SECTION 01730

OPERATING AND MAINTENANCE DATA

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Compile product data and related information appropriate for Owner'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 Owner'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 Owner'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 Owner's personnel.

D. Prepare and include additional data when the need for such data becomes apparent during instruction on Owner'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 OWNER'S PERSONNEL**

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

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

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 Engineer for review and transmittal to Owner.

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 Owner'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.

a. 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 Owner 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

DIVISION 02
SITE WORK

SECTION 02001

SPECIAL PROVISIONS TO DIVISION 2

The following Special Provisions to Division 2 supplement and/or supercede the Manatee County Specifications included in Division 2.

SECTION 02640
VALVES AND APPURTENANCES

PART 2 PRODUCTS

Add the Following:

2.20 LINE STOP

A. Line stop manufacturer shall be Furmanite Corporation, or approved equal.

END OF SECTION

SECTION 02002

CONCRETE PRESSURE PIPE TAPPING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Install taping saddle and valve for connection of new 42-inch ductile iron pipe to existing 54-inch prestressed concrete cylinder pipe (PCCP).

1.02 RELATED WORK

A. Section 02064 - Modification to Existing Structures, Piping and Equipment

B. Section 02615 - Ductile Iron Pipe and Fittings

C. Section 02617 - Installation and Testing of Pressure Pipe

D. Section 02640 - Valves and Appurtenances

1.03 QUALITY ASSURANCE

A. The Tapping Contractor shall have experience with similar size taps of prestressed concrete pipe in the last five years.

B. Furnish the services of the PCCP manufacturer (Price Brothers/Hanson Pressure Pipe 678-428-2484) for two (2) days to supervise the tapping procedure.

1.04 SUBMITTALS

A. Materials and Shop Drawings:

1. Copies of all materials required to establish compliance with the specifications shall be submitted to the Engineer. Submittals shall include the following:

   a. Certified drawings and data.

   b. Literature on drawings describing the equipment and showing all-important details of construction and dimensions.

B. Operating Instructions: Operating and maintenance shall be furnished to the Engineer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery at Site

1. All materials, which will not be installed the same day as delivered to the site, shall be stored in the appropriate manner in the original manufacturer's packaging. Each package shall have an identifying mark and a complete list showing contents. Loose items with no original packaging shall be boxed to protect the products from scratches, abrasion, or breakage.

B. Protection Prior to Installation

1. All products shall be protected from excessive heat and from moisture during storage and handling.

2. All plastic materials shall be stored out of direct sunlight.

PART 2 PRODUCTS

2.01 TAPPING VALVE

A. Refer to Specification Section 02640, Valves and Appurtenances, article 2.18, A.

2.02 FLANGED TAPPING SLEEVES FOR PCCP

A. Materials

1. Saddle Plate shall be manufactured from ASTM A283 Grade C Steel or equal.

2. Straps shall be manufactured from ASTM A 276 Type 304 Stainless Steel.

3. Gasket shall have a broad, flat sealing surface and shall be manufactured of a material suitable for secondary effluent.

4. Flange to be connected to valve shall be manufactured in accordance with AWWA C207 Class D. Flanges larger than 12inch diameter shall have an alignment recess suitable for accepting the alignment lip of the tapping valve.

5. Waterway shall be lined with fusion-bonded epoxy to a minimum thickness of 15 mils in accordance with AWWA C213.

6. All other steel shall be coated with a fusion-bonded epoxy coating.

7. Bolts, studs and nuts shall be stainless steel 18-8 type 304.

C. Features

1. Sleeve shall be designed for an operating pressure of 150 psi.

2. The sleeve shall have a separate gland, which allows the sleeve to be installed, and the annular space between the pipe and the sleeve to be grouted, prior to cutting the prestressed wires.

3. Foam or rubber grout gaskets and hard rubber spacers shall be used to provide an annular space between the pipe and the sleeve. Grout horns shall be furnished to facilitate grouting of the annular space.

4. The annular space shall be grouted with a suitable Portland Cement grout. The grout shall be allowed to set prior to cutting any prestressing wires. Any accelerant used in the grout shall not be deleterious to prestressing wire.

5. The pressure plate shall be adequately braced to eliminate vibration & flexing of the plate while the tapping machine is operating.

6. The machined gasket groove on the pressure plate must be consistently positioned about throat of tapping gland waterway. However, ID of the gasket groove must be set back a minimum of 1 inch from the waterway to allow dispersal of forces generated by gasket compression. Gasket grooves machined in a circle and then rolled to an elliptical shape will not be allowed.

7. All waterway welds shall be dye-penetrant inspected or hydrostatically shop tested for water tightness.

8. The gland shall be equipped with load bearing set screws to transfer thrust loads from the branch piping to the sleeve.

9. A three-flange configuration shall be used on all outlets above twelve-inch to allow for valve bypass.

10. Welding the gland to the steel cylinder of the pipe to provide a watertight seal shall not be permitted.

11. The sleeve shall be encased in a minimum of one inch of Portland cement mortar or concrete for corrosion protection after the tap.

12. The sleeve shall be Hanson Pressure Pipe or approved equal.

PART 3 - EXECUTION

3.01 SADDLE INSTALLATION AND TAPPING OPERATION

A. Prior to ordering material:

1. Determine from pipeline owner and/or pipe manufacturer's records the following:

   a. Manufacturer
   b. Year of manufacture,
   c. Outside diameter of pipe barrel,
   d. Steel cylinder outside diameter, and
   e. Internal working pressure

2. Excavate, expose, and clean the exterior of the pipe at the location of the tap.

   a. Measure barrel circumference.
   b. Chip mortar coating away exposing the prestressing wire to determine depth of mortar coating. Be careful to not damage the prestressing wire.
   c. Patch the mortar coating and then backfill the pipe.

B. Performing the Tap

1. Excavate and clean pipe in area where saddle is to be installed. Remove any irregularities extending beyond the normal contour of the pipe surface. Check all measurements to be certain saddle is correct size for the pipe.

2. Position gland on the pipe and mark the area where the mortar coating is to be removed.

3. Remove gland and set aside. Carefully remove mortar coating from area where tap is to be made - exposing but not damaging the prestressing wires.

4. Check to make certain all grout gaskets are in place around the edge of the saddle and over the opening in the mortar coating (with the grouting openings up). Install the straps. Tighten straps with only sufficient torque to lightly compress and seal the grout gaskets, alternating from one side of the saddle to the other - starting at the outside straps and working in toward the center.

5. Pour portland cement grout into the grout horns in the saddle filling the space between the saddle and the pipe. Strike the saddle with a hammer to vibrate

the grout into place. After the grout has set, again tighten the bolts on the straps.

6. Carefully cut and remove the exposed prestressing wires. Then remove the exterior portion of the concrete core exposing the steel cylinder. Clean the steel cylinder surfaces of any remaining concrete. (Note: If there is a weld seam on the cylinder of the pipe in the area of the tap, carefully flatten the weld so that the tapping gland gasket will seal on it. Do not grind the weld.)

7. Check the gasket in the gland to make certain it is undamaged and is in its retaining groove. Remove any tape used to secure the gasket in place during shipment.

8. Install the four threaded studs in the saddle outlet to assist in properly aligning the gland. Install the gland in the saddle outlet so that the contour of the gasket seat exactly matches the contour of the steel cylinder. Install the remainder of the draw bolts. Check the gasket seat and all alignments. Tighten the draw bolts evenly to compress the gland gasket. A feeler gauge can be used to check gland gasket position during tightening. When completely tightened there should be approximately 1/8 inch between the gasket seat and the steel pipe cylinder.

9. After installation of the tapping gland, tighten the load bearing set screws located between the draw bolts of the outer circle. This locks the gland in place and transfers any loading from the outlet onto the saddle and away from the cylinder.

10. Install the tapping valve utilizing the inner circle of studs and nuts furnished with the gland (for tap outlets 12 inch and smaller). For tapping outlets 14 inch and larger, a three flange configuration is used (two draw flanges and the flange for mating the tap valve). It is strongly recommended that fully threaded studs and nuts be used to connect the valve, as the flange configuration may not allow for the use of bolts. Valve shall be properly braced/blocked prior to releasing tension from lifting equipment.

11. Use water to pressure test the gland gasket seal, flange gaskets, and tapping valve to assure all joints are tight and gaskets properly seated. Pressure test to 50 psi.

12. Mount the tapping machine to the tapping valve. Open the valve completely. Advance the cutter by means of the hand screw through the open valve. Apply power, and the pilot drill will begin to cut the cylinder. Resistance will increase when the shell cutter contacts the pipe cylinder. When the automatic feed screw has advanced to a predetermined distance, the cut is

complete. Tap completion is verified by advancing cutter manually to verify there is no resistance to rotating cutter.

13. Withdraw the cutting head past the gate and close the valve. Disconnect the tapping machine.

14. Upon completion of the tap, pour a Portland cement mortar mix (two parts sand, one part Portland cement) into the opening between the gland and the saddle, and into the grouting hole in the saddle neck, completely filling the space around the gland. Encase the saddle in a protective coating of Portland cement mortar or concrete to a minimum thickness of 1 inch over the entire assembly including the straps.

15. Provide a permanent support beneath the valve (36" x 36" x 12" thick with 10 x 10 wwf).

3.02 MANUFACTURER'S REPRESENTATIVE

A. Furnish the services of the PCCP manufacturer (Price Brothers/Hanson Pressure Pipe 678-428-2484) for two (2) days to supervise the tapping procedure.

END OF SECTION

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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 (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall cut, repair, reuse, excavate, demolish or otherwise remove parts of the existing structures or appurtenances, as indicated on the Contract Drawings, herein specified, or necessary to permit completion of the work under this Contract. The Contractor shall 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. The Contractor shall dismantle and remove all existing equipment, piping, and other appurtenances required for the completion of the work. Where called for or required, the contractor shall cut existing pipelines for the purpose of making connections thereto. Anchor bolts for equipment and structural steel removed shall be cut off one inch below the concrete surface. Surface shall be finished as specified in the Contract Documents.

C. 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 anchorage, if required, shall also be installed as directed by the Engineer.

D. No existing structure, equipment, or appurtenance shall be shifted, cut, removed, or otherwise altered except

with the express approval of and to the extent approved by the Engineer.

E. When removing materials or portions of existing utility pipelines and/or structures or when making openings in walls and partitions, the Contractor shall 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 permitted, line drilling will be required in cutting existing concrete.

F. Materials and equipment removed in the course of making alterations and additions shall remain the property of the Owner, except that items not salvageable, as determined by the Engineer and the Owner, shall become the property of the Contractor to be disposed of by him off the work site at his own place of disposal. Operating equipment shall be thoroughly cleaned, lubricated, and greased for protection during prolonged storage.

G. All alterations to existing utility pipes and structures shall be done at such time and in such manner as to comply with the approved time schedule. So far as possible 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 delay.

H. All workmanship and new materials involved in constructing the alterations shall conform to the General Specifications for the classes of work insofar as such specifications are applicable.

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 Specifications covering the new work. When not covered, the work shall be carried on in the manner and to the extent directed by the Resident Project Representative.

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

K. Non-shrink grout shall be used for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete and elsewhere as shown.

L. Where necessary or required for the purpose of making connections, the Contractor shall cut existing pipelines in a manner to provide an approved joint. Where

required, he shall use flanges, or provide Dresser Couplings, all as required.

M. The Contractor shall provide flumes, hoses, piping 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 under this Contract.

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

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 Manatee County representative 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 abatement contractor or subcontractor registered in the State of Florida.

B. The asbestos abatement contractor or subcontractor 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 Contractor shall be responsible for all fees associated with permits, licenses and notices to the governing regulatory agencies.

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 17-251, "Asbestos".
2. National Emission Standards Hazardous Air Pollution (NESHAP), 40 CFR, Part 61, Subpart M, latest revision.
3. Occupational Safety and Health Act, 29 CFR
4. The Environmental Protection Agency (EPA) Asbestos Abatement Worker Protection Rule.
5. Florida Statute 455.300.

3.04 ASBESTOS CEMENT PIPE REMOVAL

A. All asbestos cement pipe sections shown on the Drawings to be removed, and all related valves, fittings and appurtenances shall be removed in their entirety and disposed of by the Contractor in accordance with this Section. After removal of the facilities, all trenches shall be backfilled in accordance with the Contract Documents. The cost of disposing of the removed materials shall be borne by the Contractor.

B. The Contractor shall make necessary provisions for the Engineer's representative to monitor all removal operations.

C. The cutting of existing asbestos-cement (A/C, aka "Transite") pipe shall be by hand saw only. No machine cutting shall be allowed. Removal of all portions 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 and every 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 (Phone #748-5543) is required.

3.05 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 sand/cement grout as specified herein. When such pipes are constructed with asbestos cement materials, the abandonment activities shall be performed by a licensed asbestos abatement contractor as specified in these Specifications.

B. Grout shall be injected within the pipe sections indicated on the Drawings. The ends of these sections shall be capped and/or plugged. The grouting program shall consist of pumping sand-cement grout with suitable chemical additives at pressures necessary to fill the pipe sections shown on the Drawings to prevent the potential for future collapse.

C. The pump used for grouting should be a continuous flow, positive displacement model with a pugmill type mixing vat having a minimum shaft speed of 60 rpm and incorporated as an integral part of the equipment. Alternate equipment may be used subject to the approval of the Engineer. The rate of pumping shall not exceed six (6) cubic feet per minute. The pumping pressures shall be in the range of 100 to 150 psi.

D. The Contractor shall provide standpipes and/or additional means of visual inspection as required by the Engineer to

determine if adequate grout material has filled the entire pipe section(s). The Contractor shall make necessary provisions for the Engineer's representative to monitor all grouting operations.

E. All pipe to be abandoned shall be capped or plugged with a fitting or material that will prevent soil or other material from entering the pipe. All caps and plugs shall be subject to approval by the Engineer.

END OF SECTION

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SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers clearing, grubbing and stripping of the project site and/or along the pipeline route.

B. The Contractor shall clear and grub all of the area within the limits of construction or as required, which includes, but is not limited to utility easements. The width of the area to be cleared shall be reviewed by the Engineer prior to the beginning of any clearing.

C. The Contractor's attention is directed to any Soil Erosion and Sediment Control Ordinances in force in Manatee County. The Contractor shall comply with all applicable sections of these ordinances.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEARING

The surface of the ground, for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. However, trees shall be preserved as hereinafter specified unless otherwise designated by the Engineer. Clearing operations shall be conducted so as to prevent damage to existing structures and installations and to those under construction, so as to provide for the safety of employees and others. Soil erosion control devices such as hay bales and silt fences shall be installed to satisfy all Federal, State and County requirements.

3.02 GRUBBING

Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for or by the removal of such objects, shall be refilled with

suitable materials and compacted to a density conforming to the surrounding ground surface.

3.03 STRIPPING

In areas so designated, topsoil shall be stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. The Owner shall have the option to receive all excess topsoil materials. The Contractor shall pay all equipment and labor cost to deliver excess top soil material to a remote site chosen by the Owner within a five mile radius of the construction site. Should Owner not choose to receive any or all excess topsoil materials, the Contractor shall dispose of said material at no additional cost to Owner.

3.04 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

The Contractor shall dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris off site. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor; the cost of which shall be included in the prices bid for the various classes of work.

3.05 PRESERVATION OF TREES

Those trees which are not designated for removal by the Engineer shall be carefully protected from damage. The Contractor shall erect such barricades, guards and enclosures as may be considered necessary by him for the protection of the trees during all construction operation.

3.06 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

A. The Contractor shall exercise extreme care to avoid unnecessary disturbance of developed private property adjacent to proposed project site. Trees, shrubbery, gardens, lawns and other landscaping, which are not designated by the Engineer to be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.

B. All soil preservation procedures and replanting operations shall be under the supervision of a nursery representative experienced in such operations.

C. Improvements to the land such as fences, walls, outbuildings and other structures which of necessity must be removed, shall be replaced with equal quality materials and workmanship.

D. The Contractor shall clean up the construction site across

developed private property directly after construction is completed upon approval of the Engineer.

3.07 PRESERVATION OF PUBLIC PROPERTY

The appropriate paragraphs of these Specifications shall apply to the preservation and restoration of public lands, parks, rights-of-way, easements and all other damaged areas. This includes, but is not limited to the trimming of trees damaged by contractor's equipment.

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 Engineer.

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 Engineer.

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, sanding 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 Engineer.

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 Engineer.

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 Engineer.

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 Engineer who will make an inspection of the excavation. No concrete or masonry shall be placed until the excavation has been approved by the Engineer.

C. The elevations of the footing bottom and the base slab as shown on the Drawings, shall be considered as approximate and the Engineer 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 Engineer, 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 Engineer 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 Engineer 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.

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 Engineer. The Contractor shall securely tamp the backfill with pneumatic rammer around all wall foundations. The method of compaction shall be satisfactory to the Engineer.

D. Compaction of structural backfill by ponding and jetting shall be permitted when, as determined by the Engineer: 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 Engineer, ponding and jetting may be permitted with compaction layers not to exceed four feet. The work shall be performed without damage to the structure or embankment and in such a manner that water will not be impounded.

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 shall 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 Engineer.

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 Engineer.

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 98 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 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 Engineer. During the progress of the work, the Engineer 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 Owner/Engineer. 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 Engineer 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 6" 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.
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 Engineer 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 Engineer 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 Engineer.
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. For each material, the Contractor shall notify the Engineer of the source of the material and shall furnish the Engineer, 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. Structural Fill

1. Structural fill 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. Structural fill material shall be a minimum of 60 percent clean sand, free of organic, deleterious and/or compressible material. Minimum acceptable density shall be 98 percent of the maximum density as determined by AASHTO T-180. Rock in excess of 2-1/2" in diameter shall not be used in the fill material. If the moisture content is improper for attaining the specified density, either water shall be added or material

shall be permitted to dry until the proper moisture content for compaction is reached.

C. Base Course

1. Asphalt, crushed concrete, soil cement or approved equal, shall be used as base course for bituminous paved roads and parking areas.

D. Common Fill

1. Common fill material shall be free from organic matter, muck or marl and rock exceeding 2-1/2" in diameter. Common fill shall not contain broken concrete, masonry, rubble or other similar materials. Existing soil may be used to adjust grades over the site with the exception of the construction area.
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 Engineer, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials by the Contractor.

E. Crushed Stone

1. Crushed stone may be used for pipe bedding, manhole bases, as a drainage layer below structures with underdrains and at other locations indicated on the Drawings.
2. Crushed stone shall be size No. 57 with gradation as noted in Table 1 of Section 901 of Florida Department of Transportation, Construction of Roads and Bridges.

PART 3 EXECUTION

3.01 FILL PLACEMENT

A. General

1. Material placed in fill areas under and around pipelines and structures shall be deposited within the lines and to the grades shown on the Drawings or as directed by the Engineer, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the Engineer. If sufficient common fill material is not available from excavation on site, the Contractor shall provide borrows as may be required.
2. Limerock base course material, structural fill and screened limerock, may be provided as borrow.
3. Fill shall be brought up in substantially level lifts throughout the site, starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section. Fill shall not be placed against concrete structures until they have attained sufficient strength.
4. Fill shall be dumped and spread in layers by a bulldozer or other approved method. During the process of dumping and spreading, all

roots, debris and stones greater in size than specified under Materials, shall be removed from the fill areas. The Contractor shall assign a sufficient number of men to this work to insure satisfactory compliance with these requirements.

5. If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.

6. All fill materials shall be placed and compacted "in-the-dry". The Contractor shall dewater excavated areas and is required to perform the work in such manner as to preserve the undisturbed state of the natural inorganic soil.

3.02 COMPACTION

A. Structural fill, limerock base course and screened limerock in open areas, shall be placed in layers not to exceed nine inches in depth as measured before compaction. Each layer shall be compacted by a minimum of six coverages (3 passes each way) with the equipment described below, to at least 98 percent of the maximum density, as determined by AASHTO T-180. Incidental compaction due to traffic by construction equipment will not be credited toward the required minimum six coverages.

B. Common fill shall be placed and compacted in a manner similar to that described above for structural fill, with the following exceptions: layer thickness prior to compaction may be increased to 12-inches in open areas; and common fill except dike fill, required below water level in peat excavation areas may be placed as one lift, in-the-wet, to an elevation one foot above the water level at the time of filling.

C. Compaction equipment in open areas shall consist of a medium-heavy vibrator roller (minimum static weight of 10 tons) operated at resonant frequency and at a speed of 2 fps or less or other compaction equipment approved by the Engineer.

D. Areas adjacent to pipelines, structures and other confined areas inaccessible to the vibrator roller shall be compacted with a manually operated sled-type vibratory compactor. The Contractor shall also conform to additional backfill requirements at pipelines and structures as specified in the Contract Documents. Compaction of the fill by such means shall be to the same degree of compaction as obtained by the rubber-tired equipment, and the Engineer may make the necessary tests to determine the amount of compactive effort necessary to obtain equal compaction. Unless such tests indicate that modifications may be made, the fill compacted by mechanical compactors shall be placed in 6-inch layers and thoroughly tamped over the entire surface.

Compaction equipment is subject to approval by the Engineer.

E. It is the intention that the fill materials with respect to moisture be used in the condition they are excavated insofar as this is practicable. Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits.

F. If the Engineer shall determine that added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued.

G. The Contractor shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and all other materials and equipment necessary to place the water in the fill in the manner specified.

3.03 TRENCH EXCAVATION AND BACKFILLING

A. Excavation for all trenches required for the installation of pipes and electrical ducts shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches.

B. Rock shall be removed to a minimum 6" clearance around the bottom and sides of all the pipe or ducts being laid.

C. Where pipes or ducts are to be laid in limerock bedding or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

D. Where the pipes or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated manually, shall be done in such a manner that will give a flat bottom true to grade so that pipe or duct can be evenly supported on undisturbed material. Bell holes shall be made as required.

E. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected and the trench filled with suitable compacted material to the mid-diameter of the pipe.

F. Backfilling over ducts shall begin not less than three days after placing concrete encasement.

G. All backfilling shall be prosecuted expeditiously and as detailed on the Drawings.

H. Any space remaining between the pipe and sides of the trench shall be packed full by hand shovel with selected earth, free from stones having a diameter greater than 2" and thoroughly compacted with a tamper as fast as placed, up to a level of one foot above the top of the pipe.

I. The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.

J. The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted by rolling, ramming, or puddling, as the Engineer may direct, sufficiently to prevent subsequent settling.

3.04 GRADING

A. Grading shall be performed at such places as are indicated on the Drawings, to the lines, grades and elevations shown or as directed by the Engineer and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

B. If at the time of excavation it is not possible to place any material in its proper section of the permanent pipeline structure, it shall be stockpiled in approved areas for later use.

C. Minute adjustments in lines or grades may be made if found necessary as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction.

D. Stones or rock fragments larger than 2-1/2" in their greatest dimensions shall not be permitted in the top 6" of the subgrade line of all dikes, fills or embankments.

E. All fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings, or as directed by the Engineer.

F. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All fill slopes shall be uniformly dressed to the slope, cross section and alignment shown on the Drawings or as directed by the Engineer.

G. No grading is to be done in areas where there are existing pipelines that may be uncovered or damaged until such lines which must be maintained are relocated, or where lines are to be abandoned and removed, all required valves are closed and drains plugged at manholes.

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 Engineer, 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 Engineer 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 Engineer 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. Should the material at the level of trench bottom consist of fine sand, sand and silt or soft earth, the subgrade material shall be removed as directed by the Engineer and the excavation shall be refilled with crushed stone or washed shell.

END OF SECTION

5/24/95(Rev.)

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 Owner.

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 Engineer.

B. The Contractor shall cut out areas to sub-grade elevation to stabilize base material for paving and sidewalks.

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 Engineer. 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

12/08/94(Rev.)

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 Owner/Engineer.

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 Owner/Engineer.

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. South Florida Building Code and Standard 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 Owner.

B. Seed and sod.

2.02 SEDIMENTATION CONTROL

A. Bales - clean, seedfree cereal hay type.

B. Netting - fabricated of material acceptable to the Owner.

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

12/8/94(Rev.)

SECTION 02355

LUMBER LEFT IN PLACE

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish and install shoring and sheeting as necessary to provide adequate safety.

PART 2 PRODUCTS

2.01 MATERIALS

Wood for shoring and sheeting shall be green, rough cut hardwood planking.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall furnish, install and maintain sheeting and bracing required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below which is necessary for proper construction and to protect adjacent structures from undermining or other damage. If the Engineer determines that insufficient or improper supports have been provided, he may order additional supports to be installed at the expense of the Contractor. Compliance with such orders shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting. Should voids form, they shall be immediately filled and rammed.

B. The Contractor shall embed and leave in place all sheeting, bracing and other related items as shown on the Contract Drawings. The Owner/Engineer may direct that sheeting and bracing timber be cut off at a specified elevation. No additional payment or compensation shall be made for this work.

C. Sheeting and bracing not left in place shall be removed carefully in such manner as not to endanger other structures, utilities, property, or proposed construction.

D. The Owner/Engineer may order sheeting and bracing to be left in place; however, this shall not relieve the Contractor from liability for damages to persons or property due to negligence or the failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

E. The Contractor shall receive no payment other than that included in the pipe bid item price for any timber used for sheeting bracing, or other related items.

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 Engineer/Owner.

1.02 RELATED WORK NOT INCLUDED

A. 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. Requirements

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 Owner 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.

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 Engineer.

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 Engineer 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 Owner. 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 Engineer.

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 Engineer shall approve the finish grade of all areas to be seeded or sodded prior to seed or sod application.

C. 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 Owner shall be repaired by the Contractor as directed by the Engineer.

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

Any existing landscape items damaged or altered during construction by the Contractor shall be restored or replaced as directed by the Engineer.

Maintain landscape work for a period of 90 days immediately following complete installation of work or until Owner 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 Owner.

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

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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 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 99% 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 or 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 Engineer.

3.02 PAVEMENT REPAIR AND REPLACEMENT

A. The Contractor shall repair, to meet or exceed original surface material, all existing pavement 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 width of all 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.

3.03 MISCELLANEOUS RESTORATION

Sidewalks 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, restrained joint ductile iron pipe and cast iron or ductile iron 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. Newly installed pipe shall be kept clean and free of all foreign matter.

1.02 SUBMITTALS

A. The Contractor shall submit to the Engineer, 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.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ductile iron pipe shall conform to AWWA C150 and AWWA C151. Thickness of pipe shall be Pressure Class 350. All ductile iron pipe used in above ground applications shall be Special Thickness Class 53. The pipe exterior coating shall be a standard 1 mil asphaltic coating per AWWA C151. All ductile iron pipe shall be clearly marked on the outside of the barrel to readily identify it. All pipe materials used in potable water systems shall comply with NSF Standard 61.

B. Unrestrained joint pipe shall be supplied in lengths not to exceed 21 ft. and 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 an approved equal.

C. All fittings shall be pressure rated for 350 psi for sizes 4-24 inches and 250 psi for

sizes 30 inches and larger and 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 EPDM rubber for potable water and reclaimed water pipelines. Standard gaskets shall be such as Fastite as manufactured by American Cast Iron Pipe Company, or an approved equal.

E. Water Mains and Reclaimed Water Mains:

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. 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 asphaltic exterior coatings or they shall have factory-applied fusion bonded epoxy coatings both inside and outside in accordance with AWWA C550.

F. Sewer Mains:

All ductile iron pipe and all ductile iron and cast iron fittings used in wastewater sewer systems shall have a factory applied fusion bonded minimum dry film thickness 40-mil Protecto 401 or Amine Cured Novalac_ceramic epoxy lining or minimum 60-mil Polybond Plus polyethylene lining with a fusion bonded epoxy primer layer on the inside in accordance with the manufacturer's specifications. 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 the holiday testing at production per ASTM G62 with a minimum 10,000 volt charge. The lining shall have a minimum ten year warranty covering failure of the lining and bond failure between liner and pipe.

G. Ductile iron or cast iron pipe and fittings used in sewer systems shall have either an asphaltic coating per AWWA C151 or a factory applied fusion bonded epoxy exterior coating.

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 as 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. 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

2.02 DETECTION

A. Pipe shall have a 3-inch wide detectable metallic tape of the proper color placed directly above the pipe 12-inches below finished grade or a 6-inch detectable tape between 12-inches and 24-inches below finished grade.

B. Pipe shall have a No. 10 gauge solid, insulated wire of proper color installed along the pipe alignment as detailed in these standards.

2.03 IDENTIFICATION

A. Each length of pipe and each fitting shall be marked with the name of the manufacturer, size and class 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. Pipe shall be poly wrapped blue for water mains, purple (Pantone 522 C) for reclaimed water mains and green for sewer mains.

END OF SECTION

SECTION 02617

INSTALLATION AND TESTING OF PRESSURE PIPE

1.01 INSTALLING PIPE AND FITTINGS

A. The Contractor shall install all pipe in accordance with the recommendations of the pipe manufacturer and as specified herein.

B. The Contractor shall take care in handling, storage and installation of pipe and fittings to prevent injury to the pipe or coatings. All pipe and fittings shall be examined before installation and pipe which is deemed to be defective by the Owner/Engineer shall not be installed.

C. The Contractor shall thoroughly clean and keep thoroughly clean, all pipe and fittings prior to during and after installation.

D. The Contractor shall lay the pipe to the lines and grades shown on the Contract Drawings with bedding and backfill as shown on the Drawings or called out in the Contract Documents. Blocking under the pipe shall not be permitted except through casing sleeves.

E. The Contractor shall keep the open ends of all pipe closed with a tightly fitting plug when installation is not in progress or the potential exists for dirt or debris to enter the pipe.

F. The pipe or accessories shall not be dropped into the trench under any circumstances.

G. The Contractor shall construct all water mains pursuant to the provisions of "Recommended Standards for Water Works", Part 8, incorporated by reference in Rule 17-555.330(3), F.A.C.

1.02 PROCEDURE FOR TESTING WATER LINES, FORCE MAINS AND RECLAIMED WATER LINES

A. The Engineer must call in to schedule all testing. 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. Engineer and Contractor must be present for all testing, except for testing tapping valves and sleeves.

C. All pressure pipe lines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipe lines shall be subjected to a hydrostatic pressure test for two (2) hours at full working pressure, but not less than 180 psi for water/reclaimed (150 psi for force main). Maximum length of pipe to be tested at one time is 2,600 feet. If line is longer than 2,600 feet and cannot be sectioned in 2,600 feet (max.) lengths, the allowable leakage will be figured at 2,600 feet.

D. Allowable leakage shall be determined by AWWA C600 table for hydrostatic tests. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof; to maintain the test pressure after the air in the pipe line has been expelled and the pipe has been filled with water.

E. All digging on the job site in the right-of-way must be completed before any testing of water or sewer. Any digging or boring across water or sewer lines after they have been tested may result in a retest of the lines at the County's request.

F. All water and sewer lines will be installed per approved construction plans by the County. If any revisions or changes are made after initial testing, lines will be re-tested at the County's request.

G. Disconnect water supply during test.

H. All force mains will be tested from the valves in the valve vault at the lift station to the point of connection whether it be against a valve on another force main or into a manhole.

I. All services to be aboveground during test. The services should be the correct length so they will be one (1) foot inside right-of-way line.

J. All fire hydrant gate valves to be open during test.

K. All visible leaks are to be repaired, regardless of the amount of leakage.

L. Check gauge pressure periodically during test. If test pressure drops to 175 psi for water/reclaimed lines or to 145 psi for force mains during test, the line must be repumped back to 180 psi for water/reclaimed (150 psi

force mains) and the amount of leakage measured. The test will continue on with the remaining time left. At the end of the test, the line must be repumped again back to 180 psi (150 psi for force main) and the amount of leakage measured and added to any previous leakage determined earlier in the test.

M. After the line passes the test, the pressure will be blown off from the opposite end of line from the gauge location. Fire hydrants, services and end-of-line blow offs will be opened to demonstrate they were on line during the test.

N. At end of test, the test gauge must return to zero. The pressure gauge must read 0 psi to a maximum of 300 psi in 5 psi increments.

O. The section of line being tested must be identified on the charge sheet. The length and size of pipe, the exact area being tested and the valves being tested against, must be identified. Use Station numbers if available.

P. A punch list must be made at the end of all tests.

Q. A copy of the charge sheet will be given to the Engineer and the Contractor at the end of the test.

1.03 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 owner and obtain the best as-built information available. Allow sufficient time for the owner to field locate the existing pipe lines.

2) Submit drawings of proposed location to the Owner 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 Owner 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.

END OF SECTION

SECTION 02622

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS (AWWA SPECIFICATIONS C-900 & C-905)

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials, equipment and incidentals required to install the plastic piping, fittings and appurtenances complete and ready for use as specified in the Contract Documents and these Standards.

1.02 DESCRIPTION OF SYSTEM

The Contractor shall install the piping in the locations as shown on the Drawings.

1.03 QUALIFICATIONS

All plastic pipe, fittings and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable, qualified and specializes in the manufacture of the items to be furnished. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.04 SUBMITTALS

A. The Contractor shall submit shop drawings to the Engineer including, but not limited to, dimensions and technical specifications for all piping.

B. The Contractor shall submit to the Engineer, samples of all materials specified herein.

C. The Contractor shall submit and shall comply with pipe manufacturer's recommendation for handling, storing and installing pipe and fittings.

D. The Contractor shall submit pipe manufacturer's certification of compliance with these Specifications.

1.05 TOOLS

The Contractor shall supply special tools, solvents, lubricants, and caulking compounds required for proper

installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pressure Class-Rated Polyvinyl Chloride (PVC) Pipe

1. Pressure class-rated PVC pipe and accessories four to twelve inches (4"-12") in diameter, where shown or as specified on the Drawings, shall meet the requirements of AWWA Specification C-900 "Polyvinyl Chloride (PVC) Pressure Pipe". Pipe shall be Class 150, meeting requirements of Dimension Ratio (DR) 18 and shall have the dimension of ductile iron outside diameters. Each length of pipe shall be hydrotested to four (4) times its class pressure by the manufacturer in accordance with AWWA C-900.

2. PVC pipe 14" through 36" shall meet the requirements of AWWA Standard C-905, Polyvinyl Chloride (PVC) Water Transmission Pipe. Pipe 14" thru 24" for potable and reclaim water shall meet the requirements for dimension ratio (DR) 18. Each length of pipe shall be tested at twice the pressure rating (PR 235 psi) for a minimum dwell of 5 seconds in accordance with AWWA C-905. Fourteen inch (14") thru 36" PVC pipe for sewer force mains shall meet AWWA C-905 requirements for dimension ratio (DR) 21. Each length of pipe shall be tested at twice the pressure rating (PR 200 psi) for a minimum dwell of five seconds in accordance with AWWA C-905. Pipe shall be listed by Underwriters Laboratories. Provisions shall be made for expansion and contraction at each joint with an elastomeric ring, and shall have an integral thickened bell as part of each joint. PVC Class pipe shall be installed as recommended by the manufacturer. Pipe shall be furnished in nominal lengths of approximately 20 feet, unless otherwise directed by the Engineer. Pipe and accessories shall bear the NSF mark indicating pipe size, manufacturer's names, AWWA and/or ASTM Specification number, working pressure, and production code.

3. Gaskets for 16" diameter and larger pipe used for potable water pipe shall be EPDM (Ethylene-Propylene Dine Monomer).

4. PVC pipe 3" and less in diameter may be constructed using pipe conforming to ASTM D2241 with push-on joints. Pipe shall be 200 psi pipe-SDR 21 unless otherwise specified by the Engineer. This PVC pipe

shall not be used for working pressures greater than 125 psi.

5. Pipe shall be blue for potable water mains, green for sewage force mains and purple for reclaimed water mains. All potable water pipe shall be NSF certified and copies of lab certification shall be submitted to the Engineer.

6. Where colored pipe is unavailable, white PVC color coded spiral wrapped pipe shall be installed.

B. Joints

1. The PVC joints for pipe shall be of the push-on type unless otherwise directed by the Engineer so that the pipe and fittings may be connected on the job without the use of solvent cement or any special equipment. The push-on joint shall be a single resilient gasket joint designed to be assembled by the positioning of a continuous, molded resilient ring gasket in an annular recess in the pipe or fitting socket and the forcing of the plain end of the entering pipe into the socket, thereby compressing the gasket radially to the pipe to form a positive seal. The gasket and annular recess shall be designed and shaped so that the gasket is locked in place against displacement as the joint is assembled. The resilient ring joint shall be designed for thermal expansion or contraction with a total temperature change of at least 75 degrees F in each joint per length of pipe. The bell shall consist of an integral wall section with a solid cross section elastomeric ring which shall meet requirements of ASTM F-477. The thickened bell section shall be designed to be at least as strong as the pipe wall. Lubricant furnished for lubricating joints shall be nontoxic, 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. Gaskets shall be suitable for use with potable water, reclaimed water or sanitary sewer as applicable.

2. 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. PVC joints for pipe shall be restrained by the following methods: thrust blocks, restraining glands such as Certa-Lok Restraining Joint Municipal Water Pipe by the Certain Teed

Corporation of Valley Forge, PA, or approved equal. All Grip, Star Grip by Star Products, MJR by Tyler Pipe, Tyler, Texas. Restrained joint PVC pipe shall be installed in strict accordance with the manufacturer's recommendation.

C. Fittings

1. All fittings for class-rated PVC pipe shall be ductile iron with mechanical joints and shall conform to the specifications for ductile iron fittings, unless otherwise directed. Class 200, C-900 PVC fittings are allowable for sewage force main applications up to and including 12" diameter only. DR ratio shall be the same as the pipe.

2. The manufacturer of the pipe shall supply all polyvinyl chloride accessories as well as any adapters and/or specials required to perform the work as shown on the Drawings and specified herein. Standard double bell couplings will not be accepted where the pipe will slip completely through the coupling.

PART 3 EXECUTION

3.01 INSTALLATION

The Contractor shall install the plastic pipe in strict accordance with the manufacturer's technical data and printed instructions. Direct bury pipe shall have 3" detectable metallic tape of the proper color placed directly above the pipe 12" below finished grade or 6" detectable tape between 12" and 24" below grade.

3.02 INSPECTION AND TESTING

A. All pipe lines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipe lines shall be subjected to a hydrostatic pressure test for two (2) hours at full working pressure, but not less than 180 psi for water/reclaimed (150 psi for force main). All visible leaks shall be repaired and retested for approval by the County. Prior to testing, the pipe lines shall be supported in a manner approved by the Engineer to prevent movement during tests.

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 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 one manufacturer.

C. All valves and appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

D. All valves shall have a factory applied, fusion bonded epoxy coating on interior and exterior.

E. The equipment shall include, but not be limited to, the following:

1. Gate valves (Sec. 2.01)
2. Pressure Sustaining and Check Valves (Sec. 2.02)
3. Ball Valves for PVC Pipe (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 Cocks (Sec. 2.09)
10. Flange Adapter Couplings (Sec. 2.10)
11. Flexible Couplings (Sec. 2.11)
12. Hose Bibs (Sec. 2.12)
13. Slow Closing Air and Vacuum Valves (Sec. 2.13)
14. Surge Anticipator Valve (Sec. 2.14)
15. Check Valves (Sec. 2.15)
16. Hydrants (Sec. 2.16)
17. Restraining Clamps (Sec. 2.17)
18. Tapping Sleeves and Tapping Valves (Sec. 2.18)
19. Single Acting Altitude Valves (Sec. 2.19)

1.02 DESCRIPTION OF SYSTEMS

All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of potable water, reclaim water, wastewater, etc., depending on the applications.

1.03 QUALIFICATIONS

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 Specifications as applicable. Valves shall be as covered under mechanical devices in Section 8 of ANSI/NSF Standard 61.

1.04 SUBMITTALS

A. Submit to the Engineer 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 Engineer for approval in accordance with the Specifications.

1.05 TOOLS

Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2 PRODUCTS

2.01 GATE VALVES

A. All buried valves shall have cast or ductile iron three (3) piece valve boxes.

B. 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.

C. Where required, gate valves shall be provided with a box cast in a concrete slab and a box cover. Length of box shall include slab thickness. Box cover opening shall be for valve stem and nut. Valve wrenches and extension stems shall be provided by the manufacturer to actuate the valves. The floor box and cover shall be equal to

those manufactured by Rodney Hunt Machine Company, Orange, Massachusetts, Clow, DeZurik or approved equal.

D. Gate valves with 3"-20" diameters shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509 and UL/FM of latest revision and in accordance with the following specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

E. The valves shall have a non-rising stem of stainless steel or of cast, forged, or rolled bronze as shown in AWWA C509. Stem seals shall be provided and shall be of the O-ring type, two above and one below the thrust collar.

F. The sealing mechanism shall consist of a cast iron gate fully encapsulated with an EPDM Elastomer coating. 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.

G. The valve body, bonnet, and bonnet cover shall meet or exceed all the requirements of AWWA C509 latest edition. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating. Wrench nut shall be provided for operating the valve.

H. Valves shall be suitable for an operating pressure of 200 psi and shall be tested in accordance with AWWA C509.

I. All bonnet bolts, nuts and studs shall be stainless steel.

2.02 PRESSURE SUSTAINING AND CHECK VALVE

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. The stainless steel stem shall be fully guided at both ends by a bearing in the valve cover, and an integral bearing in the valve seat. It shall be sleeved at both ends with delrin. 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 cocks 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 seat cut to 5 degrees taper.

B. Valve shall maintain a minimum (adjustable) upstream pressure to a preset (adjustable) maximum. The pilot system shall consist of two direct acting, adjustable, spring loaded diaphragm valves.

C. Valve shall be cast iron (ASTM A48) with main valve trim of brass (QQB-B-626) and bronze (ASTM B61). The pilot control valves shall be cast brass (ASTM B62) with 303 stainless steel trim. Valve shall be similar in all respects to CLA-VAL Company, Model 692G-01ABKG, as manufactured by CLA-VAL Company, Winter Park, Florida, or similar pressure sustaining and check valve as manufactured by Golden Alderson; or approved equal.

2.03 BALL VALVES FOR PVC PIPE

A. Ball valves for PVC pipe shall be of PVC Type 1 with union, socket, threaded or flanged ends as required. Ball valves shall be full port, full flow, all plastic construction, 150 psi rated with teflon seat seals and T-handles. PVC ball valves shall be as manufactured by Celanese Piping Systems, Inc., Wallace and Tiernan, Inc., Plastiline, Inc., or approved equal.

B. All valves shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.

2.04 BUTTERFLY VALVES

A. Butterfly valves shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designated C504, except as hereinafter specified. Valves, except as specified hereinafter, shall be Class 150A or B, except that valves furnished downstream of the high service pumps shall be Class 250 and equal to those manufactured by Henry Pratt Company, DeZurik, Kennedy, or approved equal. The valve discs shall be constructed of cast iron conforming to ASTM A-48, Class 40, ASTM A-126, Class B or ductile iron conforming to ASTM A536, Grade 65-45-12 for Class 150 or less. Ductile iron conforming to ASTM A536, Grade 65-45-12 shall be provided for all Class 250 valves. All valves shall be leak tested at 200 psi.

B. The face-to-face dimensions of flanged end valves shall be in accordance with Table 2 of above mentioned AWWA Specification for short-body valve. Adequate two-way thrust bearings shall be provided. Flange drilling shall be in accordance with ANSI B16.1.

C. Valve seats shall be an EPDM elastomer. Valve seats 24 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of

corrosion resistant material with stainless Nylock screws and be capable of the 1/8-inch adjustment. Valves 20 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C 504. Where the EPDM seat is mounted on the valve body, the mating edge of the valve disc shall be 18-8 stainless steel or Nickel-Chrome, 80-20%. Where the EPDM seat is mounted on the valve disc, the valve body shall be fitted with an 18-8 stainless steel seat offset from the shaft, mechanically restrained and covering 360 degrees of the peripheral opening or seating surface.

D. The valve body shall be constructed of ductile iron or close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housings of the through boss-type. Butterfly valves of the "wafer" or "spool" type will not be accepted.

E. The valve shaft shall be turned, ground, and polished 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. 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 for a period of five minutes. 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 230 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. The Class 150 valves shall be tested in conformance with AWWA C-504.

G. In general, the butterfly valve operators shall conform to the requirements of Section 3.8 of the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable, and as herein specified.

H. 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.

I. 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.

J. 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.

K. Where indicated on the Drawings, extension stems, floor stands, couplings, stem guides, and floor boxes as required shall be furnished and installed.

L. All iron body parts, inside and out, of butterfly valves shall be provided with a fusion bonded epoxy coating that is shown to be holiday free using an electronic holiday test, or a two part thermoset epoxy coating which is shown to be an electrically void free coating, in accordance with AWWA C504 and AWWA C550.

2.05 PLUG VALVES

A. All plug valves shall be eccentric plug valves capable of sustaining 150 psi in either direction without leaking.

Exception: Single direction plug valves may be used if it is clearly demonstrated they will <u>never</u> be required to resist pressure in both directions either in service or during pipe line testing.

B. Plug valves shall be tested in accordance with current AWWA Standard C-504-80 Section 5. Each valve shall be performance tested in accordance with paragraph 5.2 and shall be given a leakage test and hydrostatic test as described in paragraphs 5.3 and 5.4. The manufacturer shall furnish certified copies of reports covering proof of design testing as described in Section 5.5.

C. Plug valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the Plans. Flanged valves shall be faced and drilled to the ANSI 150 lb. standard. Mechanical joint ends shall be to the AWWA Standard C111-72. Bell ends shall be to the AWWA Standard C100-55 Class B. Screwed ends shall be to the NPT standard.

D. Plug valve bodies shall be of ASTM A126 Class B Semi-steel, 31,000 psi tensile strength minimum in compliance with AWWA Standard C507-73, Section 5.1 and AWWA Standard C504-70 Section 6.4. Port areas for valves 20-inches and smaller shall be 80 percent of full pipe area. Valves 24 inch and larger shall have a minimum port area between 80 and 100 percent of full nominal pipe area. All exposed nuts, bolts, springs, washers, etc. shall be zinc or cadmium plated. Resilient plug facings shall be of Hycar or Neoprene.

E. Plug valves shall be furnished with permanently lubricated stainless steel or oil-impregnated bronze upper and lower plug stem bushings. These bearings shall comply with current AWWA Standards.

2.06 VALVE ACTUATORS

A. General

1. All valve actuators shall conform to Section 3.8 of the AWWA Standard Specification and shall be either manual or motor operated.

2. 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.

3. Butterfly valve actuators shall conform to the requirements of Section 3.8 of the AWWA Standard specifications for Rubber Seated Butterfly Valves, Designated C504, insofar as applicable and as herein specified.

B. Manual Actuators

1. 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 and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Actuators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds on the handwheel or chainwheel. Actuator components shall withstand an input of 450 foot pounds for 30" and smaller and 300 foot pounds for larger than 30" size valves at extreme actuator positions without damage. Valves located above grade shall have handwheel and position indicator, and valves located below grade shall be equipped with a two inch (2") square AWWA operating nut located at ground level and cast iron extension type valve box. Valve actuators shall conform to AWWA C504, latest revision.

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.

8. 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.

9. The electronics for the electric operator shall be protected against temporary submergence.

10. 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.

   (a) 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.

   (b) The motor shall be prelubricated and all bearings shall be of the anti-friction type.

3. 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.

4. 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 toro. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. Motor operators shall be as manufactured by Limitorque Corporation, Type L120 or approved equal.

2.07 AIR RELEASE VALVES

The air release valves for use in water or force mains shall be installed as shown on the Drawings. The valves shall have a cast iron body cover and baffle, stainless steel float, bronze water diffuser, Buna-N or Viton seat, and stainless steel trim. The fittings shall be threaded. The air release valves shall be Model 200A or 400A as manufactured by APCO Valve and Primer Corporation, Schaumburg, Illinois; or approved equal.

2.08 VALVE BOXES

1. Buried valves shall have cast-iron three piece valve boxes or HDPE adjustable valve boxes. Cast iron valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by the Engineer. The barrel shall be two-piece, screw type, having a 5-1/4 inch shaft. The upper section shall have a flange at the bottom with sufficient bearing area to prevent settling and shall be complete with cast iron covers. Covers shall have "WATER", "SEWER", or "RECLAIM", as applicable, cast into the top.

2. All valves shall have actuating nuts extended to within four (4) feet of the top of the valve box. All valve extensions will have a centering guide plate two (2) inches maximum below the actuating nut. The valve extension shall be fastened to the existing nut with a set screw. Valve boxes shall be provided with a concrete base and a valve nameplate engraved with lettering 1/8-inch deep as shown on the Drawings.

3. HDPE adjustable valve boxes shall be one complete assembled unit composed of the valve box and extension stem. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. Valve box assembly shall be adjustable to accommodate variable trench depths.

4. The entire assembly shall be made of heavy wall high density polyethylene. All exterior components shall be joined with stainless steel screws. The valve box top section shall be adaptable to fit inside a valve box upper section.

5. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The stem material shall be of plated steel square tubing. The stem assembly shall have a built-in device that keeps the stem assembly from disengaging at its fully extended length. The extension stem must be torque tested to 1000 foot pounds. Covers shall have "WATER", "SEWER" or "RECLAIMED" clearly and permanently impressed into the top surface.

2.09 CORPORATION COCKS

Corporation cocks for connections to cast-iron, ductile iron or steel piping shall be all brass or bronze suitable for 180 psi operating pressure and similar to Mueller Co. H-10046 or approved equal by Clow Corp., and shall be of sizes required and/or noted on the Drawings.

2.10 FLANGE ADAPTER COUPLINGS

Flange adapter couplings shall be of the size and pressure rating required for each installation and shall be suitable for use on either cast iron or ductile iron pipe. They shall be similar or approved equal to Dresser Company, Style 128. All couplings shall have a sufficient number of factory installed anchor studs to meet or exceed a minimum test pressure rating of 230 psi minimum.

2.11 FLEXIBLE COUPLINGS

Flexible couplings shall be either the split type or the sleeve type as shown on the Drawings.

1. Split type coupling shall be used with all interior piping and with exterior pipings noted on the Drawings. The couplings shall be mechanical type for radius groove piping. The couplings shall mechanically engage and lock grooved pipe ends in a positive couple and allow for angular deflection and contracting and expansion.

2. Couplings shall consist of malleable iron, ASTM Specification A47, Grade 32510 housing clamps in two or more parts, a single chlorinated butyl composition sealing gasket with a "C" shaped cross-section and internal sealing lips projecting diagonally inward, and two or more oval track head type bolts with hexagonal heavy nuts conforming to ASTM Specification A 183 and A194 to assemble the housing clamps. Bolts and nuts shall be hot dipped galvanized after fabrication.

3. Victualic type couplings and fittings may be used in lieu of flanged joints. Pipes shall be radius grooved as specified for use with the Victaulic couplings. Flanged adapter connections at fittings, valves, and equipment shall be Victaulic Vic Flange Style 741, equal by Gustin-Bacon Group, Division of Certain-Teed Products, Kansas City, Kansas, or approved equal.

4. Sleeve type couplings shall be used with all buried piping. The couplings shall be of steel and shall be Dresser Style 38 or 40, as shown on the Drawings, or equal. The coupling shall be provided

with hot dipped galvanized steel bolts and nuts unless indicated otherwise.

5. All couplings shall be furnished with the pipe stop removed.

6. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

7. If the Contractor decides to use victaulic couplings in lieu of flanged joints, he shall be responsible for supplying supports for the joints.

2.12 HOSE BIBS

Hose bibs shall be 3/4" or 1" brass, polished chromium plated brass, with vacuum breaker as noted on the drawings.

2.13 SLOW CLOSING AIR AND VACUUM VALVES

A. The Contractor shall furnish and install slow closing air and vacuum valves as shown on the Drawings which shall have two (2) independent valves bolted together. The air and vacuum valve shall have all stainless steel float, guided on both ends with stainless shafts. The air and vacuum valve seat shall be Buna-N to insure drop tight closure. The Buna-N seat shall be fastened to the cover stainless shoulder screws in a manner to prevent distortion of the seat. The float shall be guided at both ends with stainless steel bushings.

B. The valve cover shall have a male lip designed to fit into the body register for accurate alignment of the float into the Buna-N seat. The valve cover shall have 250-pound class flanged outlet connection.

C. The surge check valve shall be bolted to the inlet of the air and vacuum valve and consist of a body, seat, disc, and compression spring. A surge check unit shall operate on the interphase between the kinetic energy and relative velocity flows of air and water, so that after air passes through, and water rushes into the surge check, the disc starts to close, reducing the rate of flow of water into the air valve by means of throttling orifices in the disc to prevent water hammer in the air valves. The surge check orifices must be adjustable type for regulation in the field to suit operating conditions. Valve shall be rated for 250-pound class working pressure.

D. The complete slow closing air and vacuum valve with air release valve shall have been flow tested in the field, substantiated with test data to show reduction of surge pressure in the valve. Flow test data shall be submitted with initial shop drawings for approval.

E. Valve exterior to be painted Red Oxide, Phenolic TT-P86, Primer or approved equal for high resistance to corrosion.

F. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

Air Valve Cover, Body, and Surge Check Body	Cast Iron	ASTM A48, Class 30
Float	Stainless Steel	ASTM A240
Surge Check Seat and Disc	Stainless Steel	ASTM A582
Air Valve Seat	Buna-N	
Spring	Stainless Steel	T302

2.14 SURGE ANTICIPATOR VALVES

A. Surge anticipator valves shall be furnished for the pumping systems as shown on the Drawings. The valve shall be hydraulically operated, pilot controlled, and diaphragm or piston actuated. The main valve shall be cast iron conforming to ASTM A48 with bronze trim conforming to ASTM B61 and flanged ends conforming to ANSI B161.1. The main valve shall be globe type with a single removable seat and a resilient disc.

B. The diaphragm actuated valve shall have a stainless steel stem guided at both ends by a bearing in the valve cover and an integral bearing surface in the seat. No external packing glands shall be permitted. The valve shall be fully serviceable without removing it from the line. The pilot system shall be of noncorrosive construction and provided with isolation cocks.

C. The piston actuated valve shall operate on the differential piston principle. The valve piston shall be guided on its outside diameter. The valve shall be able to operate in any position and shall be fully serviceable without removing it from the line. The pilot system shall be provided with isolation cocks, and be of noncorrosive materials of construction.

D. The valve shall be designed specifically to minimize the effects of water hammer, resulting from power failure at the pumping station, or from normal stopping and starting of pumping operators. The valve shall open hydraulically on a down surge, or low pressure wave created when the pump stops, remain open during the low pressure cycle in order to be open when the high pressure wave returns.

The high pressure pilot shall be adjustable over a 20 to 200 psi range and the low pressure pilot shall be adjustable over a 15 to 75 psi range. The valve shall be the 250 Class.

2.15 CHECK VALVES

A. Check valves for cast iron and ductile iron pipe lines shall be swing type and shall meet the material requirements of AWWA Specification C508. The valves shall be iron body, bronze mounted, single disc, 175 psi working water pressure and nonshock. Valves shall be as manufactured by Mueller, Clow, American, Kennedy, M&H, or 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 hinge pins and bronze nuts on the bolts of 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. Weights provided and approved by the Engineer shall be installed.

2.16 HYDRANTS

Hydrants shall be AVK Series 27 DRX Barrel (nostalgic style with stainless steel bolts) Kennedy Type K-81, American Darling B-84-B or Mueller Super Centurian A423, or approved equal and shall conform to the "Standard Specification for Fire Hydrants for Ordinary Water Works Service", AWWA C502, and UL/FM certified, and shall in addition meet the specific requirements and exceptions which follow:

1. Hydrants shall be according to manufacturer's standard pattern and of standard size, and shall have one 4-1/2" steamer nozzle and two 2-1/2" hose nozzles.

2. Hydrant inlet connections shall have mechanical joints for 6" ductile-iron pipe.

3. Hydrant valve opening shall have an area at least equal to that area of a 5-1/4" minimum diameter circle and be obstructed only by the valve rod. Each hydrant shall be able to deliver 500 gallons minimum through its two 2-1/2" hose nozzles when opened together with a loss of not more than 2 psi

in the hydrants.

4. Each hydrant shall be designed for installation in a trench that will provide 5-ft. cover.

5. Hydrants shall be hydrostatically tested as specified in AWWA C502.

6. Hydrants shall be rated at 200 psi.

7. All nozzle threads shall be American National Standard.

8. Each nozzle cap shall be provided with a Buna N rubber washer.

9. Hydrants shall be so arranged that the direction of outlets may be turned 90 degrees without interference with the drip mechanism and without the mechanism obstructing the discharge from any outlet.

10. Hydrants must be capable of being extended without removing any operating parts.

11. Hydrants shall have bronze-to-bronze seatings as per AWWA C502-85.

12. Hydrant main valve closure shall be of the compression type opening against the pressure and closing with the pressure. The resilient seat material shall meet the requirements of AWWA C-509 and shall preferably be EPDM Elastomer.

13. Internal and below ground iron parts (bonnet, nozzle section and base) shall have a fusion bonded epoxy coating per AWWA C550. Aboveground external hydrant parts (cap, bonnet and nozzle section) shall be either epoxy coated together with a UV resistant polyester coating or have two shop coats of paint per AWWA C502. The lower stand pipe or barrel shall be protected with asphaltic coatings per AWWA C502.

14. Exterior nuts, bolts and washer shall be stainless steel. Bronze nuts may be used below grade.

15. All internal operating parts shall be removable without requiring excavation.

2.17 RESTRAINING CLAMPS

Restraining clamp assemblies as detailed in the drawings for use at hydrant connections to water mains, or at fittings where shown on the Drawings, shall be as manufactured by American Cast Iron Pipe, Star Pipe

Products, U.S. Pipe; or approved equal.

2.18 TAPPING SLEEVES AND GATE VALVES

A. Tapping valves shall meet the requirement of AWWA C500. The valves shall be flanged, shall be mechanical joint outlet with nonrising stem, designed for vertical burial and shall open left or counterclockwise. Stuffing boxes shall be the "O-ring" type. Operating nut shall be AWWA Standard 2" square for valves 2" and up. The valves shall be provided with an overload seat to permit the use of full size cutters. Gaskets shall cover the entire area of flange surfaces and shall be supplied with EPDM wedges up to 30" diameter.

B. Tapping sleeves and saddles shall seal to the pipe by the use of a confined "O" ring gasket, and shall be able to withstand a pressure test of 180 psi for one hour with no leakage in accordance with AWWA C110, latest edition. A stainless steel 3/4" 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. Sleeves and saddles shall be protected from corrosion by being fusion applied epoxy coated, or be made of 18-8 Type 304 stainless steel. Saddle straps shall be 18-8 Type 304 stainless steel.

2.19 SINGLE ACTING ALTITUDE VALVES

A. Function

1. The altitude control valve shall be of the single acting type, closing off tightly when the water reaches the maximum predetermined level in the tank to prevent overflow; and opening to permit replenishing of the tank supply when the water level drops approximately 6" to 12" below the maximum level.

2. A hand operated valve in the power water line to the top of the piston shall permit adjustment of the speed of valve closing. The tank water level control shall be by means of a diaphragm operated, spring loaded, three way pilot which directs power water to or from the top of the main valve piston. The three way pilot shall be of bronze construction. The diaphragm surface exposed to the tank head shall be not less than 57 sq. inches. It shall be possible to adjust the spring above the diaphragm for water level control approximately 20% above or below the factory setting.

B. Description

1. The main valve shall operate on the differential piston principle such that the area on the

underside of the piston is no less than the pipe area on the upper surface of the piston is of a greater area than the underside of the piston.

2. The valve piston shall be guided on its outside diameter by long stroke stationary Vee ports which shall be downstream of the seating surface to minimize the consequences of throttling. Throttling shall be done by the valve Vee ports and not the valve seating surfaces.

3. The valve shall be capable of operating in any position and shall incorporate only one flanged cover at the valve top from which all internal parts shall be accessible. There shall be no stems, stem guides, or spokes within the waterway. There shall be no springs to assist the valve operation.

C. Construction

1. The valve body shall be of cast iron ASTM A-126 with flanges conforming to the latest ANSI Standards. The valve shall be extra heavy construction throughout. The valve interior trim shall be bronze B-62 as well as the main valve operation.

2. The valve seals shall be easily renewable while no diaphragm shall be permitted within the main valve body.

3. All controls and piping shall be of non-corrosive construction.

4. A visual valve position indicator shall be provided for observing the valve piston position at any time.

D. Figure Number

The valves shall be the 20" Globe type (Fig. 3200-D) as manufactured by GA Industries of Mars, Pennsylvania, or approved equal.

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 Engineer.

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 Engineer.

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 shall be made with high strength, low alloy Corten bolts, nuts and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe. All buried bolts and nuts shall be heavily coated with two (2) coats of bituminous paint comparable to Inertol No. 66 Special Heavy.

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 Engineer 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.

3.05 INSPECTION AND TESTING

Completed pipe shall be subjected to hydrostatic pressure test for two hours at 180 psi. All leaks shall be repaired and lines retested as approved by the Engineer. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION

5/24/95(Rev.)

SECTION 02999

MISCELLANEOUS WORK AND CLEANUP

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes items and operations which are not specified in detail as separate items, but may be sufficiently described as to the kind and extent of work involved. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to complete all work under this Section.

B. The work of this Section may include, but is not limited to the following:

1. Restoration of roads, sidewalks, driveways, curbing and gutters, fences, guardrails, lawns, shrubbery and any other existing items damaged or destroyed.

2. Crossing utilities.

3. Relocation of existing water, reclaim water, or sewer lines less than four inches diameter, water and sanitary sewer services, low pressure gas lines, telephone lines, electric lines, cable TV lines as shown on the Contract Drawings.

4. Restoring easements (servitudes) and rights-of-way.

5. Clean up.

6. Incidental work (project photographs, testing, shop drawings, traffic control, record drawings, etc.).

7. Excavation and Embankment - As defined in the Florida Department of Transportation Standard Specifications for Road and Bridge Construction (1991 Edition or latest revision).

1.02 SUBMITTAL OF LUMP SUM BREAKDOWN

Contractor shall submit to the Owner/Engineer, a breakdown of the lump sum bid for Miscellaneous Work and Cleanup Item in the Proposal within 10 days after date of Notice to Proceed.

1.03 WORK SPECIFIED UNDER OTHER SECTIONS

All work shall be completed in a workmanlike manner by competent workmen in full compliance with all applicable sections of the Contract Documents.

PART 2 PRODUCTS

2.01 MATERIALS

Materials required for this Section shall equal or exceed materials that are to be restored. The Contractor may remove and replace or reuse existing materials with the exception of paving.

PART 3 EXECUTION

3.01 RESTORING OF ROADS, CURBING, FENCES AND GUARDRAILS

A. The Contractor shall protect existing curbing. If necessary, curbing shall be removed from joint to joint and replaced after backfilling. Curbing damaged during construction because of the Contractor's negligence or convenience, shall be replaced with curbing of equal quality and dimension at no cost to the Owner.

B. At the locations necessary for the Contractor to remove, store and replace existing fences and guardrails during construction, the sections removed shall be only at the direction of the Engineer. If any section of fence is damaged due to the Contractor's negligence, it shall be replaced at no cost to the Owner with fencing equal to or better than that damaged and the work shall be satisfactory to the Engineer.

C. Guardrails in the vicinity of the work shall be protected from damage by the Contractor. Damaged guardrails shall be replaced in a condition equal to those existing.

D. Road crossings shall be restored in accordance with the Contract Documents and current FDOT Standards. Compensation for road restoration shall be included under the Road Restoration Bid Item if specified or under Miscellaneous Cleanup if it is not specified.

3.02 CROSSING UTILITIES

This item shall include any extra work required in crossing culverts, water courses, drains, water mains and other utilities, including all sheeting and bracing, extra excavation and backfill, or any other work required or implied for the proposed crossing, whether or not shown on the Drawings.

3.03 RELOCATIONS OF EXISTING GAS LINES, TELEPHONE LINES, ELECTRIC LINES AND CABLE TV LINES

The Contractor shall notify the proper utility involved when relocation of these utility lines is required. The Contractor shall coordinate all relocation work by the utility so that construction shall not be hindered.

3.04 RESTORING THE EASEMENTS AND RIGHTS-OF-WAY

The Contractor shall be responsible for all damage to private property due to his operations. He shall protect from injury all walls, fences, cultivated shrubbery, pavement, underground facilities, including water, sewer and reclaimed water lines and services, or other utilities which may be encountered along the easement. If removal and replacement is required, it shall be done in a workmanlike manner, at his expense, so that the replacement are equivalent to that which existed prior to construction.

END OF SECTION

DIVISION 03
CONCRETE WORK

SECTION 03010

CONCRETE WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

The extent of concrete work is shown on the Drawings.

1.02 RELATED WORK

A. Section 01340 - Project Data, Samples and Shop Drawings

1.03 SUBMITTALS

A. Manufacturer's Data: For information only, submit manufacturer's specifications with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds and others as requested by the Engineer.

B. Shop Drawings: Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

C. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design test as specified.

1.04 REFERENCE STANDARDS

Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified:

A.	ACI 301	"Specifications for Structural Concrete for Buildings"
B.	ACI 305	"Hot Weather Concreting"
C.	ACI 306	Standard Specification for Cold Weather Concreting"
D.	ACI 311.4R	"Guide for Concrete Inspection"
E.	ACI 315	"Manual Of Standard Practice For Detailing Reinforced

Concrete Structures"

F. ACI 318 "Building Code Requirements for Reinforced Concrete"

G. ACI 347 "Recommended Practice for Concrete Formwork"

H. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete"

I. ACI 540R "Guide to Sealing Joints in Concrete Structures"

J. Concrete Reinforcing Steel Institute, "Manual of Standard Practice"

K. Where local building code requirements exist, comply with provisions of such codes, which are more stringent than the preceding codes and standards.

1.05 QUALITY ASSURANCE

A. Workmanship: The Contractor is responsible for correction of concrete work, which does not conform to the specified requirements, including strength, tolerances and finishes. Correct deficient concrete as approved by the Engineer. All defects shall be repaired to Owner's satisfaction.

B. Construction Tolerances

1. Variation from Grade: For grades shown for slabs, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 foot maximum, nor 3/4 inch in 40 feet or more.

2. Variation from Linear Building Line: For position shown in plan do not exceed 1/2 inch in 20 foot maximum, nor one inch in 40 feet or more.

3. Variation in Cross-Sectional Dimensions: For thickness of slabs, do not exceed minus 1/4 inch nor plus 1/2 inch.

1.06 TESTING AND MIX DESIGN

A. Testing Before Construction: Employ concrete testing laboratory, acceptable to the Owner, at Contractor's expense to perform material evaluation tests and to design concrete mixes.

B. Tests for Concrete Materials

1. Test aggregates by the methods of sampling and testing of ASTM C33.

2. For Portland cement, sample the cement and determine the properties by the

methods of test of ASTM C-150.

3. Certificates of material properties and compliance with specified requirements may be submitted in lieu of testing, when acceptable to the Engineer.

4. Proportioning and Design of Mixes

   a. Prepare design mixes for each type of concrete. Use an independent testing facility acceptable to the Owner for preparing and reporting proposed mix designs.

   b. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1.

   c. Submit written reports to the Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been approved by the Engineer.

5. Laboratory Trial Batches

   a. When laboratory trial batches are used to select concrete proportions, prepare test specimens in accordance with ASTM C192 and conduct strength tests in accordance with ASTM C39, as specified in ACI 301.

   b. Establish a curve showing relationship between water-cement ratio (or cement content) and compressive strength with at least three points representing batches which produce strengths above and below that required. Use not less than three specimens tested at 28 days, or an earlier age when acceptable to the Engineer, to establish each point on the curve.

6. Field Experience Method

   a. When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301.

   b. Strength data for establishing standard deviation will be considered suitable if the concrete production facility has certified records consisting of at least thirty consecutive tests in one group or the statistical average for two groups totaling thirty or more tests, representing similar materials and projects conditions.

c. Standard Deviation: If standard deviation exceeds 600 psi or if no suitable records are available, select proportions to produce an average strength of at least 1200 psi greater than the required compressive strength of concrete.

d. After sufficient experience and test data become available from the job, using ACI214 methods of evaluation, the standard deviation may be reduced when the probable frequency of an average of three consecutive tests below required compressive strength will not exceed one in one hundred.

7. Adjustment to Concrete Mixes

a. Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the Owner and as accepted by the Engineer.

b. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by the Engineer before using in the work.

8. Compressive Strength: 4,000 PSI (minimum)

9. Admixtures: Use air-entraining admixture in all concrete, unless otherwise shown or specified. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content by volume within the following limits:

a. 6% to 9% for maximum aggregate 1/2 inch and under.

b. 4% to 6% for maximum aggregate over 1/2 inch through 1-1/2 inch.

c. 2.5% to 4.5% for maximum aggregate over 1-1/2 inch.

10. Slump Limits: Proportion and design mixes to result in concrete slump at the point of placement as follows:

a. Ramps and Sloping Surfaces: Not more than 4 inches.

b. Reinforced Foundation Systems: Not less than 3 inches and not more than 5 inches.

c. All Other Concrete: Not less than 3 inches and not more than 6 inches.

11. Testing During Construction

a. Employ at Owner's expense a testing laboratory.

b. The following quality control testing is required during construction:

c. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.

d. Slump: ASTM C143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens; additional tests when concrete consistency seems to have changed.

e. Compressive Strength: ASTM C39; one set of 4 standard cylinders (ASTM C31) for each 50 cubic yards or fraction thereof, of each concrete class placed in any one day or for each 5,000 square feet of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

f. When the total quantity of a given class of concrete is less than 50 cubic yards, or the quantity of concrete for any single structure is less than 10 cubic yards, the Engineer may waive compressive strength testing, but such action shall not relieve the Contractor from responsibility for furnishing concrete of the required strength.

g. The strength level of concrete will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength and no individual strength test result falls below the specified strength by more than 500 psi.

h. Air Content: ASTM C231, pressure method or ASTM C173; one for each set of compressive strength test specimens.

i. Additional Tests: When test results indicate specified concrete strengths and other characteristics have not been attained, perform additional testing to determine the extent to which deficiencies exist. Additional testing program is to be performed by a testing laboratory and acceptable to the Engineer. Where cored cylinders are utilized to determine adequacy of concrete, comply with ASTM C42. It is the Contractor's responsibility to pay for additional testing.

PART 2 PRODUCTS

2.01 FORM MATERIALS

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

Where plywood is used in form-work, provide material complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete For", Class I, unless otherwise acceptable to Engineer.

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

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

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60 unless otherwise shown.

B. Steel Wire: ASTM A82, plain, cold-drawn, steel.

C. Welded Wire Fabric: ASTM A185, welded steel wire fabric.

D. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise specified. Solid precast concrete block may be used for supporting footing and foundation mats against earth material. Wood, clay, brick and other non-standard devices will not be acceptable.

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

2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type II, unless otherwise acceptable to Engineer.

Use only one brand of cement throughout the project, unless otherwise acceptable to Engineer.

B. Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source for all exposed concrete.

1. Fine Aggregate: Clean, sharp, natural sand from loam, clay, lumps or other deleterious substances.

2. Coarse Aggregate: Clean, uncoated, crushed granite or similar hard stone processed from natural rock or stone, and containing no clay, mud, loam or foreign matter.

3. Maximum Aggregate Size: 1-1/4 inches.

C. Water: Clean, fresh, and safely drinkable by humans.

D. Air-Entraining Admixture: ASTM C260.

E. Fly Ash and Other Pozzodanic Materials: ASTM C618, Type C or Type F

2.04 RELATED MATERIALS

A. Grout: Ready mixed Portland cement, sand and water mixture conforming with materials and mix design of highest strength project-required concrete except for deletion of coarse aggregate.

B. Non-shrink Grout: Factory-premixed cementious material containing no corrosive material, which is non-shrink from time of placement and shows no expansion after final set when tested under ASTM C827, has an initial setting time of not less than 45 minutes, has a 24 hour compressive strength of not less than 4,000 psi under ASTM C109 for a trowelable mix, and is selected and applied in conformance with manufacturer's recommendations.

C. Waterstops: Provide flat, dumbbell type or center-bulb type waterstops at construction joints and other joints as indicated. Size to suit joints. Polyvinyl chloride as per CE CRD-C572.

D. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately nine ounces per square yard, complying with AASHTO M182, Class 2.

E. Moisture-Retaining Cover: One of the following, complying with ASTM C171.

1. Waterproof paper

2. Polyethylene film

3. Polyethylene-coated burlap

F. Membrane-Forming Curing Compound: ASTM C309, Type 1 unless other acceptable to Engineer.

G. Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type which will permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be galvanized.

2.05 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with the requirements of ASTM C94, and as herein specified.

B. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.

C. When the air temperature is between 85oF and 90oF, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90oF, reduce the mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 FORMS

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members structures are of correct size, shape, alignment, elevation and position.

B. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses,

moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Provide temporary openings where interior area of formwork is inaccessible for clean-out, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges as shown, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Form Ties: Factory-fabricated, adjustable-length, metal form ties, designed to prevent form deflection, to prevent spalling concrete surfaces upon removal, and to prevent passage of water along tie surface through concrete.

H. Provide ties so portion remaining within concrete is at least 1 inch inside concrete, and do not leave holes larger than one inch diameter in concrete surface.

I. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

J. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement if required to eliminate mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT

A. Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials, which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by chairs, runners, bolsters, spacers and hangers, as required.

D. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Do not place reinforcing bars more than 2 inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

F. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.03 JOINTS

A. Construction Joints: Locate and install necessary construction joints, which are not shown on the Drawings, so as not impair the strength and appearance of the structure, as acceptable to the Engineer.

B. Provide keyways in all construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs. Construct keyways 1-1/2 inches deep unless otherwise detailed.

C. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints, unless noted.

D. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions. Protect waterstop material from damage where it protrudes from any point.

E. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs on ground as shown on the Drawings.

F. Control Joints in Slabs-on-Ground: Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/8 to 1/4 inch wide x 1/4 of the slab depth, unless otherwise shown.

G. Form control joints by inserting a pre-molded plastic, hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface.

Tool slab edges round on each side of insert. After the concrete has cured, remove inserts and clean groove of loose debris.

3.04 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screeds required. Align the concrete surface to the elevation of the screed strips by the use of strike-off templates or accepted compacting type screeds.

3.05 PREPARATION OF FORM SURFACES

A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition. Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed.

B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of the form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

C. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.06 CONCRETE PLACEMENT

A. Pre-Placement Inspection: Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit the installation of their work; cooperate with other trades in setting such work, as required. Moisten wood forms immediately before placing concrete, where form coatings are not used.

B. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

C. Construction Sequence: Before placing any concrete, complete blasting, heavy earthwork and other construction operations, which might cause damage to concrete structures.

D. General: Comply with ACI 304, and as herein specified. Deposit concrete continuously or in-layers of such thickness that no concrete will be placed on concrete, which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.

E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309 recommended practices.

G. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the placed layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

H. Placing Concrete Slabs: Deposit and consolidate concrete in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

J. Bring slab surfaces to the correct level with a straightedge and strike-off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not disturb the slab surfaces prior to beginning finishing operations.

K. Maintain reinforcing in the proper position during concrete placement operations.

L. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306R and as herein specified.

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

305R and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90oF. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

3. Fog spray forms, reinforcing steel and sub-grade just before concrete is placed.

4. Do not use retarding admixtures without the written acceptance of the Engineer.

3.07 FINISH OF FORMED SURFACES

A. Concealed Surfaces: For formed concrete surfaces not exposed-to-view in the finished work, leave surface finish imparted by the form facing material used, with defective areas and form tie voids repaired and patched as specified, and fins and other projections exceeding 1/4 inch in height rubbed flush.

B. Visible Surfaces: For formed concrete surfaces expose-to-view, including those surfaces of water or other material holding structures visible when the structure is empty, or surfaces that are to be covered with a thin or flexible finish material bonded to the concrete, perform finish operations as specified above under "Concealed Surfaces", and in addition wet and rub entire surfaces with a carborundum stone of medium fineness until all form marks and other surface irregularities have been removed and a uniform surface appearance achieved. Do not create a plaster coating on concrete.

C. Unformed Visible Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring 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.

3.08 MONOLITHIC SLAB FINISHES

A. Float Finish: Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified.

1. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has

disappeared or when concrete has stiffened sufficiently to permit operation of floats.

2. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units.

3. Check and level surface plane so that depressions between high spots do not exceed 6/16 inch under a 10 foot straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains.

4. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

B. Trowel Finish: Apply trowel finish to monolithic slab surfaces that are to be exposed-to-view, unless otherwise shown, and slab surfaces that are to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system.

1. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface.

2. Consolidate concrete surface by final hand- troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface plane so that depressions between high spots do not exceed 1/8 inch under a 10 foot straightedge.

3. Grind smooth surface defects which would telegraph through applied floor covering system.

C. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

1. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route.

2. Coordinate required final finish with the Engineer before application.

3.09 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying, and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for a period of time necessary for hydration of cement and proper hardening.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven days and in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by one or more of the following methods as selected by the Contractor:

1. Moisture Curing

a. Provide moisture curing by covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4 inch lap over adjacent absorptive cover.

b. Provide moisture-cover curing by covering concrete surfaces with moisture-retaining cover, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and water-proof tape.

2. Membrane Curing

a. Provide membrane curing by applying compound to damp concrete surfaces as soon as film has disappeared. Apply uniformly in continuous operation by power-spray or roller equipment in accordance with manufacturer's directions. Recoat areas that are subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

b. Do not use membrane curing compounds on surfaces which are to be covered with a coating material applied directly to concrete or with a covering material bonded to concrete, such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the Engineer.

3. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist

curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

4. Curing Unformed Surfaces: Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing.

5. Final cure unformed surfaces, unless otherwise specified, by methods specified above, as applicable.

3.10 FORM REMOVAL

A. In all cases, time and sequence of concrete form removal is at Contractor discretion.

B. Formwork supporting weight of concrete, such as beams and slabs must remain in place at least 14 days and until concrete has attained minimum design 28 day compressive strength.

C. Formwork not supporting weight of concrete such as sides of beams, walls and columns, may be removed no sooner than 48 hours after placement of concrete or when concrete is sufficiently hard as not to be damaged by form removal operations.

3.11 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and lutein, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Engineer.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to burbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on Drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.

3.13 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, but only when acceptable to Engineer. Cut out honeycomb, rock pockets, voids over 1/8 inch in any dimension and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than one inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to Engineer.

1. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color of surrounding surface. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

2. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets and holes left by tie rods and bolts; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement core plugs secured in place with bonding agent.

3. Repair concealed formed surfaces, where possible, that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete.

4. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having a required slope.

5. Repair finished unformed surfaces that contain defects which adversely affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01 inch wide or which penetrate to reinforcement or completely

through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

6. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

7. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

8. Repair defective areas, except random cracks and single holes not exceeding one inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete, and brush with a neat cement grout coating or concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of same materials to provide concrete of the same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

9. Repair isolated random cracks and single holes not over one inch in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and brush with neat cement grout coating or concrete bonding agent. Place dry-pack before cement grout takes its initial set. Mix dry-pack, consisting of one part Portland cement to 2½ parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

10. Repair methods not specified above may be used, subject to acceptance of Engineer.

B. Agreement by the Engineer to permit repair or patching of concrete does not waive the Owner's authority to require complete removal and replacement of defective concrete pours should the patch not prove satisfactory to the Owner, due either to deficiency in strength, function or appearance.

END OF SECTION

DIVISION 05
METALS

SECTION 05500

MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 SCOPE OF WORK

Furnish all labor, material, equipment, and incidentals required to install all miscellaneous metal as shown on the Drawings and specified herein.

1.02 RELATED WORK

A. Section 03010 – Concrete Work

B. Division 11 - Equipment

1.03 SUBMITTALS

A. Manufacturer's literature describing standard items.

B. Shop drawings showing materials, sizes, finishes, locations, attached hardware and fittings, and details for manufactured items and fabricated metalwork, including field erection details showing cuts, copes, connections, holes, thread fasteners and welds. Indicate welds, both shop and field, by symbols conforming to AWS standards. Indicate coatings or other protection against corrosion. Submittals in accordance with Section 01340, Shop Drawings, Project Data, and Samples.

C. Setting diagrams, erection plans, templates and directions for installation of backing plates, anchors, and other such similar items.

D. Material compliance certification with standards designated.

1.04 REFERENCE STANDARDS

A. Aluminum Association

1. AA 5052 - Aluminum Sheet and Plate, Rolled Rod and Bar and Drawn Tube

2. AA 6061 T6 - Aluminum Sheet and Plate

3. AA 6061 T5 - Aluminum Extruded Shapes

4. AA 6063 T6 - Aluminum Extruded Pipe

5. AA 5005 - Sheet and Plate

6. Finishes

   a. AA M31 - Mechanical Finish, Fine Satin
   b. AA C22 - Chemical Finish, Medium Matte
   c. AA A41 - Clear Anodic Coating, Class I

B. American Iron and Steel Institute (AISI)

1. AISI, Type 316 Stainless Steel Bolts, Bars and Shapes

2. AISI, Type 316 Stainless Steel Plate and Sheet

C. American National Standards Institute (ANSI)

1. ANSI A14.3 - Safety Requirement for Fixed Ladders

D. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Specification for Structural Steel

2. ASTM A48 - Specification for Gray Iron Castings

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

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

5. ASTM A153 - Specification for Zinc Coated (Hot Dip) on Iron and Steel Hardware

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

7. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

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

9. ASTM A307 - Specification for Carbon Steel Externally Threaded Standard Fasteners

10. ASTM A312 - Standard Specification for Seamless and Welded Austenitic Stainless Pipe.

11. ASTM A325 - Specification for High-Strength Bolts for Structural Steel Joints

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

13. ASTM A611 - Specification for Steel, Cold-Rolled Sheet, Carbon, Structural

14. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

15. ASTM B26 - Standard Specification for Aluminum-Alloy and Castings.

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

17. ASTM B211 - Standard Specification for Aluminum-Alloy Bar, Rod, and Wire.

18. ASTM B221 - Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

19. ASTM B241 - Standard Specification for Aluminum Alloy Seamless Pipe and Seamless Extruder Tube.

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

E. American Welding Society (AWS)

1. AWS "Structural Welding Code", D1.1

2. AWS Specification for Arc Welding (Type E70XX) Welding Rods for Steel

F. ASME International (ASME)

1. ASME B18.2.1 Square and Hex Bolts and Screws Inch Series

G. SSPC: The Society of Protective Coatings (SSPC)

1. SSPC – Paint 20 – Paint Specification No. 20 Zinc-Rich Primers (Type I, "Inorganic" and Type II, "Organic")

H. National Fire Protection Association (NFPA)

1. 101 Life Safety Code

1.05 QUALITY ASSURANCE

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

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

1.06 DELIVERY, STORAGE AND HANDLING

A. Identify and match-mark all materials, items and fabrications, for installation and field assembly.

B. Deliver items to job-site as complete units, wherever practicable, ready for installation or erection, with all anchors, hangers, fasteners and miscellaneous metal items required for installation.

C. Carefully handle and store materials, protected from weather, rusting and other damage.

D. Store structural shapes, pipes, tubes and sheets off the ground on suitable supports, with webs or flanged shapes vertical.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Shapes and Plates

1. Steel: ASTM A36

2. Nuts, Bolts, Rivets, Washers, and Anchorage Devices: ASTM A325 and AISC Specification referenced under Part 1.

3. Steel Sheets: Cold-rolled or hot-rolled carbon steel, ASTM A366, or ASTM A569.

4. Steel Pipe: ASTM A53, Standard Specifications for Pipe, Steel, Black and, Zinc-Coated, Welded and Seamless; Type S, Grade B, Schedule 40, black finish.

B. High-Strength, Low Alloy Corrosion - Resistant Steel:

1. Plates, shapes, and bars: ASTM A242 or A588.

2. Sheet and strip ASTM A606 Type A.

C. Stainless Steel

1. Type 316 unless otherwise indicated or specified.

2. Shapes and Bars: ASTM A276.

3. Plate, Sheet, and Strip: ASTM A167.

4. Tubing: ASTM A269.

5. Pipe: ASTM A312, Schedule 40S.

D. Aluminum

1. Plates, rolled or extruded shapes, sheets or castings conforming (unless otherwise permitted or indicated) to Aluminum Association alloy and temper designations.

2. Rolled structural shapes and plates 6061-T6.

3. Extruded structural shapes 6063-T5.

4. Castings 214.

5. Sheets Alclad 3003-H14 and 3003.

6. Bolts and nuts 2024-T4.

7. Pipe railings Schedule 40, ASTM, B241, 6063-T6.

8. Finishes (pipe railings only) - NAAMM AA-C22-A41 coating.

E. Fasteners: Provide hot-dip galvanized or stainless steel fasteners for exterior use of where built into exterior walls and pillars. Select fasteners for the type, grade, and

class required per the approval of the Engineer. Refer to Paragraph 2.2 for specific material requirements for anchors, bolts, and other fastening devices.

1. Bolts and nuts: Regular hexagon head type, ASTM A307, Grade A.

2. Lag bolts: Square head type, FS FF-B-561.

3. Machine screws: Steel, FS FF-S-92.

4. Masonry and concrete anchorage devices: Expansion shields FS FF-S325.

F. Galvanizing: Provide a zinc coating for those items specified to be galvanized as follows:

1. ASTM A153, for galvanizing steel hardware.

2. ASTM A123, for galvanizing assembled steel products.

G. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC – Paint 20

2.02 ANCHORS, BOLTS, AND FASTENING DEVICES

A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the Contractor in accordance herewith. Anchor bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.

B. Bolts, anchor bolts, nuts, screws, washers, and related appurtenances specified to be stainless steel shall be Type 316 stainless steel unless noted otherwise.

C. Expansion bolts shall be stainless steel unless otherwise specified.

D. Unless otherwise specified, stud, tap, and machine bolts, and nuts shall conform to the requirements of ASTM A307. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to ANS B1.1 for Unified Inch Screw Threads (UN and UNR Thread Form I).

E. Bolts, anchor bolts, nuts, and washers, specified to be galvanized, shall be zinc coated, after being threaded, by the hot-dip process in conformity with ASTM A123, or ASTM A153, as is appropriate.

F. Anchor bolts and expansion bolts shall be set accurately. If anchor bolts are set before the concrete has been placed, they shall be carefully held in suitable templates of acceptable design. Where indicated on the Drawings, specified, or required,

anchor bolts shall be provided with square plates at least 4 in. by 4 in. by 3/8 in. or shall have square heads and washers and be set in the concrete forms with suitable sleeves, or both. If anchor or expansion bolts are set after the concrete has been placed, all necessary drilling and grouting or caulking shall be done by the Contractor and care shall be taken not to damage the structure or finish by cracking, chipping, spalling, or otherwise during the drilling and caulking.

2.03 ALUMINUM GRATING

A. Unless noted otherwise, grating shall have rectangular, 3/16-in minimum thickness, bearing bars spaced at 4-in on center. All grating panels shall be banded with a bar the same size as the bearing bars.

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

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

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

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

3. Provide trench grating with symmetrical cross bar arrangement.

4. Grating clamps, nuts, bolts, washers and other fastening devices for grating and grating supports shall be Type 316 stainless steel. Anchor blocks, when used, shall be of the same material as the grating. All grating shall be anchored to the supporting system using saddle clips.

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

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

2.04 RAILINGS

A. Railing systems (handrail and guardrail) shall comply with the requirements of OSHA and Florida Building Code.

B. Aluminum railing systems shall be a welded or mechanically fastened, seamless, extruded aluminum pipe system. Rails shall be 6063-T6 alloy. Posts shall be 6061-T6 alloy. Splice and reinforcing sleeves, brackets, end caps, toeboards, etc., shall be aluminum alloy 6063-T6 or 6061-T6. Cast fittings shall be aluminum alloy No. 214. Railing system fastening hardware shall be Type 316 stainless steel. Aluminum shall have a mill finish, except as otherwise specified.

C. Railings shall be as shown on the Drawings, fabricated with 1-1/2-in nominal diameter pipe. Posts shall be Schedule 80 pipe minimum and rails and handrails shall be Schedule 40 pipe minimum. Posts and top rails shall be continuous. Spacing of posts shall not exceed 5-ft on center and shall be uniformly spaced except as otherwise shown on the Drawings. All railing posts shall be vertical.

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

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

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

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

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

1. Where non-removable railing is set in concrete, the posts shall be placed in 2-1/2 in diameter formed concrete openings and firmly caulked with non-shrink nonmetallic grout. Collars shall be placed around the post bases and fastened in place with set screws on the side of the post away from the walkway. Posts shall be placed with the centerline 4-in from the edge of the concrete except that posts shall be set at the centerline of concrete curbs.

2. Where handrail is to be fastened to walls, the rails shall be provided with screwed wall flanges fastened to the walls with stainless steel anchor bolts.

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

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

I. Toeboards shall be provided on all railing adjacent to a drop in elevation of 4-ft or more. Toeboards are not required on the inclined portion of stairway railings or where concrete or steel curbs, 4-in or more in height, are present. Toeboards shall be 4-in high plate with a minimum thickness of 1/4-in. Toeboards shall be positioned with a maximum clearance of 1/4-in from the floor and fastened to railing posts with 1/4-in stainless steel U-bolts, with J-bolts at corner posts and with clip angles and two 1/4-in stainless steel expansion bolts at walls.

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

2.06 MISCELLANEOUS STAINLESS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched.

Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

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

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

2.07 MISCELLANEOUS ALUMINUM

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

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

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

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

PART 3 - EXECUTION

3.01 GENERAL

A. Anchorage: Provide anchorage for fastening work securely in place. Set anchors in concrete as the work progresses and space not more than 2 feet on centers unless indicated otherwise. Sizes, kinds, and spacing of anchors not indicated or specified shall be as necessary for the purpose, as approved. Anchorage not otherwise specified or indicated includes slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Provide inserts of suitable and approved types where required for support or anchorage of equipment and finish construction.

B. Fastenings: Do not use wood plugs in any material. Use nonferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, and harmonizing with the material to which fastenings are applied. Conceal fastenings where practicable. Drill and punch to produce clean true lines and surfaces. Countersink metal work to receive hardware.

C. Threaded Connections: Make threaded connections tight so that threads are entirely concealed. Make bolted work tight and nick the threads or bush the stem to prevent loosening. Abutting bars shall be shouldered and headed, de-welled and pinned. Pass small bars through larger bars and pin. Rivet, bolt, and screw heads shall be flat and countersunk in exposed work and elsewhere as required. Carefully machine removable member and fit and secure by means of screws or bolts of proper size and approved spacing.

3.02 FABRICATION

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.

B. Connections and accessories shall be sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threshold connections shall be made so that the threads are concealed by fitting.

C. Welded joints shall be rigid and continuously welded or spot welded as specified or shown. 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 for 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 otherwise specified, shall have manufacturer's standard mill finish. Aluminum handrails shall be given an anodic oxide treatment in accordance with the Aluminum Association Specification AA-C22-A41.

G. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust, and foreign matter before shipment and shall be given 1 shop coat of primer compatible with finish coats specified in Section 09941 - Field Painting after fabrication but before shipping. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces. Abrasions in the field shall be touched up with primer immediately after erection.

H. Galvanizing, where required, shall be the hot dip zinc process after fabrication. Following all manufacturing operations, all items to be galvanized shall be thoroughly cleaned, pickled, fluxed, and completely immersed in a bath of molten zinc according to ASTM A653. The resulting coating shall be adherent and shall be the normal coating to be obtained by immersing the items in a bath of molten zinc and allowing them to remain in the batch until their temperature becomes the same as the bath. Coating shall be not less than 2 ounces per square foot of surface.

I. Zinc coating, which has been burned by welding, abraded, or otherwise damaged, shall be cleaned and repaired after installation. The damaged area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of SSPC – Paint 20. The paint shall be properly compounded with a suitable vehicle in the ratio of 1 part zinc oxide to 4 parts zinc dust by weight.

3.03 INSTALLATION

A. Install all items furnished except items to be embedded in concrete, which shall be installed under Division 3. Items to be attached to concrete or existing masonry after such work is completed shall be installed in accordance with the details shown.

Fastening to wood plugs in masonry will not be permitted. All dimensions shall be verified at the site before fabrication is started.

B. Where aluminum contacts a dissimilar metal, apply a protective paint. Apply protective paint to both the aluminum metal components and to the dissimilar metal(s).

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

D. Where items are cast into concrete, backpaint contact areas before setting.

END OF SECTION

DIVISION 11
EQUIPMENT

SECTION 11270

ALUMINUM STOP GATES

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 stop gates and appurtenances as shown on the Drawings and as specified herein.

B. All gates and appurtenances shall be of the size indicated in the "Gate Schedule" and, to the extent possible, all equipment of the same type on the Project shall be from one manufacturer.

C. The equipment shall include, but is not be limited to, the following:

Stop Gate Schedule					
No.	Location	Type	Size (WxH) *	Mounting	Seating Head (ft)
1	Filters 1 & 2 - Influent, West Wall	Stop	5'-6" x 7'-0"	Inside Face	6.6
2	Filters 3, 4 & 5 - Influent, East Wall	Stop	5'-6" x 7'-0"	Inside Face	6.6

* Gate width is size of channel opening.

1.02 RELATED WORK

A. Section 01340 - Shop Drawings, Project Data and Samples

B. Section 03010 - Concrete Work

C. Section 05500 - Miscellaneous Metals

1.03 SUBMITTALS

A. Materials and Shop Drawings:

1. Copies of all materials required to establish compliance with the specifications shall be submitted to the Engineer for approval. Submittals shall include the following:

a. Certified shop and erection drawings and data regarding gates.

b. Literature on drawings describing the equipment and showing all-important details of construction and dimensions.

B. Operating Instructions: Operating and maintenance instructions for each type of gate shall be furnished to the Engineer.

C. Installation: The manufacturer shall provide installation instructions. The installation and adjustment of gates, operators and all accessories shall be in full accordance with these instructions. The gates shall be installed by the best practices and methods.

1.04 REFERENCE STANDARDS

A. American Water Works Association (AWWA), C501 - Gates and Operators.

B. American Society for Testing and Materials (ASTM)

1. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate

2. ASTM B221 - Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

3. ASTM A276 - Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

1.05 QUALITY ASSURANCE

All of the types of gates 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 Specifications as applicable. The manufacturer's shop welds, welding procedures, and welders shall be qualified and certified in accordance with the latest edition of ASME, Section IX.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery at Site

1. All materials, which will not be installed the same day as delivered to the site, shall be stored in the original manufacturer's packaging. Loose items

with no original packaging shall be boxed to protect the products from scratches, abrasion, or breakage.

B. Protection Prior to Installation

1. All products shall be protected from excessive heat and from moisture during storage and handling.

2. All plastic materials shall be stored out of direct sunlight.

PART 2 PRODUCTS

2.01 STOP GATES

A. The gate frame shall be an integral unit of aluminum extrusions and structural shapes, rigidly assembled to form the waterway opening. The guides shall be designed to mount to the face of the concrete. The primary slot of the frame extrusion shall contain ultra high molecular weight polymer (UHMW) guide liner retained in the grooves, to prevent metal to metal contact between slide and frame. Guides for wall-mounted gates shall have a weight of not less than 3 pounds per foot. The guides shall be sufficiently strong so that no further reinforcing will be required where the guides extend above the operating floor. The head channels shall be welded to the gate frame. All gate frames shall have a heavy coat of bituminous paint where the guide is in contact with the concrete. Wall-mounted frames shall have a nominal 1-inch grout base.

B. The invert of the frame will be extruded aluminum welded to the lower ends of the guides, and will be furnished with a neoprene insert which shall function as a seating surface for the plate.

C. Seals shall be securely fastened to the frame and shall be replaceable and adjustable without removing the gate from the installed position. Seals attached to the slide are not acceptable.

D. The plate shall be 1/4-inch aluminum plate reinforced as required so that the plate will not deflect more than 1/360 of the span of the gate under the designed head.

E. Stop gates shall be substantially watertight under the design head conditions. Under the design seating head, leakage shall not exceed 0.1 gallon per minute per foot of seal periphery. Under the design unseating head, the leakage shall not exceed 0.2 gallon per minute per foot of seal periphery.

F. Stop gates shall be manually removed.

G. All necessary attaching bolts, studs, and anchor bolts will be 316 stainless steel and will be furnished by the gate manufacturer.

H. Stop gates shall be provided by Hydro Gate of Commerce City, Colorado or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Installation of all gates and guides shall be completed in a workmanlike manner. It shall be the responsibility of the Contractor to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's drawings and recommendations.

B. Erect and support gates in respective positions free from distortion and strain on appurtenances during handling and installation. Frames and guides shall be installed in a true vertical plane with 90° corners. Inspect material for defects in workmanship and material. Clean out debris and foreign material from gate openings and seats, test operating mechanisms to check proper functioning, and check nuts and bolts for tightness. Any damage occurring to the above items before they are installed shall be repaired to the satisfaction of the Engineer.

END OF SECTION

SECTION 11280

STAINLESS STEEL WEIR GATE

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 weir gates and appurtenances as shown on the Drawings and as specified herein.

B. All gates and appurtenances shall be of the size indicated in the "Gate Schedule" and, to the extent possible, all equipment of the same type on the Project shall be from one manufacturer.

C. The equipment shall include, but is not be limited to, the following:

Weir Gate Schedule					
No.	Location	Type	Size (WxH)	Mounting	Seating Head (ft)
1	Filter 1 – Influent	Slide – Down Opening	15'-0" x 2'-9"	Face	2.5

1.02 RELATED WORK

A. Section 01340 - Shop Drawings, Project Data and Samples

B. Section 03010 - Concrete Work

C. Section 05500 - Miscellaneous Metals

1.03 SUBMITTALS

A. Materials and Shop Drawings:

1. Copies of all materials required to establish compliance with the specifications shall be submitted to the Engineer for approval. Submittals shall include the following:

   a. Certified shop and erection drawings and data regarding gates.

b. Literature on drawings describing the equipment and showing all-important details of construction and dimensions.

B. Operating Instructions: Operating and maintenance instructions for each type of gate shall be furnished to the Engineer.

C. Installation: The manufacturer shall provide installation instructions. The installation and adjustment of gates, operators and all accessories shall be in full accordance with these instructions. The gates shall be installed by the best practices and methods.

1.04 REFERENCE STANDARDS

A. American Water Works Association (AWWA), C501 - Gates and Operators.

1.05 QUALITY ASSURANCE

A. All of the types of gates 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 Specifications as applicable. The manufacturer's shop welds, welding procedures, and welders shall be qualified and certified in accordance with the latest edition of ASME, Section IX.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery at Site

1. All materials, which will not be installed the same day as delivered to the site, shall be stored in the original manufacturer's packaging. Loose items with no original packaging shall be boxed to protect the products from scratches, abrasion, or breakage.

B. Protection Prior to Installation

1. All products shall be protected from excessive heat and from moisture during storage and handling.

2. All plastic materials shall be stored out of direct sunlight.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Weir gates shall be provided by Hydro Gate of Commerce City, Colorado or equal.

2.02 MATERIALS OF CONSTRUCTION

A. Frame, Slide and Reinforcing: Stainless steel, ASTM A276, Type 304

B. Stems: Stainless steel ASTM A276, Type 304

C. Fasteners: Stainless steel, ASTM F593/F594, Alloy Group 1

D. Anchors: Stainless steel, ASTM F593/F594, Alloy Group 1

E. Rubber Seals: Neoprene, ASTM D2000, Grade 1BE625

F. Guides: Ultra High Molecular Weight (UHMW) Polymer, ASTM D4020

2.03 GATE CONSTRUCTION

A. Gate, frame and yoke design shall be such that the flexural stress does not exceed 15,000 psi for stainless steel or that the minimum safety factor is 5-59-1 based on the ultimate strength of the material used.

B. Frame. Gate frame shall be flat back or channel mount as shown in the "Gate Schedule." Spigot-back frames are not acceptable. The frame shall be an integral unit of structural shapes, rigidly assembled to form the waterway opening. The frame members shall form guides for the slide, and holes shall be provided for mounting of anchor bolts. The head channels shall be welded to the gate frame. The channels are to be sufficiently spaced to allow removal of the gate slide. The primary slot of the frame shall contain polymer guide bars to prevent metal-to-metal contact between slide and frame.

C. Slide. Gate slide shall conform to the safety factors stated under Item A above but shall, in no case, be less than ¼ in. thickness. Deflection under full head shall be limited to 1/360 of the span. The stem connector clips or stem block pocket shall be welded to the slide.

D. Flush-Bottom Seals. Slide gates shall incorporate a flush-bottom seal that is attached to the bottom frame invert member. The seal shall be of the materials shown in "Materials of Construction." Seals attached to the slide are not acceptable.

E. Seals. J-seals shall be provided. Seals shall be securely fastened to the frame with formed stainless steel retainers and shall be replaceable and adjustable without removing the gate from the installed position. The corners of the J-seals shall be vulcanized.

F. Stems. Gate stem diameter shall be adequate to withstand twice the force created by a 40-lb pull on the handwheel or crank. Stems shall have rolled threads with a maximum roughness of 16 micro-inches. Cut threads are not acceptable. The stem shall be supported by angle guides or cast iron with a 2-piece cast bronze guide collar, spaced to provide an 1/r ratio of 200 or less. Stems shall withstand 1.25 times the stalled motor thrust of the actuator. Stem covers shall be clear plastic.

G. Motor-Operated Lift. Motor operator shall be a 460-V, 3-phase, 60-Hz motor with precision reduction gearing enclosed in weatherproof housing. The electric actuator shall be designed to raise the gate at a rate of approximately 12 in./min. Integral controls shall include a motor starter, a control power transformer, reversing controller, torque switches, limit switches, space heater to prevent condensation, open-stop-closed push-button, and gate position indicator. Electric motor operators shall be NEMA 4X construction with TEFC motors. Motor reduction helical gear and pinion shall be of heat-treated alloy steel. Final reduction worm shall be of alloy steel and worm gear of machined high-tensile strength bronze. All gearing shall be proportioned for 100% overload condition. The actuator shall have a declutch lever and handwheel for manual operation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation of all gates and guides shall be completed in a workmanlike manner. It shall be the responsibility of the Contractor to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's drawings and recommendations.

B. Erect and support gates in respective positions free from distortion and strain on appurtenances during handling and installation. Frames and guides shall be installed in a true vertical plane with 90° corners. Inspect material for defects in workmanship and material. Clean out debris and foreign material from gate openings and seats, test operating mechanisms to check proper functioning, and check nuts and bolts for tightness. Any damage occurring to the above items before they are installed shall be repaired to the satisfaction of the Engineer.

3.02 INSPECTION AND TESTING

A. Field acceptance testing shall be conducted after the installation of all equipment has been completed and the equipment operated for an initial period to make all necessary adjustments and corrections. Each unit shall be tested to determine satisfactory operation and compliance with these specifications in the presence of the Engineer or his representative. Promptly correct or replace all defective equipment revealed by or noted during tests at no additional cost to the Owner and repeat tests until specified results acceptable to Engineer are obtained.

END OF SECTION

SECTION 11290

COMPOSITE SLIDE GATES

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 slide gates and appurtenances as shown on the Drawings and as specified herein.

B. All gates 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 one manufacturer.

C. The equipment shall include, but is not be limited to, the following:

Slide Gate Schedule					
No.	Location	Type	Size (WxH) *	Mounting	Seating Head (ft)
1	Filters 6 & 7 - Influent, East Wall	Upward Opening	5'-6" x 7'-0"	Inside Face	6.6
2	Filters 3, 4 & 5 - Effluent, West Wall	Upward Opening	5'-6" x 5'-0"	Inside Face	4.4
3	Filters 3, 4 & 5 - Effluent, East Wall	Upward Opening	5'-6" x 5'-0"	Inside Face	4.4
4	Filters 1 & 2 - Effluent, West Wall	Upward Opening	5'-6" x 5'-0"	Inside Face	4.4

* Gate width is size of channel opening.

1.02 RELATED WORK

A. Section 01340 - Shop Drawings, Project Data and Samples

B. Section 03010 - Concrete Work

C. Section 05500 - Miscellaneous Metals

1.03 SUBMITTALS

A. Materials and Shop Drawings:

1. Copies of all materials required to establish compliance with the specifications shall be submitted to the Engineer. Submittals shall include the following:

a. Certified shop and erection drawings and data regarding gates.

b. Literature on drawings describing the equipment and showing all-important details of construction and dimensions.

B. Operating Instructions: Operating and maintenance instructions for each type of gate shall be furnished to the Engineer.

C. Installation: The manufacturer shall provide installation instructions. The installation and adjustment of gates, operators and all accessories shall be in full accordance with these instructions. The gates shall be installed by the best practices and methods.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery at Site

1. All materials, which will not be installed the same day as delivered to the site, shall be stored in the original manufacturer's packaging. Loose items with no original packaging shall be boxed to protect the products from scratches, abrasion, or breakage. Each package shall have an identifying mark and a complete list showing contents

B. Protection Prior to Installation

1. All products shall be protected from excessive heat and from moisture during storage and handling.

2. All plastic materials shall be stored out of direct sunlight.

1.04 REFERENCE STANDARDS

The following standards listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. American Water Works Association (AWWA), C501 - Gates and Operators.

B. American Society for Testing and Materials (ASTM)

1. D635-81 Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

2. D648-82 Test Method for Deflection Temperature of Plastics Under Flexural Load

3. NASA CR-1457, "Manual for Structural Stability Analysis of Sandwiched Plates and Shells" et al.

1.06 WARRANTY AND GUARANTEE

The Manufacturer shall guarantee the gates, when installed and operated as recommended by the Manufacturer with a documented maintenance program, trouble-free operation for a period of ten (10) years. If the Owner or Engineer is not completely satisfied with the performance of the product, the Manufacturer shall remedy the problem at no cost or refund the materials and installation cost upon the return of the equipment The Manufacturer shall guarantee the following:

A. Leakage shall be no more than that allowed by the AWWA C501 Standard during the guarantee period.

B. Door (disc) shall be free of sticking or binding as judged by the Engineer (move freely via operator provided) with no exercising required. Gate operators are to be warranted by the operator manufacturer.

1.07 OTHER

A. All gates shall be fully assembled in their frames except for operators, guides, stem-extension, and stem covers or concrete-mounted pedestals. Where shipping constraints require it, frame may be partially assembled such that the top may be easily mounted to the bottom containing the disc.

B. Where square-to-circular or bell-lip conversion is required the Contractor shall provide a bell-end pipe insert of suitable diameter and water stop.

C. J. Bulb seals attached to the Disc / mounted to the frame, or any seal that needs replacement in less than 10 years shall not be acceptable. No part of the seal shall protrude into the clear opening.

D. All gates shall be supplied by the same manufacturer, who shall be fully experienced, reputable and qualified in the manufacturing of the equipment furnished and who has been building said equipment for a minimum period of ten (10) years.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS:

Gates shall be designed for the seating and unseating heads as listed in the gate schedules. Gates shall conform to the AWWA C501. Conformance to AWWA C501 applies to discs and frames with a safety factor of five (5) with regard to tensile, compressive and shear strength and with the requirement that all gates will yield no more leakage than shown in Section 6.8 (AWWA) Field Leakage Test. Calculations shall be submitted to show conformance. Materials of construction shall be suitable for the environment in which the gates shall be installed and operated.

A. General: 316L Stainless Steel frames, reinforced plastic slide (disc) as specified herein. FRP, GRP, plastic coated steel or externally reinforced slide (disc) shall not be acceptable.

B. Slide (Disc): Shall be constructed from a reinforced rigid composite plastic material, having a minimum thickness of 1/8-inch. Slide (disc) shall have an internal matrix of carbon steel of suitable strength for the specified service. The slide (disc) outer surface skins shall be a homogeneous plastic material having extremely high tensile and impact strength, be nontoxic and shall be stabilized against ultraviolet light. The plastic material shall be an Aramid fiber from the KEVLAR family of fibers, and shall have the following minimum properties and shall be designed to limit the deflection to a maximum of 1/1000 of the span under design head conditions based upon horizontal support members only. Manufacturer shall submit drawings and comprehensive design criteria to substantiate that the required deflection figure for each door has been achieved. Comprehensive safety factor calculations shall include bending moments, buckling stress, and bonding stress with thermal expansion factors suitable for reference in NASA CR-1457, "Manual for Plates and Shells". et al. Safety factors shall be calculated for the disc under maximum head, and shear at the disc/seal interface. No substitute of fiber type will be acceptable.

PROPERTIES TABLE

Tensile Strength	12,500
Young's Modulus	1,200,000 psi
Flexural Strength	18,000 psi
Flexural Modulus	1,400,000 psi
Compressive Strength	11,000 psi
Impact Strength	40.3 x 10^6 erg
Water Absorption	0.38 %
Specific Gravity	1.72
Coefficient of Thermal Expansion	1.6 x 10^{-5} per C
Heat Distortion Point	80 degrees C ASTM D648
Low Temperature Impact Strength	93% @ -20 C
Notch Sensitivity	Not notch sensitive
Weathering Properties	Excellent
Fire Resistance	Class 1 Spread of Flame, Rating BS476: Part 1: 1953 self-extinguishing, ASTM D635 - 56R
Chemical Resistance	Organics, Alkaline, Ozone (2 to 3 PPM)

Rigid Polyurethane foam shall be used as filler between the steel grid reinforcing system and shall be a minimum of 7 lb density/cu.ft.

C. Seals: The sealing arrangement for the reinforced plastic gates shall comprise of sealing faces and side guides constructed of ultra high molecular weight polyolefin having an extremely low coefficient of friction and backing constructed of highly resilient expanded neoprene. Guides and seating of the gate shall be easily adjustable (min. 5/8-inch). All moving contact surfaces shall be compatible to each other there by minimizing sticking / jamming and making the operation easy. Leakage rates shall be one-half (½) that allowed by AWWA C501.

2.02 FASTENERS:

A. Shall be 316 stainless steel. All anchor bolts, assembly bolts, screws, nuts, etc. shall be of ample section to safely withstand the forces created by operation of the gate while subjected to the heads specified.

2.03 STEMS:

A. All stems shall be the rising types. The entire stem, including extension stem, shall be Type 316 Stainless Steel. The sections of extension stems shall be joined together by solid couplings, threaded and keyed to the stems. All couplings of the same size shall be interchangeable. Stems shall be furnished with adjustable, polyethylene bushed stem guides, spaced as necessary to maintain a slenderness

ratio L/R of less than 200. Stems shall be of ample cross section to prevent distortion and shall have stub acme threads. Stems shall be designed to withstand tensile and compressive loads that occur under maximum operating conditions. Design for compressive loading shall meet AISC code where K=1 with a minimum safety Factor of 2 to 1. These requirements exceed AWWA standards. Stems shall be cold rolled with a double start stub acme thread and a finish of 32 microns or less. Stems shall be fixed to the disc by a threaded and keyed assembly into a lifting nut attached to the disc in a lifting bracket, which is bolted to the disc.

2.04 LIFTING DEVICE

A. Operation of the gate will be by means of handwheel actuated manual lift mechanism. Maximum effort on the handwheel shall not exceed 40 pounds pull to open or close the gate. The lift mechanism must be capable of withstanding, without damage, an effort up to 80 pounds. The lift mechanism shall have a bronze lift nut supported by tapered roller, needle, or ball thrust bearings. Fittings shall be provided so that all bearings (and gears) can be periodically lubricated without disassembly. Suitable seals shall be provided to prevent entry of foreign matter. The lift mechanism shall be supplied with an epoxy coated carbon steel pedestal machined and drilled for mounting the lift housing and ready for bolting to the gate yoke. The handwheel shall be corrosion-resistant. The direction of handwheel rotation to open the gate shall be clearly and permanently indicated on the lift mechanism. Each rising stem shall be provided with a stem cover made of clear plastic pipe that will not discolor, crack, or become opaque for at least five years after installation. The stem cover shall be of sufficient diameter and length to permit full travel of the threaded stem. The stem cover top shall be closed and the bottom end shall be vented, drained, and mounted in a housing or adapter plate for easy field mounting.

2.05 MANUFACTURER

A. Slide gates shall be Coplastix as manufactured by Ashbrook Corporation of Houston, Texas, Composite as manufactured by Hambaker of Houston, Texas , or equivalent.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation of all gates and guides shall be done by the Contractor in a manner acceptable to the Manufacturer and Owner. It shall be the responsibility of the Contractor to handle, store, and install the equipment specified in this Section in strict accordance with the Manufacturer's drawings and recommendations. Frames and guides shall be installed in a true vertical plane with 90-degree corners.

B. Erect and support gates in respective positions free from distortion and strain on appurtenances during handling and installation. Frames and guides shall be installed in a true vertical plane with 90° corners. Inspect material for defects in workmanship and material. Clean out debris and foreign material from gate openings and seats, test operating mechanisms to check proper functioning, and check nuts and bolts for tightness. Any damage occurring to the above items before they are installed shall be repaired to the satisfaction of the Engineer.

3.02 INSPECTION AND TESTING

A. Furnish the services of a factory representative for one (1) day who has complete knowledge of proper operation and maintenance to inspect the final installation and supervise a test run of the equipment.

B. Maximum gate leakage shall be as defined in the General Design Criteria of this Specification, herein. If gates, operators, and appurtenances do not meet specified requirements, corrective measures shall be taken by the Contractor, or the equipment shall be removed and replaced with equipment that satisfies the conditions specified.

END OF SECTION

DIVISION 16
ELECTRICAL

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1. 01 SUMMARY

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1. 02 DEFINITIONS

A. "Contract Documents" shall be understood to include the Contract Specifications, Contract Drawings, official addenda, official revision bulletins, and all other official documents.

B. "Electrical equipment and materials" shall be understood to include all electrical related equipment, apparatus, components, devices, assemblies, materials, accessories, and appurtenances.

C. "Owner" shall be understood to include the Owner's Designated Representative.

D. "Provide" shall be understood as "furnish and install."

1. 03 BASIC REQUIREMENTS

A. Contractor's Charge: It shall be this Contractor's responsibility to complete the Work of this project as conveyed in these Contract Specifications and on the Contract Drawings.

B. Site Inspection: Prior to the bid, the Contractor shall thoroughly inspect the Project Site and shall become familiar with project areas and existing site conditions.

C. Hazardous Materials/Conditions: Advise the Owner and Engineer/Architect in writing of any suspected hazardous materials and hazardous conditions discovered during the course of the Work. Make this notification as soon as the discovery is made.

D. General: Installations shall conform to the requirements of NFPA 70, NFPA 101, and IEEE C2, unless more stringent requirements are indicated herein or elsewhere on the Contract Drawings.

E. Workmanship: All work must be performed in a neat and workmanlike manner by a licensed journeyman electrician or a certified apprentice working under the direct supervision of a licensed journeyman electrician, and shall present a neat and professional appearance when complete.

F. Electrical Equipment and Materials: Listed and labeled as defined in NFPA 70,

Article 100, by a Nationally Recognized Testing Laboratory meeting the requirements of OSHA 29 CFR 1910.

G. Electrical Equipment and Materials described in these specifications and on the Contract Drawings establish the minimum standards for quality and style, shall be the basis of the bid, and shall be new unless otherwise indicated as existing. Manufacturer names are indicated as basis of design, or suggested alternate manufactures. Alternates shall be considered upon approval of the engineer.

H. Electrical Equipment and Materials shall be installed in accordance with the manufacturer's recommendations using the best methods known to the trade.

I. Onsite Storage: Onsite storage of electrical equipment and materials, and tools will be at the Owner's discretion and the Contractor's risk. The Contractor shall follow the pathways as directed by the Owner for the movement of electrical equipment and materials, and tools in and out of the building, and to and from the project areas. Such pathways will be established by the Owner, and are subject to change at the Owner's discretion.

J. Delivery, Storage, and Handling: Equipment and materials shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced at the Contractor's expense. Stored items shall be protected from theft.

K. Maintenance of Work Areas: The Contractor shall maintain all work areas in a neat and orderly fashion. The Contractor shall employ means as necessary including, but not necessarily limited to, dust curtains, to prevent the migration of dust, dirt, and debris from the immediate project areas to other areas accessible to the public and/or other building occupants. The Contractor shall clean all work areas of dust, dirt, and debris at the end of each workday and more frequently if directed to do so by the Owner.

L. Protection: The Contractor shall make every effort to ensure a safe work environment for his employees, contractors, and agents, and for the public. The Contractor shall follow the applicable requirements and recommendations of OSHA. All exposed energized equipment, components, and wiring shall be shielded from accidental contact by employees, workers and building visitors. In no case shall exposed energized equipment, components, or wiring be left unprotected or unguarded. The Contractor shall provide all warning apparatus and materials required to cordon off the Project Site from those not directly associated with the Project including, but not necessarily limited to, warning tape and barriers, cones, signs, and dust curtains. The placement and erection of warning apparatus and materials shall be coordinated with, and to the satisfaction of the Owner and/or Engineer/Architect.

M. Installations: The Contract Drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the Work and verify all dimensions in the field so that equipment and materials shall be properly located and readily accessible. The

Contractor shall sequence, coordinate, and integrate the various elements of electrical equipment and materials and comply with the following:

1. Verify all dimensions by field measurement.
2. Coordinate the installation of electrical equipment and materials with other building systems, features, and components.
3. Sequence, coordinate, and integrate the installation of electrical equipment and materials for efficient flow of the Work.
4. Install electrical equipment and materials to conform with approved submittal data to the greatest extent possible. Conform to the arrangements indicated on these drawings recognizing that portions of the work are shown only in diagrammatic form.
5. Any confusing, conflicting, or unclear information on these drawings shall be referred to the Engineer/Architect prior to the bid for his resolution. By failing to refer confusing, conflicting, or unclear information in the Contract Documents to the Engineer/Architect for his resolution prior to the bid, the Contractor thereby acknowledges the Contract Documents as error free.
6. In general, install electrical equipment and materials level and plumb, parallel and perpendicular to building lines and features.
7. Install electrical equipment and materials to facilitate servicing and maintenance, and repair or replacement of component parts. To the greatest extent possible, connect electrical equipment for ease of disconnecting with a minimum of interference with other installations.

N. The work shall consist of the relocation of electrical and electrical circuits to accommodate the proposed installation of underground process pipes as shown. The plans are based on Record Drawings of previous installations and site inspections. Additional underground pipes, ducts and conduits may be encountered and routings may be different than indicated. The Contractor shall exercise caution in excavations during the Work and care shall be taken to avoid damage to existing underground process and electrical components not included in the Contract. The work includes, but not necessarily limited to:

1. The installation, rerouting and demolition of conduits, conductors, and duct banks as indicated on the plans.
2. Provide new electrical conductor and instrumentation cable connections to a new weir gate controller and new flowmeters as indicted.
3. Provide new lighting and instrument panels as indicated on the drawings.
4. Modify existing motor control center as shown

O. Power Outages: The Contractor shall schedule power outages as required to complete the Work of this Project. The number and duration of power outages shall be kept to an absolute minimum. Power outages must be coordinated and scheduled with the Owner with a minimum of fourteen-(14) calendar days advance notice.

P. Temporary Power and Lighting:

1. Provide temporary power, signal, and control devices to assure continuous process operations.

Q. Permits / inspections: Obtain (arrange, apply, pay for, and maintain) and post all required construction permits. Obtain (arrange, apply, and pay for) inspection of all electrical work performed under this Contract.

R. Quality Control: Upon completion of the Work, but prior to the punchlist inspection, the Contractor shall complete the following:

1. General: Verify that all electrical equipment is installed, operational, and fully functional in accordance with the manufacturer's requirements and tolerances.

2. Connections and Terminals: Verify all electrical connectors and terminals have been tightened in accordance with the manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

S. Facilitate Punchlist Inspection: The Contractor shall make one journeyman electrician available to accompany the Engineer/Architect during the punchlist inspection. The journeyman electrician shall assist the Engineer/Architect including, but not necessarily limited to, the removing of equipment covers to facilitate inspection of equipment interiors. The punchlist inspection shall be scheduled by the Engineer/Architect with a minimum of 7 calendar days advance notice following the Contractor's notification of his successful checkout and testing of the completed installations. During the punchlist inspection, the Engineer/Architect will survey the completed installations for compliance with Contract Requirements. Subsequent to the punchlist inspection, the Engineer/Architect will compile a list of installation deficiencies. The Owner's notification to the Contractor of Final Acceptance will not be issued until all installation deficiencies have been corrected to the satisfaction of the Owner and/or Engineer/Architect.

T. Record Drawings: The Contractor shall maintain at the site a clean undamaged set of blue or black-line white prints of the Contract Drawings. This record set drawings shall be marked to show the actual installation, and where the actual installation varies substantially from the Work as originally shown. Mark whichever drawings are most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Mark record drawings with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

END OF SECTION

SECTION 16020

INSTALLATION OF UNDERGROUND ELECTRICAL DUCT BANKS, CONDUIT, MANHOLES AND HANDHOLES

PART 1 GENERAL

1. 01 DESCRIPTION OF WORK

A. This item shall consist of underground electrical ducts or conduits installed in accordance with this specification at the locations and in accordance with the dimensions, designs, and details shown in the Contract Drawings for the electrical and instrumentation work. It shall also include all concrete encasement, mandrelling, installation of pull wires and duct markers, capping, core drilling, and the testing of the installation as a completed raceway system ready for the installation of cables, to the satisfaction of the Engineer.

This item shall also include furnishing and installing manholes and handholes at locations shown on the Drawings, including cable pulling rings, cable racks, bell ends, ground rods, grounding non-current carrying metal parts, core drilling existing manholes, handholes and light bases and shall also include adjusting of existing duct markers.

All trenching, backfilling, removal and restoration of all paved areas shall be covered under another section of this Specification.

1. 02 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements that affect the work of this section.

1. 03 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following codes, specifications, and standards except where more stringent requirements are shown or specified:

1. National Board of Fire Underwriter's National Electrical Code, latest edition.
2. Underwriter's Laboratories, Inc., Standards for Cabinets and Boxes, Service Equipment, and Rubber-Covered Wires and Cables.
3. National Electrical Manufacturer's Association Standards.
4. All applicable state and local codes or ordinances.
5. Insulated Power Cable Engineer's Association Standards.
6. Occupational Safety and Health Regulations.
7. Institute of Electrical and Electronics Engineers' Standards.

B. Federal material requirements shall comply with the following:

Number	Title
A 48-76	Gray Iron Castings
A 120-79	Pipe, Steel, Black or Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless, for ordinary uses
A 123-78	Zinc (hot-galvanized) on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip
A 615-79	Deformed and Plain Billet-Steel Bars for Concrete Reinforcements

1. 04 SHOP DRAWINGS

A. Shop drawings and design calculations showing precast concrete electrical handholes and/or manholes, if used, reinforcement size and location, inserts, grout holes, bolt holes, slab, wall and roof openings shall be submitted to the Engineer for approval.

PART 2 PRODUCTS

2. 01 MATERIALS

A. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the acceptable specification when so requested by the Engineer.

2. 02 CONCRETE

A. Concrete shall conform to the requirements for Portland cement concrete, using 1-inch maximum size coarse aggregate, of Section 03010 "Concrete Work" of this Specification.

2. 03 CAST-IN-PLACE ELECTRICAL MANHOLES AND HANDHOLES

A. Manholes and handholes shall be constructed in accordance with the details shown on the drawings. Precast units may be substituted for cast-in-place. Shop drawings must be provided and establish the ability of the precast units to support required loadings. Frames and covers shall be of the manufacturer and type as indicated on the Drawings. Covers shall be imprinted with the work "ELECTRIC" or shall be imprinted as shown or called for on the Drawings.

Ground rods for the electric manhole shall be as shown on the Drawings. Non-current carrying metal parts in the manholes, including metallic sheathes of cables shall be connected to the ground rods with bare copper conductors.

PART 3 EXECUTION

3. 01 GENERAL

A. The Contractor shall install underground ducts, manholes and handholes at the approximate locations indicated in the Contract Drawings. The Engineer may indicate specific locations as the work progresses. Ducts shall be of the size, material, and type indicated in the Contract Drawings or Specifications. Where no size is indicated in the Contract Drawings or Specifications, the ducts shall be not less than 2 inches inside diameter. All duct lines shall be laid so as to grade toward handholes, manholes, vaults, and duct ends for drainage. Grades shall be at least 3 inches per 100 feet. On runs where it is not practicable to run the grade all one way, the duct lines shall be graded from the center in both directions toward manholes, handholes, or duct ends. Pockets or traps where moisture may accumulate shall be avoided.

B. The Contractor shall utilize large radius sweeps for all duct and conduit direction changes and for all elbows entering concrete slabs. The minimum inside radius shall be 30" for all ducts and conduits larger than 1-½" nominal.

C. The Contractor shall mandrel each duct. An iron-shod mandrel, not more than ¼-inch smaller than the bore of the duct shall be pushed through each duct by means of jointed conduit rods. The mandrel shall have a leather or rubber gasket slightly larger than the duct hole.

D. Any non-metallic ducts which terminate in concrete walls of new manholes or handholes shall terminate in bell ends, flush with the inside wall. Non-metallic ducts which terminate in concrete walls of existing manholes or handholes shall be brought through the wall in core drilled holes, trimmed flush with the inside wall, grouted into place.

E. All new ducts and conduits installed and all empty/spare extended ducts shall be provided with a ¼ inch polyprophylene monofilament rope for pulling the permanent wiring. Sufficient length shall be left in manholes or handholes to tie the drag wire back to prevent it from slipping back into the duct.

F. All ducts shall be securely fastened in place during construction and progress of the work and shall be plugged to prevent seepage of grout, water, or dirt. Any duct section having a defective joint shall not be installed.

G. All nonmetallic ducts installed under paved areas shall be encased in a concrete envelope.

H. Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

3. 02 DUCTS ENCASED IN CONCRETE

A. Trenches for concrete-encased ducts shall be opened the complete length between bases, manholes, handholes, etc., before concrete is laid so that if any obstructions

are encountered, proper provisions can be made to avoid them. All ducts for concrete encasements shall be supported on plastic spacers designed for the purpose. Spacer bases shall be installed on wooden planks. The wooden planks shall be installed on a base of 3" of compacted sand in the bottom of the trench. Where two or more ducts are encased in concrete, the contractor shall space them not less than 1½ inches apart (measured from outside wall to outside wall) using spacers applicable to the type of duct. As the duct laying progresses, concrete not less than three inches thick shall be placed around the sides and top of the duct bank. Couplings shall be installed flush with the edge of the concrete encasement where it is required to terminate the duct bank in earth.

B. When pouring ducts for consecutive days, between each day's pour shall be a reinforced joint. When pouring ducts for future extensions, there shall be a keyed joint with no reinforcement as detailed on the Drawings. All costs for keying and reinforcing bars are considered incidental to the Item.

C. When specified, the Contractor shall reinforce the bottom, side and top of concrete encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy.

3. 03 DUCTS OR CONDUITS WITHOUT CONCRETE ENCASEMENT

A. Trenches for single duct lines shall be not less than 12 inches nor more than 16 inches wide, and the trench for 2 or more ducts installed at the same level shall be proportionately wider. Trench bottoms for ducts without concrete encasement shall be made to conform accurately with the grade so as to provide uniform support for the duct along its entire length.

B. A layer of fine earth material, at least 4 inches thick (loose measurement) shall be placed in the bottom of the trench as bedding for the duct. The bedding material shall consist of soft sand or other fine fill, and it shall contain no particles that would be retained on a ¼ inch sieve. The bedding material shall be tamped until firm.

C. Unless otherwise shown in plans, ducts for direct burial shall be installed so that the tops of all ducts are at least 18 inches below the finished grade.

D. When two or more ducts are installed in the same trench without concrete encasement, they shall be spaced not less than 2 inches apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches apart in a vertical direction.

E. Trenches shall be opened the complete length between bases, manholes, etc., before duct is installed so that if any obstructions are encountered, proper provisions can be made to avoid them.

F. Where steel conduits terminate in an unpaved area for transition to direct burial installation, the end of the conduit shall be equipped with an insulated throat, threaded, grounding bushing and shall be connected to the equipment ground.

3. 04 CORE-DRILLED HOLES

A. Certain conduit runs will originate or terminate at existing manholes or light bases. It will be necessary to core-drill into these units to complete the runs. Core-drilled holes into existing manholes or handholes will have the annular space between the conduit and the cored hole filled with mortar.

3. 05 REAMING EXISTING DUCTS

A. In the event that:

1. There are no empty spare ducts that can be utilized,
2. There are no abandoned cables which can be removed,
3. There are no existing cables which can be consolidated to obtain a spare duct:
   a. When directed by the engineer the Contractor may utilize a mechanical reamer or high-pressure water to ream out the blisters and debris from the duct to make it ready to receive new cables.

3. 06 ABANDONED DUCT

A. When a duct bank is to be abandoned in place, these conduits shall be sealed with grout in the manhole where they originate.

3. 07 COMPLETION OF THE WORK

A. After completion of work in any manhole or handhole, both new and existing, the manhole or handhole shall be left in a clean condition satisfactory to the Engineer, regardless of the cause of the debris required to be cleaned.

Number	Title
W-C-571	Fire-Conduit and Fittings; Nonmetal, Rigid, (Asbestos-Cement or Clay Cement), (for Electrical Purposes)
W-C-575	Conduit and Fittings; Nonmetallic, Rigid, Bituminized Fiber; Laminated Wall
W-C581	Conduit and Fittings; Nonmetallic, Rigid, (Bituminized Homogeneous Fiber)
W-C-1094	Conduit and Fittings; Nonmetallic, Rigid, (Plastic)
W-C-581	Conduit, Metal, Rigid; and Coupling, Elbow, and Nipple, Electrical Conduit, Zinc Coated

END OF SECTION

SECTION 16123

600 VOLT OR LESS CABLE

PART 1 GENERAL

1. 01 SUMMARY

A. This Section includes requirements for insulated copper stranded conductors and associated connections for general power, instrumentation, and control use at voltages below 600 volts.

B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and other Specification Sections, apply to the Work as if specified in this Section.

1. 02 REFERENCES

A. ASTM (American Society for Testing and Materials) - B3, B8.

B. NECA (National Electrical Contractors Association) – National Electrical Installation Standards.

C. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

D. NEMA WC 26 - (1996) Wire and Cable Packaging.

E. NFPA 70 – (1999) National Electrical Code.

F. UL 83 - (1991; Rev. through Mar. 1996) Thermoplastic – Insulated Wires and Cables.

G. UL 486A – (1991; Rev. Oct. 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors.

H. UL 510 – (1994) Insulating Tape.

1. 03 QUALITY ASSURANCE

A. Listing and Labeling: Provide wire and cable that are Listed and Labeled as defined in NFPA 70, Article 100 and marked for specific types, sizes, and combinations of conductors and connected items.

B. Comply with NFPA 70. Products shall bear the UL label.

C. Perform work in accordance with codes and standards listed.

D. Wire shall be manufactured within 12 months prior to the date of delivery to the site.

1. 04 SUBMITTALS

A. Data Sheets: Submit as a minimum the following information on each different type of wire and connector. The information shall be in the form of manufacturer's standard data sheets or drawings.

1. Wire and cable.
2. Conductor material.
3. Conductor gage or MCM.
4. Solid or stranded conductor.
5. Insulation material.
6. Insulation type designation.
7. Insulation temperature rating.

B. Wiring Connectors:

1. Connector type.
2. Connector material.
3. Voltage, amperage, and temperature ratings.
4. Conductor size ranges.
5. Tools required.
6. Picture of connector and tools.
7. Manufacturer's installation instructions.

C. Heat Shrink Material:

1. Type of material.
2. Wall thickness.
3. Voltage and temperature ratings.
4. Conductor size ranges.
5. Tools required.
6. Picture of material and tools.
7. Manufacturer's installation instructions.

D. Insulating Tape:

1. Type of material.
2. Thickness and width.
3. Wire pulling lubricants.
4. Type of material.
5. Types of conductor, insulation and conduit for which it is approved.

E. Megger Test Reports: Indicate values obtained.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Codes and Standards.

1. 05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire and cables according to NEMA WC 26.

PART 2 PRODUCTS

2. 01 ACCEPTABLE MANUFACTURERS

A. Low Voltage Conductors: Equal to Cablec, Continental, Okonite, Southwire or Triangle.

B. Signal Circuit Conductors: Equal to Belden, Continental, Dekoron or Penn.

C. Low Voltage Connectors: Equal to Burndy, Thomas & Betts, Ideal or OZ.

D. Pulling Compounds: Water soluble, equal to Polywater J.

E. Wire and Cable Markers: Plastic, split sleeve or tubing type, equal to Brady Type XC or T & B Type SM.

2. 02 BUILDING WIRE

A. Description: UL 83, single conductor insulated wire.

1. Conductor: Copper; 98 percent conductivity, stranded.

2. Insulation Thermoplastic: 600 volts, NFPA 70, Type THHN/THWN-2, unless otherwise indicated; 90° C.

3. All building wire shall be of the same manufacturer. Do not mix wire of different manufacturer on the same project.

4. General: All wire shall be identified as required by NEC.

5. The insulation on wiring #8 or smaller shall have factory-colored insulation. For wire larger than #8, color-coding shall be colored tape wrapped around the insulation of each wire at each connection, splice and pull box. Each phase conductor of each branch circuit shall be of one color throughout the installation.

2. 03 CONTROL WIRE

A. Description: UL 83, single conductor insulated wire.

1. Conductor: Copper; stranded for all sizes.

2. Insulation: Thermoplastic; 600, NFPA 70 Type MTW unless otherwise indicated; 75° C or 90° C as applicable.

3. All control wire shall be of the same manufacturer.

4. Identification: Control wire shall be color-coded throughout. Each wire shall be identified at each terminal and junction point by permanently attaching wire markers indicated the terminal number, etc. Refer to Section 16050 – for Electrical Identification requirements.

2. 04 TRAY CABLE

A. Multi-conductor copper; 600 volt thermoplastic insulation; 75/90 degrees C; Type THWNITHHN; flame and moisture resistant fillers and binder with non-propagating, flame resistant PVC jacket; UL labeled Type TC.

2. 05 INSTRUMENTATION SIGNAL CABLE

A. #16 AWG stranded tinned copper conductors; 600 volt polyethylene insulation; twisted pair or three conductor construction; 100 percent coverage aluminum polyester shield; #18 stranded tinned copper drain wire; vinyl outer jacket; UL listed.

2. 06 ACCESSORIES

A. Heat Shrink Material: Heavy wall tubing or caps; UL listed as waterproof.

B. Insulating Type: Vinyl type; minimum 7-mil; listed for use as primary insulation and splice jacketing on 600 volt wire and cable.

C. Wire Pulling Lubricants: Compatible with all conductor, insulation and conduit types.

PART 3 EXECUTION

3. 01 PREPARATION

A. Completely and thoroughly swab raceway where moisture and/or dirt has collected inside before installing wire.

B. Do not install wire in conduit, raceways, etc. until they are complete and sealed against the entry of moisture and/or debris.

3. 02 WIRING METHODS

A. Building wire, type THHN/THWN-2, or Tray Cable insulation in raceway.

B. Use wiring methods in accordance with the appropriate article of NFPA 70.

C. Connect each circuit of a multi-circuit home run to a different phase.

D. Do not terminate more than one conductor in a single terminal of a lug or connector, unless noted otherwise.

E. Leave slack conductor at each connection and splice to allow for future additional connections.

3. 03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install all wiring in raceways. As standard practice, route control conductors in separate raceways from power conductors. When engineering consideration dictates, control conductors may be routed in power raceway under the following conditions:

1. All conductors must have insulation rated for the highest voltage rated insulation in the raceway.

2. The largest power conductor in the raceway is #4 or smaller.

C. Use conductor not smaller than #12 AWG for power circuits.

D. Use conductor not smaller than #14 AWG for control circuits.

E. Pull all conductors into raceway at the same time.

F. Use suitable wire pulling lubricant.

G. Use a pulling means such as tape, rope, grips, etc. that will not damage the wire, cable or conduit.

H. Neatly train and lace wiring inside boxes, equipment, cabinets, switchboards, and panelboards with nylon tie straps. Three phase circuits shall be grouped by circuit.

I. Clean conductor surfaces before installing lugs and connectors.

J. Make terminations to carry full ampacity of conductors with no perceptible temperature rise.

K. In general, no splices shall be made unless approved by the Engineer. Conductors to be replaced shall be new and repulled without splices.

L. Tighten set screws and bolts on connectors according to the manufacturer's torquing requirements.

M. Use compression connectors for copper conductor approved splices, 8 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of the conductor.

N. Use insulated spring wire connectors with plastic caps for copper conductor approved splices and taps, #10 AWG and smaller.

O. Where approved splices and taps are made in junction boxes or handholes, etc. below grade, use tool-applied crimp type compression connectors. Insulate the conductors and the connector with heavy wall heat shrink material.

P. For parallel conductors of a single phase, insure that conductor lengths are equal by actual length comparison before installation.

Q. Splices in raceways are not allowed. Splice only in junction or outlet boxes in accessible locations.

R. Provide green colored conductor insulation for the entire length of the grounding conductors for wire size smaller than #6 AWG.

S. Provide white colored conductor insulation for the entire length of the neutral conductors for wire size smaller than #6 AWG.

3. 04 IDENTIFICATION

A. Identify wires and cables in accordance with Section 16050.

B. In pull or junction boxes where there is more than one circuit, identify each conductor with its panel and circuit number or other designation indicated on drawings.

3. 05 WIRING TEST

A. Measure the insulation resistance of conductors using a "Megger." The test voltage shall be 500 volts. Test the conductor without circuit loads applied. The minimum resistance value shall be 1,000,000 ohms.

3. 06 FIELD QUALITY CONTROL

A. Inspect wire for physical damage and proper connection.

B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

C. Verify continuity of each branch circuit conductor.

END OF SECTION

SECTION 16130

RACEWAYS

PART 1 GENERAL

1. 01 SUMMARY

A. This Section includes rigid metal conduit, intermediate metal conduit, flexible metal conduit, liquid light flexible metal conduit, electrical metallic tubing, rigid PVC conduit, fitting and conduit bodies.

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections apply to the work of this Section as if specified herein.

1. 02 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. LFMC: Liquidtight flexible metal conduit.

D. PVC: Polyvinyl chloride.

E. RGS: Rigid galvanized steel.

F. FMC: Flexible metal conduit.

G. EPT: Electrical polyvinyl chloride tubing.

1. 03 SUBMITTALS

A. Data Sheets: Submit as a minimum the following information for each type of conduit, conduit body, fitting and attachment device.

1. Conduit.
    a. Type of material.
    b. Thickness of material.
    c. Types of protective coatings on the outside and inside.
    d. Type of protective coating on threads, if applicable.
2. Conduit Bodies:
    a. Type of material.
    b. Type of cover material.
    c. Type of protective coatings, interior and exterior.
    d. Type of material for screws and gaskets.

3. Conduit Fittings:
   a. Type of materials such as bodies, gaskets, seals, etc.
   b. Threaded.
   c. Compression or set screw type.
   d. Liquid tight.
   e. Concrete tight.

1. 04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100. Products shall be the UL label.

B. Comply with NFPA 70.

C. ANSI C80.5: Rigid Aluminum Conduit.

D. ANSI/NEMA FB I: Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

E. NECA: "Standard Installations."

F. NEMA RN 1: Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

G. NEMA TC 2: Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80).

H. NEMA TC 3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

I. UL 1: Flexible Metal Conduit.

J. UL 6: Rigid Metal Conduit.

K. UL 6A: Rigid Aluminum Conduit.

L. UL 360: Liquid Tight Flexible Steel Conduit.

M. UL 514B: Fittings for Conduit and Outlet Boxes.

N. UL 651: Schedule 40 and 80 Rigid PVC Conduit.

O. UL 886: Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

1. 05 COORDINATION

A. Coordinate layout and installation of raceways with other construction that penetrates ceilings or is supported by them, including light fixtures, communication system, HVAC equipment.

1. 06 DELIVERY STORAGE AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

B. The threads of rigid aluminum shall be protected by factory installed caps.

C. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2. 01 METAL CONDUIT

A. Rigid Aluminum Conduit (RAC): ANSI C80.5, RAC shall be threaded.

B. Couplings: Couplings shall be threaded, aluminum and made by the same manufacturer as the conduit.

2. 02 LIQUID TIGHT FLEXIBLE METAL CONDUIT (ALUMINUM)

A. Description: Aluminum core with PVC jacket.

2. 03 NONMETALLIC CONDUIT

A. Description: PVC; Schedule 80.

B. Fittings: Fittings shall match conduit type and material and shall be provided by the same manufacturer as the conduit.

C. Cement for connections of conduit and fittings shall be approved by the manufacturer of the conduit.

2. 04 FITTINGS AND CONDUIT BODIES FOR METAL AND FLEXIBLE CONDUIT

A. Fittings:

1. All fittings, locknuts, bushings, etc. shall be malleable iron or steel.
2. For RAC fittings shall be threaded type.
3. Locknuts shall have shape edges that bite into the enclosure when tightened.
4. Bushings shall be high temperature plastic, with insulating throats and grounding lugs where applicable.
5. Hub fittings shall be two-piece, liquid-tight with high temperature, plastic, insulating throats.
6. Fittings used in concrete shall be UL listed as concrete tight.
7. Fittings used in exterior and other damp or wet applications shall be UL listed as liquid-tight.
8. Fittings for flexible metal conduit shall have insulated throats and grounding lugs where applicable.

B. Conduit Bodies: Conduit bodies shall be cast copper-free aluminum. They shall be threaded type with cast cover and solid gasket. Where used in dry interior applications, provide coated steel screws. Where used in exterior or other damp or wet applications, use aluminum screws. Conduit bodies 1 ¼ inches and larger shall have rollers or wire guards.

C. Expansion Fittings: Expansion fittings shall be malleable iron or steel with insulator bushing, gaskets, washers, packing, etc. as required to provide a complete unit. Provide a braided copper bonding jumper. The fittings shall be rated for interior or exterior use as applicable.

D. Seal Fittings: Seal fittings shall be cast aluminum, threaded type with packing, sealing compound, plugs, etc. to provide a complete unit. Fittings shall be rated for interior or exterior use as applicable.

E. Deflection Fittings: Deflection fittings shall be hot dip galvanized ductile iron, threaded type with molded neoprene outer jacket, tinned braided copper bonding jumper, molded plastic inter sleeve, stainless steel clamping bands, etc. to provide a complete unit. The fitting shall be rated for interior or exterior use as applicable. Where fittings are used below grade, they shall be PVC coated as specified under PVC coated metal conduit fittings.

PART 3 EXECUTION

3. 01 INSTALLATION

A. Underground Installation:

1. Concrete Encased: Use schedule 40 PVC conduit.
2. Direct Buried: Use schedule 80 PVC conduit.

B. Outdoor Locations, Above Grade: Use coated rigid aluminum conduit and liquid-tight flexible aluminum conduit for connection to motors and control devices.

C. Wet and Damp Locations, Above Grade: Rigid aluminum conduit, flexible waterproof conduit for connection to motors and control devices.

D. Dry Locations:

1. Concealed in Concrete or Masonry Construction Above Grade, Columns, Walls and Above Suspended Ceilings: Use rigid aluminum conduit. Exposed: Use rigid aluminum.

E. Locations Subject to Physical Damage: Use rigid aluminum conduit.

F. Liquid-Tight Flexible Metal Conduit: Liquid-tight flexible metal conduit shall be installed for:

1. Connections to motor equipment subject to movement or vibration where exposed to rain, spray, or a corrosive atmosphere.
2. Connections to equipment subject to oil or grease.
3. Connections to control equipment.

G. General Requirements:

1. Install conduit in accordance with NECA "Standard of Installation" and manufacturer's written instructions.

2. Install nonmetallic conduit in accordance with manufacturer's instructions.
3. Minimum Conduit Size: ¾-inch unless otherwise specified.
4. Verify routing and termination requirements and locations of conduit prior to rough-in.
5. Routing and termination of conduits shall be coordinated with structural, equipment, piping and ductwork to assure accessibility to junction and pull boxes.
6. Conduit routing shown on the drawings is diagrammatic unless otherwise dimensioned. Route conduit as specified and as required. Conduit offsets, risers, junction boxes, pull boxes, and fittings are not necessarily shown; however, provide these as required by the conditions involved and applicable codes for a correct and complete installation.
7. Finished Areas: Conceal conduits below floors, within slabs only where indicated, within walls, within pipe chases, above suspended ceilings, and within other building construction, unless otherwise indicated. Conduits shall be run in floor slabs except where otherwise indicated.
8. Install conduits run exposed or concealed above ceilings or in walls in straight, level and plumb lines, parallel with and at right angles with beams, wall, ceilings and other building lines.
9. Route conduit in slabs above grade and in and under slabs on grade from point-to-point or shortest practical path.
10. Arrange conduit supports to prevent misalignment during wiring installation.
11. Support individual conduit using malleable two-hole conduit straps, lay-in adjustable hangers, clevis hangers, threaded rods with conduit fasteners and split hangers.
12. Group related conduits; support using conduit rack. Construct rack using aluminum channel; provide space on each for 25 percent additional conduits. Each conduit shall be independently attached to the rack.
13. Fasten conduit supports to building structure. Do not fasten conduit supports to mechanical piping or ducts or their supports.
14. Do not support conduit with the tie wire or perforated pipe straps. Remove wire used for temporary supports.
15. Do not cross conduits in slab.
16. Conduit shall be installed a minimum of 12 inches from steam or hot water piping, flues or any other surface with a surface temperature exceeding 104° F (40° C) run in parallel with the conduit, and a minimum of 6 inches where run perpendicular to the conduit. Conduit shall be installed a minimum of 3 inches from cold or chilled water piping.
17. Cut conduit square using saw or pipecutter; ream and de-burr cut ends.

18. Bring conduit to shoulder of fittings; fasten wrench-tight.

19. When threads are cut in rigid conduit in the field, the conduit and fittings shall be made up immediately. If there are any showing, they shall be coated with a corrosion resistant compound approved by the conduit manufacturer.

20. Solvent weld nonmetallic conduit and fittings using cement as approved by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fittings. Allow joint to cure as instructed by the manufacturer.

21. Use conduit hubs or watertight fittings to fasten conduit to metal boxes in damp and wet locations.

22. In general, install no more than equivalent of three 90° bends between pull or outlet boxes. Make field-made bends and offsets with hickey or conduit bending machine. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2-inch size. Do not install crushed or deformed conduits. Keep the legs of a bend in the same plane and the straight legs of offsets parallel. For banked runs, all bends and offsets shall be parallel.

23. Avoid moisture traps; provide junction box with drain fitting at low point in conduit system.

24. Provide approved adapters when PVC conduits are coupled to metallic conduits.

25. Where PVC is used underground, a rigid aluminum elbow shall be provided at the point where the conduit turns up. The vertical portion of the riser shall be rigid aluminum conduit.

26. Provide approved fittings that maintain conduit electrical continuity by bonding jumpers or other means to accommodate expansion and deflection where conduit crosses control and expansion joints.

27. Provide seal fittings on all conduits where they rise out of the ground or fill below slabs. If the conduit terminates in a floor mounted metal enclosure such as a switchboard, pull box, etc., provide a sealing bushing with a grounding bushing.

28. Provide seal fittings on all conduits that penetrate exterior walls or to or from interior spaces or other areas where conduit passes from one extreme temperature or moisture situation to another such as walk-in refrigerators, freezers or wash down bays.

29. Install a pull rope in each empty conduit. Pull rope shall be monofilament plastic having a minimum 200-lb. tensile strength. Leave a minimum of 12 inches of slack at each end of the pull line and securely fasten pull rope to conduit.

30. Where conduits rise through floor slabs, curved portions or bends shall not be visible above the finished slab.

31. Support non-concrete encased underground conduits by laying with full length bearing on firm trench bottoms.

32. Support horizontal and vertical runs of conduit at intervals in accordance with the code for the types of conduit used. In addition, support each riser conduit at each building floor level.

33. Prior to wire pulling, use suitable caps to protect installed conduit against entrance of dirt and moisture and blow out or swab out conduits in which moisture or dirt has collected. Free clogged conduits of obstructions.

34. All conduits shall have a grounding conductor.

35. Identify conduit under provisions of Section within 16050 – Electrical Identification.

36. Provide all necessary sleeves for conduits and other electrical items passing through concrete and masonry construction where conduit and other electrical items are not installed prior to concrete beams shall be rigid aluminum conduit, flush with finished concrete surfaces. Sleeves for all conduits passing through the floor shall be rigid aluminum conduit extending two inches above finished floor, and flush with slab below.

37. Provide code size pull boxes, in accessible locations, in all conduits where the number and degree of bends exceed the code limitations and every 150 feet maximum for long straight runs.

38. All conduits that are stubbed out below grade shall have a threaded, watertight cap installed on the end.

39. Conduits shall be located so as not to hinder access to mechanical and electrical equipment through the ceiling tiles.

40. Exposed suspended conduits shall be located as to provide proper headroom as required by OSHA regulations.

41. Conduit runs shall be complete before conductors are installed in them.

42. Tighten set screws of threadless fittings with suitable tools.

43. Terminations:

    a. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

    b. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

44. Install pull wires in empty raceways. Use polypropylene or monofilament

plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches of slack at each end of pull wire.

45. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

    b. Where otherwise required by NFPA 70.

46. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid aluminum conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

3. 02 FLEXIBLE CONNECTIONS: USE MAXIMUM OF 72 INCHES OF LFMC CONDUIT FOR EQUIPMENT SUBJECT TO VIBRATION, NOISE TRANSMISSION, OR MOVEMENT; AND FOR ALL MOTORS. **PROTECTION**

A. Provide final protection and maintain conditions that ensure coatings, and finishes are without damage or deterioration at time of Substantial Completion.

1. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3. 03 CLEANING

A. After completing installation of exposed, factory-finished raceways, inspect exposed finishes and repair damaged finishes.

END OF SECTION

DIVISION 17
INSTRUMENTATION

SECTION 17010

INSTRUMENTATION

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide elements of process instrumentation, auxiliary equipment, and supplies.

B. The requirements specified in the Conditions of the Contract, Division 1 apply to this Section.

C. Refer to Electrical sheets for Instrumentation, raceway and wiring. Refer to Mechanical sheets for sensors and control components.

D. The work at Automatic Backwash shall include, but not necessarily be limited to:

1. Furnish and install four (4) new dual-channel ultrasonic flowmeters to measure the flow at the effluent weir of each of the seven (7) ABW Filters. The flowmeters shall provide 4-20 mA outputs to the existing SCADA system.

E. The Contractor shall route signal wires to the SCADA system. No programming of the SCADA system is required. Manatee County has contracted with McKim & Creed to provide the SCADA Integration and Control Programming. The Contractor shall be required to coordinate with McKim & Creed and the County to provide all information necessary for this work. The Contractor shall notify M&C six weeks prior to completing all related equipment installation, wiring, terminations, calibrations, and testing. At that time, M&C will begin the SCADA development activities. Following completion of the SCADA development activities and within one week of notification by the Contractor that all related equipment has been confirmed ready for commissioning, M&C will be on-site to perform the SCADA integration and commissioning activities. The commissioning activities will be completed within two weeks.

1.02 RELATED WORK

A. Division 16 - Electrical

1.02 SUBMITTALS

A. The submittals shall be in accordance with Division 1, Section 01340, as well as include the following:

1. Manufacturer's data.

2. Shop drawings.

3. Certificates of compliance.

4. Certified test reports.

5. Operation and maintenance manuals.

1.03 QUALITY ASSURANCE

A. Manufacturer. Instrumentation, control and monitoring equipment furnished shall be manufactured by a firm regularly and currently engaged in the design and manufacture of similar equipment. Equipment furnished shall be new and of current design.

B. Maintainability. Equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. Materials and Installation shall comply with the requirements of the referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. Equipment of the same type shall be a product of the same manufacturer. Capacities of equipment shall not be less than that indicated on the drawings or specified.

D. All exterior mounted instruments shall be furnished with appropriately sized rain shields.

PART 2 PRODUCTS

2.01 ULTRASONIC FLOWMETER

A. Dual –channel ultrasonic microprocessor-based flow/level meters shall be installed at the locations on the plans in accordance with the manufacturer's recommendations. The unit shall be a Model 2200 with two (2) FB5 Sensors as manufactured by Eastech Flow Controls. The unit shall match existing units in operation at the facility.

B. The ultrasonic unit shall have the following features:

1. Enclosure: IP66/NEMA 4X

2. Power: 80/240 VAC, 50/60 Hz or 12-28 VDC @ 150 mA with surge suppression and fuse.

3. Outputs: 4-20 mA isolated into 1000 ohms, monitored to detect open circuits, with RFI and gas discharge surge protection and two fuses. Two outputs per unit, to provide the flow measured by each sensor.

4. Relays: A minimum of 5 relays rated at 0.25A @ 120 VAC or 0.5 A @ 24 VDC. The relays must be assignable by the front panel keypad for up to three setpoints, loss of signal, 4-20 loop, overange 1, overange 2, contact integrator or pump alternation.

5. Data Logger: There shall be a data logger integral to the electronics. The data logger shall have non-volatile flash memory with a storage capacity of 32,768 records. Software shall be supplied for downloading the data. The logged data shall have the capability to be displayed on the backlit display in graphing form for daily minimum, maximum, average and total flow units for the past eight days.

6. RS-232: There shall be a RS-232 serial port of 1200-38400 baud, Modbus RTU protocol.

7. RS-485: There shall be a RS-485 serial port optically isolated, Modbus RTU protocol.

8. Electronics: The display for the electronics must be a four line, 20 character display with the ability to turn the display On or Off by the front panel keypad and also to adjust the contrast. The meter must employ a menu-driven programming style of data entry. All programming functions and data entry and collection shall be initiated by the display and the 16-button keypad.

   At least 78 flow curve calculations shall be stored in the firmware with the ability to produce special curves either via flow equations or head vs flow tables. The unit shall compute all flow calculations using IEEE 754 single floating point precision. Units using flow lookup tables for standard flume or weir equations shall not be permitted. The Ultrasonic Flowmeter Panel shall be capable of adding flow values and transmitting these values to another microprocessor-based unit.

   The electronics shall be able to accept up to two separate sensors per panel and display all functions for both channels.

C. The sensor shall be designed for open channel flow applications and shall have integral temperature compensation. The sensor housing shall be made of glass-filled polyester resin and be supplied with 30 feet of cable. 1000 foot maximum cable runs allowed. Splices shall be made waterproof. The maximum level range of the sensor

shall be 25 feet with a 1 foot offset region. The sensor shall include 1-inch NPT mounting threads. The sensor mounting bracket shall be stainless steel. The sensor shall be mounted per the manufacturer's recommendations and the Contractor shall ensure that there are no obstructions that will interfere with the level / flow measurement.

D. The electronics and sensor shall carry a 3-year warranty.

2.02 INSTRUMENT LOOP POWER SUPPLIES

A. An instrument loop power supply shall be provided for each loop, where required. The power supply shall be rated for 2.8 amps at 24 VDC and shall be output overload protected. Shall be factory wired for 120V AC, 60 Hz operation. The power supply shall be rated for operation in ambient conditions of 0-50 degrees C. Input protection shall be provided in the form of a 1 amp fuse or circuit breaker. Provide a Blown Fuse Indicator across the protective circuit for positive visual verification of an open condition. The power supply shall be a Model SPS 30-24/28 as manufactured by ACME or approved equal.

2.03 TRANSIENT PROTECTION/SURGE SUPPRESSION DEVICES

A. Surge and transient protection devices shall be provided for 4-20 mA loops where not provided by panel originating loop. They shall be two-stage units incorporating gas tube and electronic clamping. Either polarity in surges shall be equally protected. The protection devices shall provide long life, reliability and easy mounting. Surge protection devices for 4-20 mA loops shall add no more than 50 ohms to the circuit and provide impulse clamping levels of 100V maximum for line-to-line and 50V maximum for line-to-ground. Surge protection devices for instrument loops of 4-20 mA shall be Model 1669-02 as manufactured by Joslyn Electronic Systems Corporation.

PART 3 EXECUTION

3. 01 GENERAL

A. Install all system components in accordance with the Drawings, manufacturers' recommendations, and approved Shop Drawings. Provide all necessary interconnection, services, and adjustments necessary for a complete, operational and fully functional system.

B. All electrical work shall be accordance with NEC and Division 16 of these Specifications. Install all control wiring / cabling, without splices between terminal points. Group, bundle, train and route wires and cables, as required for a neat and professional looking wiring / cabling system in accordance with the best practice known to the industry.

C. All wires entering / exiting control enclosures shall be terminated on terminal blocks. All terminal blocks shall be permanently, legibly labeled with the unique identification number of the wire terminated thereon.

D. Maintain a minimum 6-inch separation between descrete I/O wiring and analog cabling / wiring. Provide separate plastic wireways to segregate discrete I/O wiring from analog I/O cabling / wiring.

E. Provide surge protection on all control and control power circuits routed outside of the control building. Surge protection shall be per data transmission equipment manufacturer's requirements. Surge protection shall consist of surge suppressors, transient protectors and optical isolated relays as applicable.

F. All field-mounted instruments shall be protected and isolated from vibration, temperature extremes, radiant heat, rain, sleet or falling water, and similar adverse conditions.

G. Field mounted elements shall be marked with data required for calibration such as location of adjustments, span, offset, zero suppression, and test voltages. If such data are not provided in permanent markings or on the manufacturer's nameplate, a durable tag or label shall be affixed in a protected location that will become readily visible in the normal course of servicing the instrument.

3. 02 EXAMINATION

A. Verify that systems are ready to receive work.

B. Commencing installation of Division 11 specified systems means the Division 11 Installer accepts existing conditions without exception.

3. 03 INSPECTION

A. Inspect work in progress for compliance with manufacturer specified tolerances.

3. 04 DELIVERY, STORAGE AND HANDLING

A. Provide factory shipping cartons for each piece of equipment and control device. Provide factory applied plastic end caps on each length of pipe and tube. Maintain cartons and end caps through shipping, storage and handling as required to prevent equipment and pipe-end damage, and to eliminate dirt and moisture from equipment and inside of pipe and tube. Store equipment and materials inside and protected from weather.

3. 05 IDENTIFICATION

A. Piping and Cabling / Wiring: Tag control piping and cabling / wiring at each end and at accessible junction points as specified herein, in accordance with Division 16. Develop and apply a logical alphanumeric identification scheme uniquely identify each wire / cable. The unique identification should relate the wire to the programmable logic controller, the I/O card and the type of device to which the wire is connected.

3. 06 WIRING

A. General: Provide surge protection on all discrete control, signal and power circuits routed outside of the Operations Building. Surge protection shall be per data transmission equipment manufacturer's requirements. Surge protection shall consist of surge suppressors, transient protectors and optically isolated relays as applicable.

3.07 EQUIPMENT TESTING AND CALIBRATION

A. General: Provide Construction Manager-approved operation and acceptance testing of the complete system. The Resident Engineer's representative will witness all tests.

B. Factory Tests and Calibration. All field-mounted elements shall be factory-tested by the manufacturer to assure satisfactory performance prior to shipment to the job site. Whenever possible, this shall include calibration to the actual range and conditions of use. Calibration shall be traceable to the National Bureau of Standards with an uncertainty not more than 1/2 of the specified or claimed accuracy of the instruments.

C. Field Calibration. Field mounted elements which were not calibrated to final working values of range, span, and zero suppression at the factory shall be so calibrated prior to or at the time of installation. This calibration shall meet the same requirements of accuracy and traceability required for factory testing above. The engineer shall be given 48 hours notice and the opportunity to witness this calibration.

D. Field Test: When installation and field calibration is complete, verify transmission media operation before the system is placed on-line. Provide a detailed crosscheck of each sensor within the system by making a comparison between the reading at the sensor and a standard traceable to the National Bureau of Standards. Provide a crosscheck of each control point within the system by making a comparison between the control command and the field-controlled device. Submit the results of functional and diagnostic tests and calibrations to the Engineer for final system acceptance.

E. The PLCs have been previously programmed and modified to accept the signals for this project. The Contractor shall communicate with the Owner so that County

instrumentation personnel can to land the signal wires at the PLC and be on-site during checkout and startup.

3.08 SCADA INTEGRATION AND CONTROL PROGRAMMING

A. The Contractor shall route signal wires to the SCADA system. No programming of the SCADA system is required. Manatee County has contracted with McKim & Creed to provide the SCADA Integration and Control Programming. The Contractor shall be required to coordinate with McKim & Creed and the County to provide all information necessary for this work. The Contractor shall notify M&C six weeks prior to completing all related equipment installation, wiring, terminations, calibrations, and testing. At that time, M&C will begin the SCADA development activities. Following completion of the SCADA development activities and within one week of notification by the Contractor that all related equipment has been confirmed ready for commissioning, M&C will be on-site to perform the SCADA integration and commissioning activities. The commissioning activities will be completed within two weeks.

END OF SECTION