall adjpust the system to initial settings as specified in Article 3.4 of this Section. Minimum number of hours on-Site: 4 hours.

c. Third visit shall be to instruct operations and maintenance personnel.

1) Furnish services of manufacturer's qualified, factory-trained specialists to instruct OWNER's operations and maintenance personnel in recommended operation and maintenance of equipment.

2) Training requirements, duration of instruction and qualifications shall be in accordance with Section 01730, Instruction of Operations and Maintenance Personnel.

3) Number of hours on-Site shall be in accordance with Section 01730, Instruction of Operations and Maintenance Personnel.

d. Technician shall revisit the Site as often as necessary until installation is acceptable.

e. Furnish services of manufacturer's factory-trained service technicians to correct defective Work within 72 hours of notification by OWNER during the correction period.

6. All costs, including expenses for travel, lodging, meals and incidentals, and cost of travel time, for visits to the Site shall be included in the Contract Price.

3.04 ADJUSTING

A. Calibrate, set, and program all protective devices. Coordinate protective devices furnished under this Section and provide proper settings of devices in accordance with the study performed under Section 16215, Electrical Power Distribution System Studies.

3.05 GUARANTEES AND WARRANTIES

A. The Contractor shall guarantee and warrant all materials and labor provided under this Section for three (3) years from date of Substantial Completion in accordance with Section 01740 and Section 16050 of these Specifications.

END OF SECTION

SECTION 16450 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope: ALL SITES

1. CONTRACTOR shall provide labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install complete grounding for electrical systems, structures, and equipment.
2. CONTRACTOR to test integrity and performance of existing ground grid including all connections to ground which encompasses equipment grounds and lightning system. Excavation may be necessary. Contractor to correct all deficiencies.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.
2. ASTM B8, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
3. UL 467, Grounding and Bonding Equipment.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Field Acceptance Testing Firm: Retain services of independent testing firm to perform acceptance field testing of grounding system. Testing firm shall have experience in testing grounding systems, surge suppression devices, grounding currents, leakage currents, ground loops, wiring errors, and shall be a member company of NETA. Contractor to correct all deficiencies.

2. Lightning Protection System: CONTRACTOR to employ the services of a Master licensed lighting installer to perform, inspection and testing of the lightning system. Contractor to correct all deficiencies.

B. Regulatory Requirements

1. National Electrical Code, (NEC).

a. NEC Article 250, Grounding and Bonding.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Listing of grounding connector types identifying where each will be used.
b. Layouts of each structure's ground grid.
c. Test point construction details.

2. Product Data:

a. Manufacturer's technical information for grounding materials proposed for use.

3. Testing Plans:

a. Ground resistance test procedure.

B. Informational Submittals: Submit the following:

1. Field Quality Control Submittals

a. Results of ground resistance tests at each test point.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bare Ground Cable:

1. Manufacturers: Provide products of one of the following:

a. Cablec Corporation.
b. General Cable Corporation.
c. Southwire Cable Company.
d. Or approved equal.

2. Material: Soft-drawn, tinned plated bare copper stranded cable complying with ASTM B8. No. 4/0 AWG minimum size for connection between ground rods and to busbars, motor housings, MCC's, transformers and switchgear unless otherwise shown or indicated on the Drawings. No. 4 AWG minimum for all others.

B. Ground Rods:

1. Manufacturers: Provide products of one of the following:

a. Copperweld, Bimetallics Division.
b. ITT Blackburn Company.
c. Or approved equal.

2. Material: Copper-clad rigid steel rods, 3/4-inch diameter, 10 feet long minimum.

C. Grounding Connectors:

1. Products and Manufacturers: Provide one of the following:

a. Pressure Connectors:

1) O.Z./Gedney, Division of General Signal Corporation.
2) Burndy Corporation.
3) Or approved equal.

b. Welded Connections:

1) Cadweld by Erico Products, Incorporated.
2) Therm-O-Weld by Burndy Corporation.
3) Or approved equal.

2. Material: Pressure connectors shall be copper alloy castings, designed and fabricated specifically for items to be connected and assembled with Durium or silicone bronze bolts, nuts, and washers. Welded connections shall be by exothermic process utilizing molds, cartridges, and hardware designed specifically for connection to be made.

D. Grounding Additive:

1. Grounding additive, in its set form, shall have resistivity of not more than 20 ohm-cm.
2. Product and Manufacturer:

a. Ground Enhancement Material (GEM) by Erico
b. Or approved equal.

3. Grounding additive shall be permanent and maintenance-free, without requiring recharging with salts or chemicals that may be corrosive, and shall maintain its earth resistance with time.
4. Grounding additive shall set up firmly and not dissolve or decompose or otherwise pollute soil or groundwater.
5. Grounding additive shall be suitable for installation in dry form or in slurry form.
6. Grounding additive shall not depend on continuous presence of water to maintain its conductivity.

E. Ground Test Well

1. Provide heavy-duty test well suitable for heavy-duty traffic.
2. Manufacturer

a. Advanced Lightning Technology
b. Or approved equal.

3. Diameter and Material: 12.75-inch outside diameter, Schedule 80 PVC.
4. Depth: Two feet.

5. Cover: Provide test well with cast iron cover marked, “Ground” with cast iron ring to support lid.

F. Ground system components shall comply with UL 467.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions for the Work and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions are corrected.

3.02 STRUCTURE GROUND SYSTEM

A. Inspect and Test ground grids as shown and indicated on the Drawings.

B. As needed, provide No. 4/0 bare copper cable around exterior perimeter of structures at not less than 2.5 feet below grade, unless otherwise shown or indicated on the Contract Documents.

C. For structures with steel columns, provide No. 4/0 ground cable from grid to each column around perimeter of structure. Connect cable to steel with exothermic welds.

D. Connect grids to continuous underground water pipe system, when practical.

E. For new structures with concrete foundation or footings, connect structure’s reinforcing steel or other concrete-encased electrode to grounding grid.

F. Provide accessible test points for measuring the ground resistance of each grid.

G. Weld all buried connections except for test points. All welds must conform to manufacturers specifications which extends to the number of welds a mold can be used for and the quality of the weld. Compression connections are unacceptable.

3.03 EQUIPMENT GROUNDING

A. Ground electrical equipment in compliance with NEC article 250, local regulations and the Contract Documents.

B. Equipment grounding conductors shall be **tin plated** bare stranded copper cable of adequate size installed in metal conduit where required for mechanical protection. Ground conductors, pulled into conduits with non-grounded conductors, shall be insulated. Insulation shall be green.

C. Control panels grounding conductors shall be **tin plated** bare stranded copper cable of adequate size to ground grid from AC ground bus, and an insulated stranded copper cable of adequate size to ground grid from DC ground bus.

D. Connect ground conductors to conduit with copper clamps, straps, or with grounding bushings.

E. Connect to piping by welding or brazing. Use copper bonding jumpers on gasketed joints.

F. Connect to equipment by means of lug compressed on cable end. Bolt lug to equipment frame using holes or terminals provided on equipment specifically for grounding. Do not use hold-down bolts. Where grounding provisions are not included, drill suitable holes in locations recommended by equipment manufacturer or designated by ENGINEER.

G. Connect to motors by bolting directly to motor frames, not to soleplates or supporting structures.

H. Connect to service water piping by means of copper clamps. Use copper bonding jumpers on gasketed joints.

I. Scrape bolted surfaces clean and coat with conductive oxide-resistant compound.

3.04 FIELD QUALITY CONTROL

A. Site Tests:

1. Test completed grounding grid system for resistance to earth ground using an electrical three-terminal ground resistance tester and Fall of Potential Method. Test all grounded cables and metal parts for continuity of connection. ENGINEER or OWNER will witness the testing. Provide Test Report.
2. Separately test for AC Ground Impedance using a loop impedance tester. Measure the actual ac impedance of the ground wiring. Impedance should be tested and not exceed 0.25 ohms.
3. Separately test for Ground Currents, and Leakage Currents. ENGINEER or OWNER will witness the testing. Provide Test Report. Report Leakage currents to Engineer if in excess of 10mA.
4. Grounding system maximum resistance shall not exceed five ohms impedance under normally dry conditions (48 hrs. after last rainfall) when measured by ground resistance tester. Resistance values above five ohms shall be brought to ENGINEER's attention. Provide additional ground rods as required to attain a resistance to ground of less than five ohms for each ground grid. Add grounding additive installing additional ground rods to increase their effectiveness.
5. Acceptance Testing:

    a. Perform acceptance testing of grounding system. Testing shall be performed by testing firm in accordance with ANSI/NETA ATS.
    b. Test Equipment, Calibration and Reporting: Test equipment, instrument calibration, and test reports shall comply with ANSI/NETA ATS.

END OF SECTION

SECTION 16501 LIGHTING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install lighting fixtures and associated controls.
2. Provide fixtures in accordance with NEC Class 1 Div 2 classified areas as shown on drawings.
3. Refer to Lighting Schedule shown on drawings.

B. Coordination:

1. Coordinate location of fixtures with piping, ductwork, openings, and other systems and equipment and locate clear of interferences.
2. Coordinate fixtures to be mounted in hung ceilings with the ceiling suspension system proposed.

C. Related Sections:

1. Section 16050, General Provisions for Electrical Systems.
2. Section 16075, Identification for Electrical Systems.
3. Section 16160, Panelboards.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. UL 844, Luminaires for Use in Hazardous (Classified) Locations.
2. UL 935, Safety of Fluorescent Lamp Ballasts.
3. UL 1029, Safety of High-Intensity- Discharge Lamp Ballasts.
4. UL 1598, Safety of Luminaires.
5. UL 8750, Safety of LED Lighting

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:

1. NEC Article 410, Luminaires, Lamp holders, and Lamps.
2. Florida Building Code 2017, Wind Load Requirements

1.04 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Shop Drawings:

a. Schedule of light fixtures to be furnished, indicating fixture type and location for each.
b. Customized wiring diagrams.

2. Product Data:

a. Manufacturer's technical information, specifications, standard wiring diagrams, and catalog cuts for lighting fixtures proposed.
b. Fixture construction details.
c. ETL photometric and isocandle curves for each fixture proposed.
d. Verification that recessed fixtures to be mounted in hung ceilings are compatible with ceiling suspension system proposed.

B. Informational Submittals: Submit the following:

1. Manufacturer's Instructions:

a. Instructions and recommendations for handling, storing, and protecting the equipment.
b. Installation instructions for the equipment, including setting drawings, templates, and directions and tolerances for installing anchorage devices.

C. Maintenance Material Submittals: Submit the following:

1. Spare Parts and Extra Stock Materials: Furnish spare parts for each type of unit required as indicated in Part 2 of this Section.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Upon delivery, inspect equipment for evidence of water that may have entered equipment during transit.

B. Storage:

1. Store lighting fixtures, controls, related materials and equipment in clean, dry location with controls for uniform temperature and humidity. Protect materials and equipment with coverings and maintain environmental controls.
2. Store materials and equipment for easy access for inspection and identification. Keep materials and equipment off ground, using pallets, platforms, or other supports. Protect materials and equipment from corrosion and deterioration.

PART 2 PRODUCTS

2.01 MATERIALS

A. Type: Lighting fixtures required shall be in accordance with the Lighting Fixture Schedule on the Contract Drawings. Fixtures shall be complete with supports, ballasts, lamps, and incidentals, as required.

B. Fixtures in hazardous locations shall be listed in accordance with UL 1598 and UL 844. Materials shall by suitable for the area classification(s) shown or indicated on the Contract Drawings, and specified in Section 16050, General Provisions for Electrical Systems.

C. Lamps:

1. Fluorescent: Fluorescent lamps shall be Toxic Characteristic Leaching Procedure (TCLP) compliant for low mercury content. Linear fluorescent lamps shall be T8, energy-efficient, extended life type. Compact fluorescent lamps shall be long-life, energy-efficient type.
2. LED fixtures shall be modular and allow for separate replacement of LED lamps and drivers. User serviceable LED lamps and drivers shall be replaceable from the room side. Dimmable LED fixtures shall have either a 0-10 volt, 3-wire dimming driver, or a two-step (50%-100%) line voltage, two switch controlled dimming driver, as shown on the drawings.

    a. LED lamps shall have a color temperature of 3500 degrees K, a CRI of 80 minimum, and a lumen maintenance L70 rating of 50,000 hours minimum.

3. High Pressure Sodium: Shall be TCLP-compliant for low mercury content. Lamps shall be clear with high-efficacy and lumen maintenance.
4. Metal Halide: Shall be fabricated for low mercury content and be TCLP-compliant when available. Lamps shall be clear-pulse, start type with high-efficacy and lumen maintenance.
5. Incandescent: Inside-frosted.
6. Spare Parts and Extra Stock Materials: Ten percent spare lamps of each type and wattage.

D. Ballasts:

1. Fluorescent: UL 935 listed, high power factor, energy-efficient type, equipped with thermal protectors (Type “P” ballast), compatible with lamps installed. Indoor two-lamp fluorescent ballasts shall be electronic type with total harmonic distortion of less than 20 percent. Ballast factor shall be 0.85 minimum with total of less than 61 watts input. Provide cold weather type ballast where indicated in the Lighting Fixture Schedule.
2. High Intensity Discharge: UL 1029 listed, high power factor, constant wattage, stabilized autotransformer with line starting current the same or less than operating current.
3. Ballasts sound level shall be 30 decibels or less, sound rating “A”.
4. Ballasts shall be INTERTEK (ETL) listed and Certified Ballast Manufacturer Association, CMB-certified.

5. For fixtures utilizing double-ended lamps, provide fixture disconnecting means within the fixture.
6. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 “Electronic Drivers for LED Devices, Arrays, or Systems”. LED drivers shall have a sound rating of “A”, have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.
7. Spare Parts and Extra Stock Materials: Ten percent spare ballasts of each type and quantity, but not less than one.

E. Fixtures located in area identified as hazardous in Section 16050, General Provisions for Electrical Systems, shall each be approved as a complete assembly, shall be clearly marked to indicate maximum wattage of lamps for which they are approved, and be protected against physical damage by suitable guards.

F. Hardware: Provide necessary hangers, supports, conduit adaptors, reducers, hooks, brackets, and other hardware required for safe fixture mounting. Hardware shall have protective, non-corrosive finish.

G. Outdoor Fixtures: Provide each fixture to be installed outdoors with cut-off lens to reduce the fixture’s light pollution emissions.

H. Time Switch:

1. Type: Astronomic dial time switch with day-omitting device.
2. Products and Manufacturers: Provide of one of the following:

    a. 7000Z Series by Tork Time Controls, Inc.
    b. Or equal.

3. Timing Motor: Heavy-duty, synchronous, self-starting, high torque, 120-volt or 277-volt, 60 Hertz, as shown on the Contract Drawings.
4. Capacity: 40 amps per pole at 277 volts.
5. Dial: 24-hour rotation, with gear to provide one revolution per year that automatically raises the “ON” and “OFF” settings each day according to seasonal changes of sunset and sunrise.
6. Reserve Power: Spring driven reserve sufficient to operate time switch contacts for not less than 30 hours after power failure. On restoration of power, time switch shall transfer to synchronous motor drive and automatically rewind reserve.

I. Lighting Contactor and Controls:

1. Provide a lighting contactor and control system for control of each area where shown on the Drawings.
2. Product and Manufacturer: Provide products of one of the following:

    a. Type SM03 by Square D Company.
    b. Or Approved equal.

3. System shall include:

a. Enclosure sized as required, complete with input control fuse and screw type terminal blocks rated 300-volt, 20-amp quantity for all circuits, unless indicated otherwise on the Drawings.
b. Single coil, electrically-operated, mechanically-held contactor. Contactor shall be rated 30-amp, 600-volt, with 120-volt operating coil, unless indicated otherwise on the Contract Drawings. Number of poles shall be as shown on the Contract Drawings. Provide multiple contactors when necessary.
c. Where lighting contactors are controlled by photocell, provide a 120-volt, two-pole control relay, enclosure mounted to convert the two-wire photocell control to three-wire control required by contactor. Control shall include a cover mounted on-off-auto selector switch for “manual” or “auto” selection of operation. In “auto” position, contactor shall respond to photocell.
d. Enclosure: As required for area classification per Section 16050, General Provisions for Electrical Systems.
e. Identify panel in compliance with Section 16075, Identification for Electrical Systems.

J. Photocell:

1. Products and Manufacturers: Provide one of the following:

a. 2100 Series by Tork Time Controls, Inc.
b. Or equal.

2. Cadmium sulfide hermetically-sealed cell, fully temperature compensated, with time delay of not less than 15 seconds to prevent false switching.
3. Built-in fail safe light level selector, adjustable within limits of two to 50 foot-candles and factory set at 25 foot-candles.

K. Fixture-Lowering Hanger System:

1. General:

a. Provide corrosion-resistant system that lowers fixtures to ground level to allow maintenance on fixtures. Provide lowering hanger system for each fixture as shown on the Contract Drawings.

2. Products and Manufacturers: Provide one of the following:

a. Thompson Hangers, by Joslyn Hi-Voltage Corp.
b. Or equal.

3. System:

a. Upper or fixed housing of lowering devices shall contain:

1) Attached pulley.
2) Single point latching mechanism.

3) Guide.
4) Upper or socket electrical contacts.

b. Lower or moveable housing of lowering devices shall contain:

1) Operating line termination.
2) Positioning stem and lower half of latch assembly.
3) Lower electrical contacts.
4) Fixture adapter.

c. Fixtures shall be lowered on a guide line to allow operation of system in adverse weather and with structural clearance. Angles of the guide line to the structure shall be in accordance with to lowering device manufacturer's instructions.
d. Operating line shall be high-strength/high-flexibility stainless steel and supplied by the lowering device manufacturer.
e. Each operating line shall be encased in conduit where lower than eight feet above finished floor.
f. Non-hanger termination shall be of enclosed and surface mounted design.
g. Pulleys shall be supplied by hanger manufacturer as required to prevent excessive cable sag and allow lateral offsets between fixture location and cable termination.
h. Provide portable manual winch.

4. Electrical:

a. Contact material shall be silver-impregnated/silver-plated plate copper. Contacts shall use ball and socket design for ease of alignment and to allow for residual building vibration and movement.
b. Contact pressure shall be supplied by springs remote from current conductors and shall not be part of current-carrying path.
c. Termination of wiring shall be to crimp connectors.
d. Provide electrical insulation of contacts by porcelain standoffs.
e. Lowering device shall be make-and-break rated, UL-approved, as follows:

1) 250 vac: 30 amps
2) 600 vac: 15 amps
3) 250 vdc: 10 amps

f. Lowering device shall have eight contacts rated at 120 vac, 15 amps.

5. Mechanical:

a. System loading capacity: 200 pounds.
b. Manual or power winch operation.
c. Housing manufactured with copper-free or low copper content cast aluminum.
d. Operation shall be slow pull/quick release method.

e. Maintenance-free design.
f. Latching means shall be single point centered design to facilitate even wear over life of hangar.
g. Provide a tag line to facilitate lateral movement over inaccessible spaces. Tag line shall consist of the following parts by hanger manufacturer:

1) Termination kit for wall.
2) Manual winch.
3) Operating cable.
4) Pulley for upper mounting.

L. Motion/Occupancy Sensor:

1. Products and Manufacturers: Provide one of the following:

a. Leviton, Motion Sensor Field-of-View PR 150-1LW
b. Or equal.

2. Adjustable time delay interval of 15 seconds to 15 minutes.
3. Equipped with passive infrared (PIR) sensing technology.

2.02 LIGHT EMITTING DIODE (LED) LIGHTING

The LED Fixture shall consist of a LED Luminaire Assembly, LED Driver and mounting hardware.

A. LED Lighting Fixture. LED Fixture requirements are as described below:

1. The input to the LED Lighting Fixture shall be 120 to 277VAC (±10%), 60HZ or as indicated in the Contract Document.
2. Correlated Color Temperature (CCT) shall be minimum 4000K or as indicated in the Contract Document.
3. Color Rendering Index (CRI) shall be ≥70.
4. A minimum of 50,000 operating hours before reaching the L70 lumen output degradations point without catastrophic failure, or as indicated in the Contract Document.
5. Conform with UL 8750.
6. Compliance to FCC CFR Section 15.

B. LED Luminaire Assembly Luminaire Assembly requirements as described below:

1. Definition: Luminaire Assembly is the LED assembly without LED driver.
2. Input voltage shall be 24VDC, 36VDC or as indicated in the Contract Document.
3. CCT, CRI, Minimum life and UL conformity requirements are as defined in above article LED Lighting Fixture.

C. LED Driver LED: Driver requirements are as described below:

1. Must operate input voltage between 120VAC to 277VAC (±10%).
2. Operating frequency must be 60Hz.

3. Must be rated to operate between -40ºC to +50ºC.
4. Must have a minimum efficiency of 85%.
5. Self protected including short circuit protection.
6. Compliance to FCC CFR Section 15

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. General:

1. Fixture mounting heights and locations indicated on the Drawings are approximate and are subject to revision in the field where necessary to clear conflicts and obstructions.
2. Mounting Heights: Mounting heights or elevations are to bottom of fixture or to centerline of device.
3. Install fixtures in accordance with Laws and Regulations, the Contract Documents, and manufacturer instructions and recommendations.
4. Mount fixtures so that sufficient access is available for ready and safe maintenance.
5. Securely fasten equipment to walls or other surfaces on which equipment is mounted.

B. Suspended Fixtures:

1. Pendant-mount using 1/2-inch diameter conduit stems.
2. Ground to outlet box.
3. Attach mounting to building structure with expansion anchors.
4. Fixtures shall not be dependent on the outlet box cover screws for support.

C. Surface Mounted Fixtures:

1. Attach to appropriate outlet box.
2. Attach to surface using fasteners and sealing washers when mounting fixture in damp or wet locations.

D. Boxes and Fixtures:

1. For units mounted against masonry or concrete walls, provide suitable 1/4-inch spacers to prevent mounting back of box directly against wall.
2. Bolt units rigidly to building with expansion anchors, toggle bolts, hangers, or Unistrut.
3. Do not install boxes with open conduit holes.
4. Cable each circuit and identify with tag.

E. Re-lamp all fluorescent fixtures provided under this Contract with new lamps following Substantial Completion.

F. Mount photocells as shown and adjust foot-candle setting for proper dusk and dawn photo-control. Provide wiring in conduit from photocell to controls.

G. Fixture Lowering System:

1. Hangers shall be plumb.
2. Provide adequate clearance between operating line and structural members, pipes, ducts, and other equipment and devices to avoid interference.
3. Conduit runs enclosing operating lines shall be straight with no offset bends.

3.03 SCHEDULES

A. See Drawings for Lighting Schedule

END OF SECTION

SECTION 16505 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install hangers and supports for electrical systems.
2. Area Classifications: Materials shall by suitable for the area classification(s) shown or indicated on the Contract Drawings, and specified in Section 16050, General Provisions for Electrical Systems.

B. Related Sections:

1. Section 16050, Electrical - General Provisions
2. Section 16110, Conduits and Fittings
3. Section 16600, Vibration, Seismic and Wind Controls for Electrical Systems.

1.02 REFERENCES

A. Standards referenced in this section are:

1. ASTM A123/A123M, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A1011/A1011M, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
3. ASTM E84, Test Method For Surface Burning Characteristics of Building Materials

1.03 QUALITY ASSURANCE

A. CONTRACTOR shall have a minimum of five years in support systems and have installed system based on vibration, seismic and wind load calculations. If required, prepare a listing of such installations in the past five years.

1.04 SUBMITTALS

A. Shop drawings and product data as described in Division 1.

B. Operation and maintenance data as described in Division 1.

C. In addition, submit the following:

D. Action Submittals: Submit the following:

1. Shop Drawings:

a. Detailed installation drawings showing dimensions and compatibility with proposed layout.

2. Product Data:

a. Manufacturer's name, product designation, and catalog number of each material item proposed for use.
b. Manufacturer's specifications including material, dimensional and weight data, and load capacity for each supporting system component proposed for use.
c. Pictorial views and corresponding identifying text of each component proposed for installation.
d. Documentation that confirms product compatibility with Laws and Regulations.

E. Informational Submittals: Submit the following:

1. Certifications:

a. Submit certifications required under this Section.

2. Manufacturer's Instructions:

a. Manufacturer's installation instructions, including but not limited to recommended torque values for all fasteners and hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Provide products of one of the following:

1. B-Line.
2. Kindorf.
3. Unistrut
4. Or equal.

2.02 MATERIALS

A. Strut, Fittings, and Accessories:

1. General

a. Unless otherwise shown or indicated, strut shall be 1-5/8 inches by 1-5/8 inches. Double struts shall be two pieces of the same strut, welded back-to-back at the factory.
b. Attachment holes, when required, shall be factory-punched on hole centers approximately equal to the cross-sectional width and shall be 9/16-inch diameter.
c. Fittings, braces, brackets, hardware, and accessories shall be Type 316 stainless steel.
d. Strut nuts shall be spring captured Type 316 stainless steel.

e. Square and round washers shall be Type 316 stainless steel.

2. Strut materials shall be suitable for area classifications indicated in Section 16050, General Provisions for Electrical Systems, and shown or indicated on the Contract Drawings.

a. Dusty Locations:

1) Strut shall be 12-gage carbon steel, hot-dip galvanized after fabrication, complying with ASTM A123/A123M.

b. Wet Locations:

1) Strut shall be 12-gage Type 316 stainless steel.

c. Corrosive Locations:

1) Strut shall be 12-gage Type 316 stainless steel.

a. Chlorine or Sulfuric Areas:

1) Strut shall be fiberglass-reinforced plastic (FRP) complying with ASTM E84.
2) Fabricate materials either by pultrusion or extrusion process.
3) Strut, fasteners and fittings shall have a surface veil over 100 percent of the surface to protect against UV degradation.
4) Manufacture fasteners and fittings from long glass fiber-reinforced polyurethane or vinyl-ester resins.
5) Thread rods shall be made from fiber-reinforced vinyl-ester resin.

B. Hanger Rods:

1. Material:

a. Dry Locations: All-thread, zinc-coated
b. Wet, Corrosive, or Hazardous Areas: Stainless steel.

2. Size: Not less than 3/8-inch diameter, unless otherwise shown on the Contract Drawings or specified.

C. Beam Clamps for Attaching Threaded Rods or Bolts to Beam Flanges for Hanging Struts or Conduit Hangers:

1. Beam clamps shall be stainless steel equipped with stainless steel square-head set screw, and shall include threaded hole sized for attaching the all-thread rod or threaded bolt.

D. Miscellaneous Hardware:

1. Bolts, screws, and washers shall be stainless steel.
2. Hex Nuts: Shall be stainless steel and include nylon inserts.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Provide hangers and supports for electrical systems with necessary channels, fittings, brackets, and related hardware for mounting and supporting materials and equipment. Provide anchor systems, concrete inserts, and associated hardware for proper support of electrical systems.

B. Install equipment and devices on hangers and supports as shown on the Contract Drawings, as specified, and as required.

C. Install hangers and supports level, true, free of rack, and parallel and perpendicular to building walls and floors, so that the hangers and supports are installed in a neat, professional, workmanlike manner. Per NECA/NEIS installation standards

D. Holes in suspended ceilings for rods for hangers and supports and other equipment shall be provided adjacent to bars, where possible, to facilitate removal of ceiling panels.

E. Coordinate installation of hangers and supports with equipment, cabinets, consoles, panels, enclosures, boxes, conduit, cable tray, wireway, busway, cablebus, piping, ductwork, lighting fixtures, and other systems and equipment. Locate hangers and supports clear of interferences and access ways.

F. Anchor Bolts, Expansion Anchors, and Concrete Inserts: Shall be in accordance with Section 05500, Metal Fabrications, and requirements of this Section.

G. Mounting of Conduit:

1. Provide space of not less than 1/4-inch between conduit surfaces and abutting or near surfaces except struts, cable trays, steel beams, and columns.
2. Fasten conduit to struts, cable trays, steel beams, and columns using specified clamps and straps as shown, specified, and required.
3. Devices shall be compatible with size of conduit and type of support. Following installation, size identification shall be visible and legible.

4. Install conduit supports and fasteners in accordance with Section, 16110, Conduits and Fittings.

H. Supports for Cabinets, Consoles, Panels, Enclosures, and Boxes:

1. Freestanding: Unless otherwise specified or shown on the Contract Drawings, provide supports for floor-mounted equipment, cabinets, consoles, panels, enclosures, and boxes. Such supports shall be 3.5-inch high concrete equipment base with a 45 degree chamfered edge. Base shall extend 2-inches beyond outside dimensions of equipment on all sides.

2. Wall-Mounted:

a. Provide space not less than 1/4-inch between cabinets, consoles, panels, enclosures, and boxes and the surface on which each is mounted. Provide non-metallic or stainless steel spacers as required.
b. Do not mount equipment, enclosures, panels, and boxes directly to beams or columns. Mount struts to beams or columns using beam clamps, and mount equipment, enclosures, panels, and boxes to the struts.

3. Floor Stand Rack:

a. Where equipment, cabinets, consoles, panels, enclosures, and boxes cannot be wall-mounted, provide an independent floor stand rack.
b. Floor stand rack shall consist of struts, plates, brackets, connection fittings, braces, accessories, and hardware assembled in a rigid framework suitable for mounting of intended materials and equipment.
c. Equip floor stand racks with brackets and bases for rigidly-mounting the framework to the ceiling or floor, as applicable; or equip floor stand racks with beam clamps, angle plates, washers, and bolts for fastening to beam flanges, as applicable.
d. When equipment, cabinets, consoles, panels, enclosures, and boxes weigh more than 100 pounds:

1) Main vertical supports of floor stand rack assemblies shall be back-to-back struts.
2) Bracing, clamping and anchoring of each floor stand rack shall be sufficient to ensure rigidity of the floor stand rack with the intended equipment, enclosures, conduit, cable tray, busway, cablebus, and wireway installed. Floor stand racks shall not be deflected more than 1/8-inch by a 100-pound force applied at any point on the floor stand rack in any direction.

I. Drilling into beams or columns is not allowed unless authorized by ENGINEER.

J. Tighten nuts and bolts to the manufacturer's recommended torque values.

K. Field Cutting:

1. Cut edges of strut and hanger rod shall have rounded corners, edges beveled, and burrs removed. If field cutting the strut is required, use clean, sharp, dedicated tools. Remove oil, shavings, and other residue of cuttings prior to installation.
2. Coatings: To prevent corrosion:

    a. Coat cut edges with zinc-rich paint for galvanized steel.

END OF SECTION