



**TOWN OF LONGBOAT KEY  
LONGBOAT KEY, FLORIDA**

**LONGBOAT KEY SUBAQUEOUS FORCE MAIN**

**CONTRACT/TECHNICAL SPECIFICATIONS**

**50% SUBMITTAL - DRAFT**

**NOVEMBER 2024**



**DRAFT DOCUMENTS**

These Draft Documents are released for the purpose of information exchange review and planning only under the authority of Matthew S. Richards, November 22, 2024, Florida PE No. 71515. They are not to be used for bidding, permit, or construction purposes.





**TOWN OF LONGBOAT KEY**  
**LONGBOAT KEY SUBAQUEOUS FORCE MAIN**

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**SECTION 01110**  
**SUMMARY OF WORK**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section includes:
1. Detailed description of the Work.

**1.02 THE WORK**

- A. The Work consists of: 
1. Construction of approximately 14,000 linear feet of 24-inch high density polyethylene (HDPE) force main pipe including all associated valves, fittings and appurtenances from the Town of Longboat Key Master Lift Station D to the tie-in point on the mainland in Manatee County.
  2. Restoration of seagrass as permitted and indicated on the Drawings.
  3. Backfill areas affected by erosion in the Sarasota Bay with new suitable fill material as indicated on the Drawings.
  4. Restore site grades, surfaces and the site to a condition that is equal to or better than the condition of the site prior to commencing construction.
  5. Commissioning of the Work.

**1.03 LOCATION OF PROJECT**

- A. The Work is located at Longboat Key, Florida and Bradenton, Florida. The new 24-inch force main begins at Master Lift Station D located at 521 Gulf Bay Road, Longboat Key, Florida 34228 and runs northeast across the Sarasota Bay before connecting into an existing 18-inch HDPE slip lined force main located just south of El Conquistador Parkway and Foxtail Palm Way in Bradenton, Florida on the Manatee County mainland.

**1.04 ACTIVITIES BY OTHERS**

- A. Owner, utilities, and others may perform activities within Project area while the Work is in progress.
1. Schedule the Work with Owner, utilities, and others to minimize mutual interference.

**1.05 PROTECTION OF EXISTING STRUCTURES**

- A. The Contractor shall assume full responsibility for the protection of all existing buildings, structures, poles, signs, services to buildings, hydrants, drains and electric and telephone cables whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by the Contractor at the Contractor's expense.

## 1.06 STORAGE OF MATERIALS

- A. Suitable storage facilities shall be furnished by the Contractor. All materials, supplies and equipment intended for use in the work shall be suitably stored by the Contractor to prevent damage from exposure, admixture with foreign substances, or vandalism or other cause. The Town of Longboat Key will refuse to accept, or sample for testing, materials, supplies or equipment that have been improperly stored, as determined by the Town of Longboat Key. Materials found unfit for use shall not be incorporated in the work and materials shall immediately be removed from the construction or storage site. Delivered materials shall be stored in a manner acceptable to the Town of Longboat Key before any payment for same will be made. Materials may be strung out along the line of construction as approved by the FDOT, Manatee County, or whichever has jurisdiction.
- B. When storing materials on private property, the Contractor shall submit in writing the property owner's authorization to do so and provide any and all permits that may be required at no expense to the Town of Longboat Key.

## 1.07 PERMITS


- A. In accordance with General Conditions, the Contractor shall obtain all other permits required to complete the project. Refer to Section 01410 Regulatory Requirements for permitting requirements.

## 1.08 CLEAN UP

- A. The Contractor shall keep the construction site free of rubbish and other materials and restore to their original conditions those portions of the site not designated for alteration by the Contract Documents. Clean up and restoration shall be accomplished daily throughout the contract period and in such a manner as to maintain a minimum of nuisance and interference to the general public residents in the vicinity of the work. The Contractor shall also remove, when no longer needed, all temporary structures and equipment used in his operation. It is the intent of this Specification that the construction areas and those other areas not designated for alteration by the Contract Documents shall be immediately restored to their original condition. All cleanup is subject to approval by the Town of Longboat Key, FDOT, or Manatee County, whichever has jurisdiction.

## 1.09 PUBLIC SAFETY AND CONVENIENCE

- A. The Contractor shall at all times conduct his work as to ensure the least possible obstruction of traffic, or inconvenience to the general public and residents in the vicinity of the work. No road or street shall be closed to the public, except with the permission of the Town of Longboat Key, FDOT, Manatee County, Police, Fire Department and US Navy, with the submittal of an approved signed and sealed Maintenance of Traffic plan. Fire hydrants on or adjacent to the work shall be kept accessible. The Contractor shall make provisions to ensure public access to sidewalks, public telephones, and proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches. No open excavation shall be left overnight. All open excavation within the roadway shall be backfilled and temporary asphalt patch applied prior to darkness each day or covered with steel plates depending on

 FDOT approval. A temporary cold asphalt patch is acceptable. Tie-in and system shutdowns and highway crossings pipeline installation may also be required at night.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

END OF SECTION





## SECTION 01601

### PRODUCT REQUIREMENTS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes:
  - 1. Requirements for products.

##### 1.02 TERMINOLOGY

- A. The words and terms listed below, are not defined terms that require initial capital letters, but, when this Section is referenced in other Specifications, have the indicated meaning.
  - 1. Manufacturer's Certificate of Source Testing:
    - a. Form used to confirm that the applicable source tests have been performed and the results conform to the Contract Documents. Form template is provided at the end of this Section.
  - 2. Manufacturer's instructions:
    - a. Stipulations, directions, and/or recommendations issued by the manufacturer of the product addressing handling, storage, installation, protection, erection, and/or application of the product.
  - 3. Product data:
    - a. Information about the product, typically found in the manufacturer's catalogs specifications or other resources, including data sheets, bulletins, and brochures.
  - 4. Source Quality Control:
    - a. Testing and inspections at the location of fabrication or assembly.
      - 1) Includes factory acceptance testing (FAT), factory testing, and Source Testing.
    - b. Test reports, including the following information:
      - 1) Test description.
      - 2) List of equipment used.
      - 3) Name of the person conducting the test.
      - 4) Date and time the test was conducted.
      - 5) Ambient temperature and weather conditions.
      - 6) Raw data collected.
      - 7) Calculated results.
      - 8) Clear statement if the test passed or failed the requirements stated in the Contract Documents.
      - 9) Signature of the person responsible for the test.
  - 5. Special tools:
    - a. Special wrenches, gauges, circuit setters, and other similar devices required for the proper operation or maintenance of a system that would not normally be in the Owner's tool kit and that have been specifically made for use on a product for assembly, disassembly, repair, or maintenance.

### 1.03 QUALITY CONTROL

- A. Manufacturer shall provide a permanent quality control department and laboratory facility capable of performing inspections and testing as required by the Contract Documents.
  - 1. Material testing, inspection procedures, and manufacturing process are subject to inspection by the Engineer.
  - 2. Notify the Engineer in writing of the manufacturing start date, not less than 14 days prior to the start, of the manufacturer of project pipe.
  - 3. Perform manufacturer's tests and inspections required by the referenced standards and as specified in this Section, including the following:
    - a. Calibration within last 12 months for equipment such as scales, measuring devices and calibration tools used in the manufacturing of pipe as required by ISO 9001.
      - 1) Each device used in the manufacturer of pipe is required to have a tag recording date of last calibration.
      - 2) Provide calibration certificate.
      - 3) Devices are subject to inspection by the Engineer.
  - 4. Provide Manufacturer's Certificate of Source Testing.

### 1.04 SERVICES OF MANUFACTURER'S REPRESENTATIVES

- A. Qualifications of manufacturer's representative include the following:
  - 1. Authorized representative of the manufacturer, factory trained and experienced in the technical applications and installation of respective products with full authority by the product manufacturer to issue the certifications required of the manufacturer.
  - 2. Competent, experienced technical representative of the product manufacturer for installation.
  - 3. Additional qualifications may be specified in the Technical Sections.
  - 4. No substitute representatives will be allowed until written approval by the Owner and Engineer has been obtained.
- B. Completion of manufacturer on-site services: Engineer approval required.
  - 1. Manufacturer's representative will advise aspects of installation, including, but not limited to:
    - a. Handling.
    - b. Storing.
    - c. Cleaning and inspecting.
    - d. Coating and lining repairs.
    - e. Tapping.
    - f. General construction methods.
- C. Manufacturer is responsible for determining the time required to perform the specified services.
  - 1. No additional costs associated with performing the required services will be approved.
  - 2. Manufacturer required to schedule services in accordance with the Contractor's Project schedule, up to and including making multiple trips to the Project Site when there are separate milestones associated with installation of each occurrence of the manufacturer's product.

- D. Manufacturer's on-site services include the following:
  - 1. Assistance during construction.
  - 2. Provide 1 copy of daily manufacturer's representative's field notes and data to the Engineer.
  - 3. Other requirements as specified in the Contract Documents.

## 1.05 GENERAL TEST REQUIREMENTS

- A. Testing prerequisites:
  - 1. Prior to testing, verify equipment protective devices and safety devices have been installed, calibrated, and tested.
- B. Test Plan requirements:
  - 1. As specified in this Section and the Technical Sections.
  - 2. Prepared by the Contractor as a result of discussions and planning emerging from regularly conducted meetings for test planning.
  - 3. Define the following for each test:
    - a. Purpose of the test.
    - b. Identification of each item of equipment/system, including system designation, location, tag number, control loop identifier, etc.
    - c. Description of the pass/fail criteria that will be used.
    - d. Listing of pertinent reference documents (Contract Documents or industry standards applicable to the testing).
    - e. Credentials of test personnel.
    - f. Test equipment:
      - 1) Product data.
      - 2) Appropriate calibration records.
      - 3) Drawings or photographs of test stands and/or test apparatus.
    - g. Duration: Determine test durations with the Owner's input.
    - h. Detailed step-by-step test procedures.
      - 1) Setup.
      - 2) Level of detail shall be sufficient for any witness with a rudimentary technical aptitude to be able to follow the steps and develop confidence that the tests were being performed as planned.
      - 3) Include all steps in the procedures.
      - 4) Define temporary systems (pumps, piping, etc.), shutdown requirements for existing systems.
      - 5) Furnish labor, power, tools, equipment, instruments, and services required for and incidental to completing testing activities.
    - i. Test forms: Include, but not limited to, the following information:
      - 1) Name of product to be tested.
      - 2) Test date.
      - 3) Names of persons conducting the test.
      - 4) Names of persons witnessing the test, where applicable.
      - 5) Test data.
      - 6) Applicable Project requirements.
      - 7) Check offs for each completed test or test step.
      - 8) Place for signature of person conducting tests and for the witnessing person, as applicable.

- C. Submit Test Plan.
  - 1. Submit forms as specified in the Technical Sections.
  - 2. Submit a copy of the Test Plan at least 21 days before any scheduled test date.
  - 3. Engineer approval of Test Plan required prior to beginning testing.
- D. Request proposed test dates.
  - 1. Notify the Engineer of the scheduled tests a minimum of 15 days before the date of the test.
- E. Implement approved Test Plans.
  - 1. Demonstrate the product performance meets the requirements stated in the Contract Documents.
    - a. When the product fails to meet the specified requirements, perform additional, more detailed, testing to determine the cause, correct, repair, or replace the causative components and repeat the testing that revealed the deficiency.
- F. Submit Test Report.

## 1.06 SOURCE TESTING

- A. As specified in Section 01450 - Quality Control.
- B. Also referred to as factory testing or factory acceptance testing (FAT).
- C. Source Test Plan:
  - 1. As specified in this Section and other Technical Sections.
  - 2. Purpose: Test products for proper performance at point of manufacture or assembly as specified in the Technical Sections.
  - 3. Source Testing requirements as specified in Technical Sections.
    - a. Non-witnessed:
      - 1) Provide completed Attachment A - Manufacturer's Certificate of Source Testing.
    - b. Witnessed:
      - 1) 2 Owner's representatives and 2 Engineer's representatives present during testing, unless otherwise specified.
      - 2) Provide completed Attachment A - Manufacturer's Certificate of Source Testing.
  - 4. Duration: Define.
  - 5. Contractor is responsible for providing fuel, chemicals, and other consumables needed for Source Testing.
- D. Contractor is responsible for witness trip costs associated with the Owner's and Engineer's representatives.
  - 1. Include costs for at least the following:
    - a. Transportation:
      - 1) Travel on commercial airline to and from Site, including related fees.
      - 2) Rental car to and from airport, hotel, and test site, including related fees.
    - b. Hotel/meals:

- 1) Hotel costs at a facility with an American Automobile Association 4-star rating or higher equivalent for single occupancy room per person per day.
- 2) Meal allowance based on government per diem guidelines per location.
- c. Witness labor costs:
  - 1) The greater of \$200 per hour or \$1,600 per day.
2. If the Source Test is not ready when the witnesses arrive or if the Source Test fails, the witnesses will return home with the Contractor responsible for costs associated with the trip, including costs described above.
  - a. Contractor is responsible for rescheduling the Source Test and witnesses' costs associated with the second trip, including costs described above.
  - b. Contractor is responsible for witnesses' costs associated with retests, including costs described above.

## 1.07 INSTALLATION VERIFICATION

- A. Installation Verification plan:
  1. Confirm piping:
    - a. Has been properly installed, adjusted, and aligned.
    - b. Is free of any stresses imposed by connecting piping or anchor bolts.
    - c. Is able to be operated as necessary for Functional Testing.
  2. Field test backfill, welded joints, alignment and grade, and pipeline pressure as specified in the Technical Sections.
  3. Duration: Define.
  4. Coordinate Installation Verification with restrictions and requirements as specified in Section 01140 - Work Restrictions

## 1.08 FUNCTIONAL TESTING

- A. Functional Test Plan:
  1. Purpose: Test piping system to verify conformance with the Contract Documents.
  2. Duration: Define.
  3. Perform testing in the presence of the Engineer.
  4. Contractor is responsible for providing fuel, chemicals, and other consumables needed.
  5. Coordinate Functional Testing with restrictions and requirements as specified in Section 01140 - Work Restrictions.

## 1.09 SHIPMENT

- A. Prepare products for shipment by:
  1. Tagging or marking to match the Shop Drawings or Contract Documents.
  2. Including complete packing lists and bills of material with each shipment.
  3. Packaging products to facilitate handling and protection against damage during transit, handling, and storage.
  4. Securely attach special instructions for proper field handling, storage, and installation before packaging and shipment.
- B. Transport products by methods that avoid product damage.

- C. Deliver products in undamaged condition in the manufacturer's unopened packaging.

#### **1.10 DELIVERY AND HANDLING**

- A. Handle products in accordance with the manufacturer's instructions.
- B. Deliver products in undamaged condition in the manufacturer's unopened packaging.
- C. Provide construction equipment and personnel to handle products by methods in accordance with the manufacturer's instructions.
- D. Upon delivery, promptly inspect shipments:
  - 1. Verify compliance with the Contract Documents, correct quantities, and undamaged condition of products.
  - 2. Acceptance of shipment does not constitute final acceptance of products.

#### **1.11 STORAGE**

- A. Immediately store and protect products until installed in the Work.
- B. Store products with seals and legible labels intact.
- C. Protect painted or coated surfaces against impact, abrasion, discoloration, and damage.
- D. Storage of spare parts, maintenance products, special tools.
  - 1. Immediately store in accordance with the manufacturer's instructions.
  - 2. Store spare parts, maintenance products, and special tools in an enclosed, weather-proof, and lighted facility during the construction period.
  - 3. Protect parts subject to deterioration, such as ferrous metal items and electrical components with appropriate lubricants, desiccants, or hermetic sealing.
  - 4. Store large items individually:
    - a. Weight: Greater than 50 pounds.
    - b. Size: Greater than 24-inches wide by 18-inches high by 36-inches long.
    - c. Clearly labeled:
      - 1) Equipment tag number.
      - 2) Equipment manufacturer.
      - 3) Subassembly component, if appropriate.
  - 5. Store smaller items in spare parts boxes:
    - a. Weight: Less than 50 pounds.
    - b. Size: Less than 24-inches wide by 18-inches high by 36-inches long.
    - c. Clearly labeled:
      - 1) Equipment tag number.
      - 2) Equipment manufacturer.
      - 3) Subassembly component, if appropriate.
  - 6. Spare parts and special tools box:
    - a. Box material: Waterproof, corrosion resistant.
    - b. Hinged cover with locking hasp:
      - 1) Inventory list taped to underside of cover.
      - 2) Clearly labeled:
        - a) "Spare Parts and/or Special Tools".

- b) Equipment tag number.
  - c) Equipment manufacturer.
  - d) Subassembly component, if appropriate.
- E. Exterior storage of fabricated products:
- 1. Place on aboveground supports that allow for drainage.
  - 2. Cover products subject to deterioration with impervious sheet covering.
  - 3. Provide ventilation to prevent condensation under covering.
- F. Store moisture sensitive products in watertight enclosures.
- G. Store loose granular materials on solid surfaces in well-drained area.
- 1. Prevent materials mixing with foreign matter.
  - 2. Provide access for inspection.
- H. When needed and approved by the Engineer, offsite storage location shall be within 20 miles of the Project Site.
- 1. Provide proof of insurance coverage for products stored offsite.
- I. Payment will not be made for products improperly stored or stored without providing the Engineer with the manufacturer's instructions for storage.

## **PART 2 PRODUCTS**

### **2.01 GENERAL REQUIREMENTS**

- A. Provide products by the same manufacturer when units are of similar nature, unless otherwise specified.
- B. Provide like parts of duplicate units that are interchangeable.
- C. Provide equipment or products that have not been in service prior to delivery, except as required by tests.
- D. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
  - 1. Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.
- E. Provide products produced by manufacturers regularly engaged in the production of these products.

### **2.02 MATERIAL**

- A. Dissimilar metals:
  - 1. Separate contacting surfaces with dielectric material.
  - 2. Neoprene, bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators, washers, petrolatum tape, or other materials as specified.

3. Dielectric coatings can be used to separate dissimilar metal couples from surrounding environment if isolation of metals is not possible, with approval of the Engineer.
- B. Edge grinding:
    1. Sharp projections of cut or sheared edges of ferrous metals which are not to be welded shall be ground to a radius required to ensure satisfactory paint adherence and mitigate any safety hazard.
    2. A surface profile will need to be re-established for coating adherence based on coating manufacturer's profile requirements.
  - C. Use anti-galling compound on threads of stainless steel fasteners during factory assembly.
  - D. Provide anti-galling compound with stainless steel fasteners shipped for field assembly.
  - E. Aluminum in contact with concrete or masonry: Apply epoxy mastic as specified in Section 09960 - High-Performance Coatings, coating system EPX-M-5.

### **2.03 PRODUCT SELECTION**

- A. When products are specified without named manufacturers, provide products that meet or exceed the Specifications.
- B. When products are specified with names of manufacturers but no model numbers or catalog designations, provide products by one of the named manufacturers that meet or exceed specifications.
- C. When products are specified with names of manufacturers and model numbers or catalog designations, provide products with model numbers or catalog designations by one of the named manufacturers.
- D. When products are specified with names of manufacturers, but with brand or trade names, model numbers, or catalog designations by one manufacturer only, provide:
  1. Products specified by brand or trade name, model number, or catalog designation.
  2. Products by another named manufacturer proven, in accordance with requirements for an "or equal", including the Engineer's approval, to meet or exceed quality, appearance and performance of specified brand or trade name, model number, or catalog designation.
- E. When products are specified with only one manufacturer followed by "or equal," provide:
  1. Products meeting or exceeding specifications by specified manufacturer.
  2. Engineer deemed "or equal" evidenced by an approved Shop Drawing or other written communication.
- F. When products are specified by naming 2 or more manufacturers with 1 manufacturer as a "Basis of Design":
  1. Any of the named manufacturers can be submitted.



2. If the product submitted is not by the named "Basis of Design" product and requires a change in the scope (dimensions, configuration, physical properties, etc.), schedule (longer lead time), or budget, the Contractor must submit a substitution request.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Inspect equipment or products prior to installation.
- B. Repaint or recoat damaged painted or coated surfaces after installation.
- C. Use anti-galling compound on stainless steel threads used for field assembly.

### **3.02 PROTECTION AFTER INSTALLATION**

- A. Provide coverings as necessary to protect installed products from damage due to traffic and subsequent construction operations.
  1. Remove covering when no longer needed.
  2. Replace corroded, damaged, or deteriorated products before acceptance of the Project.

END OF SECTION



# ATTACHMENT A - MANUFACTURER'S CERTIFICATE OF SOURCE TESTING



**MANUFACTURER'S CERTIFICATE OF SOURCE TESTING**



OWNER \_\_\_\_\_ EQPT/SYSTEM \_\_\_\_\_  
PROJECT NAME \_\_\_\_\_ EQPT TAG NO. \_\_\_\_\_  
PROJECT NO. \_\_\_\_\_ EQPT SERIAL NO. \_\_\_\_\_  
SPECIFICATION NO. \_\_\_\_\_  
SPECIFICATION TITLE \_\_\_\_\_

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

I hereby certify Source Testing has been performed on the above-referenced product as defined in the Contract Documents, and the results conform to the Contract Document requirements. Testing data is attached.

Date of Execution: \_\_\_\_\_

Manufacturer: \_\_\_\_\_

Manufacturer's Authorized Representative Name (*print*): \_\_\_\_\_

\_\_\_\_\_  
(Authorized Signature)

If applicable, Witness Name (*print*): \_\_\_\_\_

\_\_\_\_\_  
(Witness Signature)



## SECTION 02001

### COMMON WORK RESULTS FOR GENERAL PIPING

#### PART 1 GENERAL



#### 1.01 SUMMARY

- A. Section includes:
1. Basic materials and methods for metallic and plastic piping systems.

#### 1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME).
1. B1.1 - Unified Inch Screw Threads (UN, UNR, and UNJ Thread Forms).
  2. B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
  3. B18.2.2 - Nuts for General Applications: Machine Screw Nuts; and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
- B. American Water Works Association (AWWA):
1. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe.
  2. C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
  3. C230 - Stainless-Steel Full-Encirclement Repair and Service Connection Clamps for 2 In. Through 12 In. Pipe.
- C. ASTM International (ASTM):
1. A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
  2. A194 - Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
  3. A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
  4. A536 - Standard Specification for Ductile Iron Castings.
  5. A563 - Standard Specification for Carbon and Alloy Steel Nuts.
  6. D2000 - Standard Classification System for Rubber Products in Automotive Applications.
  7. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
  8. F594 - Standard Specification for Stainless Steel Nuts.
  9. F2329 - Standard Specification for Zinc Coating, Hot-Dip, Requirements of Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.
- D. NSF International (NSF):
1. 61 - Drinking Water System Components - Health Effects.

### 1.03 TERMINOLOGY

- A. The words and terms listed below are not defined terms that require initial capital letters, but, when used in this Section, have the indicated meaning.
  - 1. Buried pipes: Pipes that are buried in the soil with or without a concrete pipe encasement.
  - 2. Exposed pipe: Pipes that are located above ground, or located inside a structure, supported by a structure, or cast into a concrete structure.
  - 3. Pipes adjacent to a wet wall: Pipe centerline within 10 inches of the wet wall.
  - 4. Underground pipes: Buried pipes - see 1. above.
  - 5. Underwater pipes: Pipes below the top of walls in basins or tanks containing water.
  - 6. Wet wall: A wall with water on at least one side.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. Pipes:
  - 1. Provide new pipe.
  - 2. Piping provided from manufacturers/distributors inventory is subject to the following condition:
    - a. Provide proof pipe manufactured more than 6 months prior to delivery was stored properly and the material and/or coating was not subjected to ultraviolet (UV) degradation.
  - 3. Mark each piece of pipe in accordance with applicable standards.

### 2.02 LINK TYPE SEALS

- A. Characteristics:
  - 1. Modular mechanical type, consisting of interlocking neoprene or synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening.
  - 2. Links to form a continuous rubber belt around the pipe.
  - 3. Provide a nylon polymer pressure plate with Type 316 stainless steel hardware. Isolate pressure plate from contact with wall sleeve.
  - 4. Hardware to be Type 316 stainless steel.
    - a. Provide anti-galling lubricant for threads.
- B. One of the following or equal:
  - 1. Link-Seal.
  - 2. Pipe Linx.

### 2.03 FLANGE BOLTS AND NUTS

- A. General:
  - 1. Washer:
    - a. Provide a washer for each nut.
    - b. Washer shall be of the same material as the nut.
  - 2. Nuts: Heavy hex-head.



3. Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face of nut after assembly.
  4. Tap holes for cap screws or stud bolts when used.
  5. Lubricant for stainless steel bolts and nuts:
    - a. Chloride-free.
    - b. Manufacturers: One of the following or equal:
      - 1) Huskey FG-1800 Anti-Seize.
      - 2) Weicon Anti-Seize High-Tech.
- B. For ductile iron pipe:
1. On exposed pipes with pressures equal to or less than 150 pounds per square inch gauge (psig):
    - a. Bolts: ASTM A307, Grade B.
    - b. Nuts: ASTM A563, Grade A.
    - c. Bolts and nuts: Hot-dip galvanized in accordance with ASTM F2329.
  2. On exposed pipes with pressures greater than 150 psig:
    - a. Bolts: ASTM A193, Grade B.
    - b. Nuts: ASTM A194, Grade 2H.
    - c. Bolts and nuts: Hot-dip galvanized in accordance with ASTM F2329.
  3. On underwater pipes, buried pipes, and pipes adjacent to wet walls:
    - a. Bolts: ASTM A193, Grade B8M Stainless Steel, ASME B1.1 Class 2A threads, with dimensions in accordance with ASME B18.2.1.
    - b. Nuts: ASTM A194, Grade 8M Stainless Steel, ASME B1.1 Class 2A Fit, with square or heavy hex dimensions in accordance with ASME B18.2.2.
  4. On buried pipes:
    - a. Bolts: ASTM A193, Grade B8M.
    - b. Nuts: ASTM A194, Grade 8M.
    - c. Bolts: ASTM A307, Grade B.
    - d. Nuts: ASTM A563, Grade A.
    - e. Encase in 2 layers of loose polyethylene wrap in accordance with AWWA C105.
    - f. Bolts: ASTM A193, Grade B7.
    - g. Nuts: ASTM A194, Grade 2H.
    - h. Coat with high solids epoxy and encase in 2 layers of loose polyethylene wrap in accordance with AWWA C105.
    - i. Bolts and nuts: Hex head Hastelloy C276.

## **2.04 MECHANICAL JOINTS BOLTS AND NUTS**

- A. Bolts, including T bolts:
  1. Type 304 stainless steel in accordance with ASTM F593.
  2. Type 316 stainless steel in accordance with ASTM F593.
- B. Heavy hex nuts:
  1. Type 304 stainless steel in accordance with ASTM F594.
  2. Type 316 stainless steel in accordance with ASTM F594.

## **2.05 GASKETS**

- A. General:

1. Gaskets shall be suitable for the specific fluids, pressure, and temperature conditions.
  2. Capable of being applied on surface of piping with cavities to provide for an improved seal with the internal piping pressure.
- B. Gaskets for flanged joints in High-Density Polyethylene (HDPE) piping for sewage service:
1. Suitable for pressures equal to and less than 150 pounds per square inch gauge, temperatures equal to and less than 250 degrees Fahrenheit, and raw sewage service.
  2. Material:
    - a. SBR or neoprene elastomer with minimum Shore A hardness value of 70.
    - b. Reinforcement: Cloth or synthetic fiber.
    - c. Thickness:
      - 1) Minimum 3/32 inch for less than 10-inch pipe.
      - 2) Minimum 1/8 inch for 10-inch and larger pipe.
  3. Manufacturers: One of the following or equal:
    - a. Pipe less than 48 inches in diameter:
      - 1) Garlock, Style 7797.
      - 2) John Crane, similar product.
    - b. Pipe 48 inches in diameter and larger:
      - 1) Garlock, Style 3760.
      - 2) John Crane, similar product.
- C. Gaskets for flanged joints in ductile iron or steel drinking water piping meeting NSF requirements:
1. Suitable for hot or cold water, pressures equal to or less than 150 pounds per square inch gauge, and temperatures equal to or less than 160 degrees Fahrenheit.
  2. Material:
    - a. EPDM material with 80 Shore A durometer rating.
  3. Manufacturers: One of the following or equal:
    - a. Garlock, 98206.
    - b. John Crane, similar product.
- D. Gaskets for mechanical joints in ductile iron:
1. Certified to NSF 61 when used for potable water service.
  2. SBR or NBR.
- E. Gaskets for push-on rubber gasket joints in ductile iron:
1. Certified to NSF 61 when used for potable water service.
  2. SBR or NBR.

## 2.06 REPAIR BANDS

- A. Design requirements:
1. In accordance with AWWA C230.
- B. Materials:
1. Shells: Type 304 stainless steel.
  2. Lugs: Removable epoxy coated ductile iron in accordance with ASTM A536.

3. Bolts and nuts: Type 304 stainless steel with fluoropolymer coated nuts.
  4. Gaskets: Compounded for water and sewer service.
- C. Manufacturers: One of the following or equal:
1. Romac Industries, Inc.
  2. Smith-Blair Inc.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. General:
1. Piping drawings:
    - a. Except in details, piping is indicated diagrammatically. Not every offset and fitting, or structural difficulty that may be encountered has been indicated on the Drawings. Sizes and locations are indicated on the Drawings.
    - b. Perform minor modifications to piping alignment where necessary to avoid structural, mechanical, or other type of obstructions that cannot be removed or changed.
      - 1) Modifications are intended to be of minor scope, not involving a change to the design concept or a change to the Contract Price or Contract Times.
  2. Piping alternatives:
    - a. Provide piping as specified in this Section, unless indicated on the Drawings or specified otherwise.
    - b. Alternative pipe ratings:
      - 1) Piping with greater pressure rating than specified may be substituted in lieu of specified piping without changes to the Contract Price.
      - 2) Piping of different material may not be substituted in lieu of specified piping.
    - c. Valves in piping sections: Capable of withstanding specified test pressures for piping sections and fabricated with ends to fit piping.
    - d. Flanged joints: Where one of the joining flanges is raised face type, provide a matching raised face type flange for the other joining flange.
  3. Unless otherwise indicated on the Drawings, piping at pipe joints, fittings, couplings, and equipment shall be installed without rotation, angular deflection, vertical offset, or horizontal offset.
- B. Wall and slab penetrations:
1. Provide sleeves for piping penetrations through aboveground masonry and concrete walls, floors, ceilings, roofs, unless specified or otherwise indicated on the Drawings.
  2. For piping 1 inch in nominal diameter and larger, provide sleeves with minimum inside diameters of 1 inch plus outside diameter of piping. For piping smaller than 1 inch in nominal diameter, provide sleeve of minimum twice the outside diameter of piping.
    - a. Arrange sleeves and adjacent joints so piping can be pulled out of sleeves and replaced without disturbing the structure.
    - b. Cut ends of sleeves flush with surfaces of concrete, masonry, or plaster.

- c. Conceal ends of sleeves with escutcheons where piping runs through floors, walls, or ceilings of finished spaces within buildings.
    - d. Seal spaces between pipes and sleeves with link-type seals when not otherwise specified or indicated on the Drawings.
  - 3. Provide flexibility in piping connecting to structures to accommodate movement due to soil settlement and earthquakes. Provide flexibility using details indicated on the Drawings.
  - 4. Core drilled openings:
    - a. Do not damage or cut existing reinforcing bars, electrical conduits, or other items embedded in the existing concrete without acceptance by the Engineer.
    - b. Determine location of reinforcing bars or other obstructions with a non-destructive indicator device.
    - c. Remove dust and debris from hole using compressed air.
- C. Exposed piping:
  - 1. Install in straight runs parallel to the axes of structures, unless otherwise indicated on the Drawings.
    - a. Install piping runs plumb and level, unless otherwise indicated on the Drawings.
      - 1) Slope plumbing drain piping with a minimum of 1/4 inch per foot downward in the direction of flow.
  - 2. Install after installing equipment and after piping and fitting locations have been determined.
  - 3. Route piping to preserve headroom, access space and workspace, and to prevent tripping hazards and clearance problems:
    - a. Install piping so it does not interfere with the proper and safe operation of equipment and does not block or interfere with ingress or egress, including hatches.
  - 4. Support piping: As specified in Section 15061 - Pipe Supports, Section 15062 - Preformed Channel Pipe Support System, and Section 15063 - Non-Metallic Pipe Support System:
    - a. Do not transfer pipe loads and strain to equipment.
  - 5. In addition to the joints indicated on the Drawings, provide unions, flexible couplings, flanged joints, flanged coupling adapters, and other types of joints or means which are compatible with and suitable for the piping system, and necessary to allow ready assembly and disassembly of the piping.
  - 6. Assemble piping without distortion or stresses caused by misalignment:
    - a. Match and properly orient flanges, unions, flexible couplings, and other connections.
    - b. Do not subject piping to bending or other undue stresses when fitting.
    - c. Do not correct defective orientation or alignment by distorting flanged joints or subjecting flange bolts to bending or other undue stresses.
    - d. Flange bolts, union halves, flexible connectors, and other connection elements shall slip freely into place.
    - e. Alter piping assembly to fit when proper fit is not obtained.
    - f. Install eccentric reducers or increasers with the top horizontal for pump suction piping.
- D. Buried piping:

1. With minimum 3-foot cover without air traps, unless otherwise indicated on the Drawings.
  2. Where 2 similar services run parallel to each other, piping for such services may be laid in the same trench.
    - a. Lay piping with sufficient room for assembly and disassembly of joints, for thrust blocks, for other structures, and to meet separation requirements of public health authorities having jurisdiction.
  3. Laying piping:
    - a. Lay piping in finished trenches free from water or debris. Begin at the lowest point with bell ends up slope.
    - b. Place piping with top or bottom markings with markings in proper position.
    - c. Lay piping on an unyielding foundation with uniform bearing under the full length of barrels.
    - d. Where joints require external grouting, banding, or pointing, provide space under and immediately in front of the bell end of each section laid with sufficient shape and size for grouting, banding, or pointing of joints.
    - e. At the end of each day's construction, plug open ends of piping temporarily to prevent entrance of debris or animals.
  4. Concrete encase buried pipe installed under concrete slabs or structures.
- E. Venting piping under pressure:
1. Lay piping under pressure flat or at a continuous slope without air traps, unless otherwise indicated on the Drawings.
  2. Install plug valves as air bleeder cocks at high points in piping.
    - a. Provide 1-inch plug valves for water lines and 2-inch plug valves for sewage and sludge lines, unless otherwise indicated on the Drawings.
  3. Provide additional pipe taps with plug cocks and riser pipes along piping as required for venting during initial filling, disinfecting, and sampling.
  4. Before piping is placed into service, close plug valves and install plugs. Protect plugs and plug valves from corrosion as specified in Section 09960 - High-Performance Coatings.
- F. Restraining buried piping:
1. At valves and at fittings where piping changes direction, changes sizes, and at ends:
    - a. When piping is underground, use concrete thrust blocks, mechanical restraints, or push-on restraints.
    - b. Determine thrust forces by multiplying the nominal cross-sectional area of the piping by design test pressure of the piping.
  2. Provide restraints with ample size to withstand thrust forces resulting from test pressures:
    - a. During testing, provide suitable temporary restraints where piping does not require permanent restraints.
  3. Place concrete thrust blocks against undisturbed soil.
  4. Place concrete so piping joints, fittings, and other appurtenances are accessible for assembly and disassembly.
  5. Provide underground mechanical restraints where specified in the Piping Schedule.
- G. Restraining above ground piping:

6. At valves and at fittings where piping changes direction, changes sizes, and at ends:
    - a. When piping is aboveground or underwater, use mechanical or structural restraints.
    - b. Determine thrust forces by multiplying the nominal cross-sectional area of the piping by design test pressure of the piping.
  7. Provide restraints with ample size to withstand thrust forces resulting from test pressures:
    - a. During testing, provide suitable temporary restraints where piping does not require permanent restraints.
- H. Connections to existing piping:
1. Expose existing piping to which connections are to be made with sufficient time to permit, where necessary, field adjustments in line, grade, or fittings:
    - a. Protect domestic water/potable water supplies from contamination:
      - 1) Make connections between the domestic water supply and other water systems in accordance with requirements of public health authorities.
      - 2) Provide devices approved by the Owner of the domestic water supply system to prevent flow from other sources into the domestic supply system.
  2. Make connections to existing piping and valves after sections of new piping to be connected have been tested and found satisfactory.
  3. Provide sleeves, flanges, nipples, couplings, adapters, and other fittings needed to install or attach new fittings to existing piping and to make connections to existing piping.
  4. For flanged connections, provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.
- I. Connections between ferrous and nonferrous metals:
1. Connect piping, tubing, and fittings with dielectric couplings, especially designed for the prevention of chemical reactions between dissimilar metals.
  2. Nonferrous metals include aluminum, copper, and copper alloys.
- J. Flanged connections between dissimilar metals such as ductile iron pipe and steel pipe:
1. Provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.

### **3.02 CLEANING**

- A. Piping cleaning:
1. Upon completion of installation, clean piping interior of foreign matter and debris.
  2. Perform special cleaning when required by the Contract Documents.
- B. Conduct pressure and leak test, as specified.

### **3.03 PIPE SCHEDULE**

- A. As specified in Attachment A - Pipe Schedule.

END OF SECTION

## ATTACHMENT A - PIPE SCHEDULE





PIPE SCHEDULE											
PROCESS ABBREV.	SERVICE	NOMINAL DIAMETER (INCHES)	MATERIAL	PRESSURE CLASS	PIPE SPECIFICATION SECTION	JOINTS/FITTINGS <sup>(3)</sup>	TEST PRESSURE/METHOD (SEE NOTES FOR SPECIAL CONDITIONS)	LINING	COATING	SERVICE CONDITIONS	COMMENTS
FM	Sanitary Force Main										
		24 (DIPS)	HDPE	DR 11	02707 - High Density Polyethylene (HDPE) Pipe: AWWA C906 - Infrastructure	Mech. Restrained	150 psig/HH	N/A	N/A		Open Cut Installation
		24 (DIPS)	HDPE	DR 11	02707 - High Density Polyethylene (HDPE) Pipe: AWWA C906 - Infrastructure	Fusion WLD	150 psig/HH	N/A	N/A		HDD

ABBREVIATIONS:

1. THE FOLLOWING ABBREVIATIONS USED IN THE TEST METHOD COLUMN REFER TO THE RESPECTIVE METHODS AS SPECIFIED IN SECTION 15956 - PIPING SYSTEMS TESTING.

AM - AIR METHOD
GR - GRAVITY METHOD
HH - HIGH HEAD METHOD
LH - LOW HEAD METHOD
SC - SPECIAL CASE

2. ABBREVIATIONS TO DESIGNATE PIPING INCLUDE THE FOLLOWING:

B&SP - BELL AND SPIGOT
CCP - BAR-WRAPPED AWWA 303 CONCRETE CYLINDER PIPE
CI CAST IRON
CISP - CAST IRON SOIL PIPE
CL - CLASS, FOLLOWED BY THE DESIGNATION
CM - CEMENT MORTAR
CTP - COAL TAR PITCH
DIP - DUCTILE IRON PIPING
EPP - EPOXY POLYURETHANE COATING AND/OR LINING
FL - FLANGE
GA - GAUGE, PRECEDED BY THE DESIGNATION
GE - GROOVED END JOINT
GSP - GALVANIZED STEEL PIPE
MJ - MECHANICAL JOINT
NPS - NOMINAL PIPE SIZE, FOLLOWED BY THE NUMBER IN INCHES
PE - POLYETHYLENE
PEE - POLYETHYLENE ENCASEMENT
PSI - POUNDS PER SQUARE INCH
PSIG - POUNDS PER SQUARE INCH GAUGE
PO - PUSH-ON JOINT
PTW - POLYETHYLENE TAPE WRAP
PVC - POLYVINYL CHLORIDE
RPO - RESTRAINED PUSH-ON
SCH - SCHEDULE, FOLLOWED BY THE DESIGNATION
SCRD - SCREWED-ON
SST - STAINLESS STEEL
SW - SOLVENT WELDED
WLD - WELD

NOTE 1. RESTRAINED LENGTHS FOR RESPECTIVE PIPE MATERIALS AND PRESSURES ARE TO BE DESIGNED BY THE PIPING MANUFACTURER PER THE SPECIFICATIONS.

NOTE 2. ALL PIPING WITHIN ZONE 3 SHALL BE OF THE SAME PIPE MATERIAL, EXCEPT AT ISOLATION VALVES.

NOTE 3. RESTRAINED JOINTS PER PIPELINE SPECIFICATIONS.

NOTE 4. WORKING PRESSURE AND TEST PRESSURE SHALL BE THE SAME AS ADJACENT RAW WATER PIPELINE.



## SECTION 02005

### PIPING SPECIALTIES



#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes:
  - 1. Piping specialties, including:
    - a. Flexible rubber connections.
    - b. Bellows type expansion joints.
    - c. Slip type expansion joints.
    - d. Rubber expansion joints.
    - e. Ball-type flexible joint pipe.
    - f. Pipe couplings for stainless steel piping.
    - g. Vibration control joints.
    - h. Transition fittings.
    - i. Pipe saddles.
    - j. Tapping sleeves.
    - k. Surge cushions.
    - l. Sight gauges.
    - m. Sight glasses.
    - n. Spray nozzles.
    - o. Washdown monitors.
    - p. Chemical injector/diffuser.

##### 1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
  - 1. B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24, Metric/Inch Standard.
- B. American Water Works Association (AWWA):
  - 1. C110 - Standard for Ductile-Iron and Gray-Iron Fittings.
  - 2. C151 - Standard for Ductile-Iron Pipe, Centrifugally Cast.
- C. ASTM International (ASTM):
  - 1. A148 - Standard Specification for Steel Castings, High-Strength, for Structural Purposes.
  - 2. A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
  - 3. A194 - Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
  - 4. A536 - Standard Specification for Ductile Iron Castings.
- D. NSF International (NSF):
  - 1. 61 - Drinking Water System Components - Health Effects, Includes Errata.

2. 372 - Drinking Water System Components - Lead Content.

### 1.03 SUBMITTALS

- A. Furnish Submittals as specified in Section 01330 - Submittal Procedures and Section 01601 - Product Requirements.
- B. Product data:
  1. Design features.
  2. Load capacities.
  3. Material designations by UNS alloy number or ASTM Specification and Grade.
  4. Data needed to verify compliance with the Specifications.
  5. Catalog data.
- C. Installation instructions:
  1. Provide manufacturer's installation instructions.
- D. Calculations:
  1. Provide calculations in accordance with NSF 372 for materials in contact with drinking water.
- E. Quality Control Submittals:
  1. Manufacturer's Certificate of Installation Verification as specified in Section 01756 - Commissioning.

### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 01601 - Product Requirements.

### 1.05 WARRANTY

- A. As specified in Section 01783 - Warranties and Bonds.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. As specified in Section 01601 - Product Requirements.
- B. Materials in contact with drinking waters: In accordance with NSF 61 and NSF 372.

### 2.02 FLEXIBLE RUBBER CONNECTIONS

- A. Manufacturers: One of the following or equal:
  1. Mercer Rubber Co., Type 150 Vibraflex.
  2. Red Valve Co., Inc., Part Number P-5.
- B. Provide flexible rubber connections with 3/8-inch thick EPDM rubber tube with full-faced flanged ends suitable to withstand a pressure of 150 pounds per square inch gauge.

- C. Provide complete flexible rubber connections, including galvanized retaining rings and control rods.

## 2.03 BELLOWS TYPE EXPANSION JOINTS

- A. For general service:
  - 1. Flexible bellows type, or as otherwise specified or indicated on the Drawings.
  - 2. Manufacturers:
    - a. Expansion joints: One of the following or equal:
      - 1) Flex-Weld, Inc., Keflex, Series 308.
      - 2) Senior Flexonics Pathway, Inc., Controlled Flexing Expansion Joint.
      - 3) Victaulic, Depend-o-Lok, Omniflex stainless bellows expansion joint.
    - b. Pipe alignment guides: One of the following or equal:
      - 1) Flex-Weld, Inc.
      - 2) Senior Flexonics Pathway, Inc.
    - c. Intermediate supports: Provide with protective saddles. One of the following or equal:
      - 1) Bergen-Paterson Pipe Support Corp.
      - 2) Unistrut Corporation, Roller-type.
  - 3. Design:
    - a. Expansion joint rating: 150 pounds per square inch gauge, at 300 degrees Fahrenheit.
    - b. Bellows: Multi-ply (3 ply minimum) stainless steel, equipped with a self-draining liner guide.
    - c. Axial travel of expansion joints: Not less than 1.5 inches.
    - d. Ends: 150 pound ASME flanges, Victaulic, Depend-o-Lok Airmaster/Fluidmaster coupled ends, or plain suitable for welding connections, as required for piping in which installed.
- B. For steam and hot water:
  - 1. Manufacturers: One of the following or equal:
    - a. Flex-Weld, Inc., Keflex, Series 308-1215.
    - b. Senior Flexonics Pathway, Inc., Controlled Flexing Expansion Joint.
    - c. Victaulic, Depend-o-Lok Omniflex Expansion Joint.
  - 2. Design:
    - a. Single reinforced bellows type or Victaulic mechanical couplings.
    - b. Pressure and temperature ratings: 150 pounds per square inch gauge, and 500 degrees Fahrenheit service.
    - c. Bellows: Multi-ply (3 ply minimum) Type 321 stainless steel, equipped with a Type 321 stainless steel liner.
    - d. Axial travel of expansion joints: 3 inches minimum.
    - e. Ends: 150 pound ASME flanges.
- C. Copper piping expansion joints:
  - 1. As specified before, except externally guided, and provide for 3-1/4 inch expansion per 100 feet of piping.
- D. Roof drain expansion joints:
  - 1. Neoprene bellows between roof drain fitting and drain piping.
  - 2. Up to 12-inch static head.
  - 3. Complete with Type 316 stainless steel clamps.

4. Manufacturers: One of the following or equal:
  - a. Flexicraft Industries, DWV.
  - b. Watts, Model RD-900.

## 2.04 SLIP TYPE EXPANSION JOINTS

- A. For steam cleaned piping:
  1. Manufacturers: One of the following or equal:
    - a. Dresser Industries, Inc., Style 63, Type 2.
    - b. Smith-Blair, Inc., Number 612 with slip pipe and without limit rods.
  2. Line and coat slip pipe and interior of body with fusion-bonded epoxy as specified in Section 15057 - Fusion Bonded Epoxy Lining with minimum thickness of 0.012 inch.
  3. Packing: Suitable for temperatures greater than 212 degrees Fahrenheit.
- B. PVC expansion joints:
  1. Flexible bellows type.
  2. Manufacturers: One of the following or equal:
    - a. Chemtrol.
    - b. NDS Flow Management, Quik-Fix.
  3. Materials: PVC with EPDM O-ring.
  4. Design:
    - a. 150 pounds per square inch pressure rating.
    - b. Double O-ring seal.
    - c. Axial travel: Not less than 1.5 inches.
    - d. Ends: 150 pound ASME flanges, or plain end suitable for solvent welding connections.

## 2.05 RUBBER EXPANSION JOINTS

- A. Manufacturers: One of the following or equal:
  1. Mercer Rubber Co., Style 500 or 700.
  2. Proco Products, Inc., Series 230 or 240.
  3. Red Valve Co., Inc., Type J-1.
- B. Provide rubber expansion joints complete with control units and split retaining rings.
- C. Design:
  1. Neoprene rubber, reinforced with embedded steel rings, and a strong synthetic fabric.
  2. Expansion rings, suitable for pressures of at least 125 pounds per square inch gauge, except as follows:
    - a. Expansion joints in pump suction piping and where indicated on the Drawings suitable for minimum 90 pounds per square inch gauge pressure, and minimum 30 inches mercury vacuum.
    - b. Ends of expansion joints: 1
    - c. 50 pound ASME flanges with drilling to match that of the piping.
  3. Bolts, nuts, control rods/plates, and retaining rings shall be galvanized steel unless otherwise specified.
  4. Bolts, nuts, control rods/plates, and retaining rings for low pressure air systems provide materials matching the piping system.

5. Bolts, nuts, control rods/plates, and retaining rings submerged in water or wastewater, buried, in wet vaults or structures, adjacent to wet walls, or above open water-containing structures shall be Type 316 stainless steel in accordance with ASTM A193, Grade B8M for bolts, and in accordance with ASTM A194, Grade 8M, for nuts.
- D. For blowers: Butyl type rubber formulated for service application and for maximum temperature of 250 degrees Fahrenheit, suitable for minimum 40 pounds per square inch gauge pressure, and minimum 15 inches mercury vacuum.

## **2.06 BALL-TYPE FLEXIBLE JOINT PIPE**

- A. Manufacturers: One of the following or equal:
1. U.S. Pipe, USIFLEX Pipe.
- B. Design working pressure: 250 pounds per square inch.
- C. Minimum joint deflection: 15 degrees from centerline.
- D. Ball is machined and the plain end of the pipe and the bell are threaded.
- E. Critical surfaces of the socket and the retainer ring are accurately machined.
- F. Retained ring is then slipped over the barrel of the pipe and the bell is screwed in.
- G. 4-inch to 36-inch pipe:
1. Standard wall ductile iron.
  2. Centrifugally cast ductile iron meeting requirements in accordance with AWWA C151.
  3. Separately cast ductile iron bell in accordance with the requirements of ASTM A536, Grade 70-50-05.
  4. High strength, corrosion resistant, alloyed steel retainer ring in accordance with ASTM A148, Grade 90-60.
  5. Outside diameter:
    - a. 4-inch to 12-inch pipe: Outside diameter corresponding with former C-D classes.
    - b. 14-inch to 36-inch pipe: Standard outside diameter with a reinforcing shoulder behind the ball.
  6. Nominal laying lengths:
    - a. 4-inch to 18-inch pipe: 18 feet-6 inches.
    - b. 20-inch to 36-inch pipe: 18 feet-9 inches.
- H. 42-inch to 48-inch pipe:
1. Centrifugally cast barrel, statically cast ball, bell, and retainer ring.
    - a. Ductile iron barrel in accordance with AWWA C151.
    - b. Separately cast ductile iron ball, bell, and retainer ring in accordance with the requirements of AWWA C110.
  2. Nominal laying length:
    - a. 42-inch pipe: 22 feet.
    - b. 48-inch pipe: 22 feet-3 inches.

## 2.07 VIBRATION CONTROL JOINTS

- A. Manufacturers:
  - 1. Braided bronze flexible vibration joints 2 inches and less in size: One of the following or equal:
    - a. Flex-Weld, Inc., Keflex, Type KFCB.
    - b. Senior Flexonics Canada, Inc., Type BRC bronze connectors.
  - 2. Flexible vibration joints larger than 2 inches: One of the following or equal:
    - a. Flex-Weld, Inc., Keflex, Series 151-TR-1215.
    - b. Senior Flexonics Canada, Inc., Type TCS.
  - 3. Corrugated stainless steel with stainless steel braid flexible vibration joints: One of the following or equal:
    - a. Flex-Weld, Inc., Keflex, Type USFNSS-31.
    - b. Senior Flexonics Canada, Inc., Type BSFS stainless steel connectors.
- B. Design:
  - 1. Flexible vibration joints 2 inches and smaller: Braided bronze, suitable for pressures of not less than 250 pounds per square inch gauge.
  - 2. Flexible vibration joints larger than 2 inches: Flexible bellows type, suitable for pressures of not less than 150 pounds per square inch gauge, at 70 degrees Fahrenheit, except as follows:
    - a. Provide vibration joints in piping subject to test pressures higher than 150 pounds per square inch gauge, suitable for such higher pressures.
    - b. Bellows: Stainless steel, equipped with a stainless steel liner.
    - c. Ends: ASME Class 150 flanges.
  - 3. Vibration joints in high-pressure air piping and in digester gas piping: Corrugated Type 316 stainless steel with stainless steel braid, suitable for pressures of not less than 150 pounds per square inch gauge.
    - a. Ends: ASME Class 150 flanges.
- C. Protection: Protect vibration absorbers against end loading and torsional stresses by anchoring attached piping.

## 2.08 TRANSITION FITTINGS

- A. Manufacturers: One of the following or equal:
  - 1. Spears.
- B. Materials:
  - 1. Slip socket: Schedule 80 PVC.
  - 2. Collar: Type 316 stainless steel.
  - 3. Threaded insert: Type 316 stainless steel.

## 2.09 PIPE SADDLES

- A. For ductile iron pipe:
  - 1. Double strap brass type.
  - 2. Manufacturers: One of the following or equal:
    - a. A.Y. McDonald, Style 3825.
    - b. Mueller Company, Style BR2B.
    - c. The Ford Meter Box Company, Style 202B.



3. Materials:
  - a. Pipe saddle body, straps, and nuts: Brass or silicon bronze.
  - b. Gaskets: EPDM.
- B. For PVC C900 or C905 pipe:
  1. Manufacturers: One of the following or equal:
    - a. Romac Industries, Inc., Style 202S.
    - b. Smith-Blair, Inc., Style 317.
  2. Materials:
    - a. Pipe saddles: Ductile iron with fusion bonded epoxy finish.
    - b. Straps, bolts, and nuts: Type 304 stainless steel with Teflon™ coating on nuts.
    - c. Gaskets: EPDM.

## 2.10 TAPPING SLEEVES

- A. Manufacturers: One of the following or equal:
  1. Romac Industries, Inc., Style FTS 420.
  2. Smith-Blair, Inc., Style 622.
- B. Materials:
  1. Tapping sleeves: Steel construction.
  2. Bolts and nuts: Type 304 stainless steel.
  3. Nuts: Teflon™ coated.
  4. Gaskets: EPDM.
  5. Size of tapped boss: As indicated on the Drawings.

## 2.11 SPRAY NOZZLES


- A. Manufacturers: One of the following or equal:
  1. Evoqua Water Technologies.
  2. Lechler USA, Series 564.
- B. Design:
  1. Operating pressure 10 pounds per square inch gauge, at which pressure each nozzle discharges not less than 3.5 gallons per minute, or more than 5.0 gallons per minute.
    - a. Spray: Flat, heavy sheet, fan with uniform distribution.
    - b. Fan width at the water surface not less than 6.5 feet at 10 pounds per square inch gauge.
    - c. Spray deflection with a replaceable deflector insert free to rotate away from the orifice opening and mechanically locked in place and counterweighted.
  2. Structurally suitable for pressure up to 200 pounds per square inch gauge.
  3. Easy flush type.
- C. Materials:
  1. Leaded bronze.
  2. Provided with 1/4-inch NPT connection, and the orifice diameter not less than 1/4 inch.
  3. Replaceable spray deflector: Neoprene rubber.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. As specified in Section 01601 - Product Requirements.
- B. Bellows type expansion joints and vibration control joints:
  - 1. Protect joints against damage during pressure test.

### 3.02 INSTALLATION

- A. Expansion control joints:
  - 1. Install bellows type expansion control joints at piping connections to mechanical equipment to prevent damaging stresses due to normal expansion and contraction with temperature changes in piping and connected equipment.
  - 2. Install bellows type expansion joints so as to allow 2-1/4-inch expansion per 100 linear feet of piping.
  - 3. Install expansion joints adjacent to an anchor, and provide 1 concentric guide on piping within 12 pipe diameters, but not more than 5 feet, from the end of the joint opposite the anchor.
    - a. Locate a similar guide approximately 30 diameters but not more than 10 feet from the first.
  - 4. For expansion joints not installed adjacent to an anchor provide 2 concentric guides similarly located at each end of the joint.
  - 5. Provide control rods and additional guides where **indicated on the Drawings** but at no greater intervals than recommended by the joint manufacturer in published instructions.
  - 6. Space intermediate supports a minimum of 10 feet, and tack weld the protective saddles to the pipe.
- B. Expansion joints for steam cleaned piping: 
  - 1. Expansion joints must be installed in all straight runs of steam cleaned piping of more than 20 feet in length.
    - a. Straight runs of less than 20 feet do not require an expansion joint.
    - b. Maximum spacing between expansion joints on straight runs is 200 feet for steam cleaned piping.
  - 2. Install expansion joints in steam cleaned piping between anchors.
- C. Bellows type expansion joints for steam and hot water:
  - 1. Expansion joints must be installed in all straight runs of steam or hot water piping of more than 20 feet in length.
    - a. Straight runs of less than 20 feet do not require an expansion joint.
    - b. Maximum spacing between expansion joints on straight runs is 150 feet for steam piping and 200 feet for hot water piping.
  - 2. Where possible, install expansion joints adjacent to an anchor; provide piping with 2 concentric guides, the first being within 2 feet of the end of the joint opposite the anchor.
  - 3. At expansion joints not installed adjacent to an anchor, provide 2 concentric guides on piping within 2 feet off both ends of the expansion joint.
  - 4. Lock expansion joint against movement until pressure test is completed.

- D. Vibration control joints:
  - 1. Install at piping connections to or from mechanical equipment to prevent transmitting equipment vibration through the piping system.
- E. Transition couplings:
  - 1. Application:
    - a. Use with function and design similar to flexible couplings and flanged coupling adapters for connecting piping having different outside diameters.
  - 2. Install products specifically designed and manufactured for that application.
- F. Pipe saddles:
  - 1. Coat threads on bolts with anti-gall coating prior to installation.
- G. Tapping sleeves:
  - 1. Verify existing pipe material and outer diameter prior to ordering materials.
  - 2. Large diameter pipe:
    - a. Verify the existence of lining material.
    - b. Verify lining material type.
    - c. Repair lining after hot tap operations are complete with similar lining or equal.
    - d. Demonstrate ability to accomplish hot tap by staging a dry run simulation of the procedure prior to the initiation of the hot tap procedure.
      - 1) Walk through each step of the hot tap installation, and show the Engineer every component needed to install the hot tap, including, but not limited to, tools and materials, to ensure that the required components are onsite and in place prior to beginning the procedure.
  - 3. Coat threads on bolts with anti-gall coating prior to installation.
- H. Surge cushions:
  - 1. Provide to dampen shock pressure surges due to power loss, fast closing valves, or other events that produce water hammer.
  - 2. Install gate valve between surge cushion and piping.
- I. Spray nozzles:
  - 1. Install so that elevation of the nozzles is 18 inches above the water surface.
- J. Furnish Manufacturer's Certificate of Installation Verification.

### **3.03 FIELD QUALITY CONTROL**

- A. Manufacturer services:
  - 1. Required only for:
    - a. Transition couplings.
    - b. Tapping sleeves for large diameter pipe.
- B. Field testing:
  - 1. As specified in Section 02001 - Common Work Results for General Piping.
  - 2. Protect bellows type expansion joints and vibration control joints.

END OF SECTION



## SECTION 02007

### PIPE COUPLINGS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes:
  - 1. Pipe couplings for ductile iron piping.

##### 1.02 REFERENCES

- A. American National Standards Institute (ANSI).
- B. American Society of Mechanical Engineers (ASME):
  - 1. B31.1 - Power Piping.
  - 2. B31.9 - Building Services Piping.
- C. American Water Works Association (AWWA):
  - 1. C111 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - 2. C207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In.
  - 3. C213 - Standard for Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
  - 4. C219 - Bolted, Sleeve-Type Couplings For Plain-End Pipe.
  - 5. C227 - Bolted, Split-Sleeve Couplings.
  - 6. C606 - Standard for Grooved and Shouldered Joints.
- D. ASTM International (ASTM):
  - 1. A36 - Standard Specification for Carbon Structural Steel.
  - 2. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 3. A193 - Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
  - 4. A351 - Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
  - 5. A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/9 ksi Minimum Tensile Strength, General Use.
  - 6. A536 - Standard Specification for Ductile Iron Castings.
  - 7. A563 - Standard Specification for Carbon and Alloy Steel Nuts.
  - 8. A576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
  - 9. A588 - Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi (345 MPa) Minimum Yield Point, with Atmospheric Corrosion Resistance.

10. C425 - Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
11. C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
12. C564 - Standard Specification for Rubber Gasket for Cast Iron Pipe and Fittings.
13. C1173 - Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
14. D1869 - Standard Specification for Rubber Rings for Asbestos-Cement Pipe.
15. D2000 - Standard Classification System for Rubber Products in Automotive Applications.
16. D5926 - Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems.
17. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
18. F594 - Standard Specification for Stainless Steel Nuts.
19. F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength.

E. NSF International (NSF):

1. 61 - Drinking Water System Components - Health Effects.
2. 372 - Drinking Water System Components - Lead Content.

### 1.03 SUBMITTALS

A. Furnish Submittals as specified in **Section 01330 - Submittal Procedures**.

B. Product data:

1. For each product in this Section as applicable:
  - a. Design features.
  - b. Load capacities.
  - c. Material designations by UNS alloy number or ASTM specification and grade.
  - d. Data needed to verify compliance with the Specifications.
  - e. Catalog data.
  - f. Clearly mark Submittal information to show specific items, materials, and accessories or options being furnished.
  - g. For grooved joint couplings used in flexible radius-cut type joints, provide information on coupling axial and angular deflection values.

C. Calculations:

1. Provide calculations in accordance with NSF 372 for materials in contact with drinking water.

### 1.04 WARRANTY

A. Provide warranty as specified in **Section 01783 - Warranties and Bonds**.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. As specified in Section 01601 - Product Requirements:
- B. Known acceptable manufacturers are listed by specific products.
- C. Provide references as specified in this Section by specific product.
- D. Manufacturer's representatives requirements as specified in Section 01756 - Commissioning and this Section by specific product.
- E. Gaskets for flexible couplings and flanged coupling adapters:
  - 1. Provide gasket materials for piping applications as follows:
    - a. Low-pressure and high-pressure air, steam, hot water: EPDM.
    - b. All other piping applications: EPDM.
- F. Exterior coatings for underground and submerged applications:
  - 1. Manufacturers: One of the following or equal:
    - a. Kop-Coat Co., Inc., Bitumastic Number 50.
    - b. Tapecoat Co., Inc., T.C. Mastic.
  - 2. Thickness: Minimum 0.040 inch.

### **2.02 PIPE COUPLINGS FOR DUCTILE IRON PIPING**

- A. Dismantling joints:
  - 1. Manufacturers: One of the following or equal:
    - a. Romac Ind., Inc., Style DJ400.
    - b. Smith-Blair, Inc., Series 975.
  - 2. Materials:
    - a. Flanged spool: AWWA C207 steel pipe:
      - 1) ASTM A53 for sizes 3 inches to 12 inches.
      - 2) ASTM A36 for sizes 14 inches to 72 inches.
    - b. End ring and body:
      - 1) For sizes 3 inches to 12 inches: Ductile iron in accordance with ASTM A536.
      - 2) For sizes 14 inches to 72 inches: Steel in accordance with ASTM A36 or ASTM A53.
    - c. Follower ring: Ductile iron in accordance with ASTM A536.
    - d. Bolts and hex nuts:
      - 1) Aboveground: High strength, low alloy steel in accordance with ASTM A588.
      - 2) Buried and underwater: Type 316 stainless steel bolts in accordance with ASTM F593.
    - e. Tie rods: High tensile steel in accordance with ASTM A193, Grade B7.
  - 3. Flange design: Class D steel ring flange in accordance with AWWA C207, compatible with ANSI Class 125 and 150 bolt circles.
  - 4. Coating and lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.

- B. Equipment connection fittings:
1. Manufacturers: The following or equal:
    - a. Romac Ind., Inc., Style ECF400.
  2. Design:
    - a. In accordance with AWWA C219.
    - b. Suitable for minimum 150 pounds per square inch working pressure.
    - c. Consist of 2 flanged coupling adapters, plain end section of pipe, thrust restraint rods, and associated fittings designed to transmit thrust without transmitting shear to the thrust restraint rods and without compromising provision for accommodating angular and parallel misalignment.
      - 1) Face to face length adjustment:
        - a) For sizes 3 inches to 12 inches: 2 inches.
        - b) For sizes 14 inches to 72 inches: 3 inches.
    - d. Provide both lateral and angular misalignment adjustment between flanges.
      - 1) Shall accommodate a minimum of 1/4-inch lateral offset and 2 degrees deflection.
    - e. Provide full pressure thrust restraint between flanges.
      - 1) Thrust rod:
        - a) Selected to provide sufficient freedom of movement through all bolt holes to allow unrestricted maximum adjustment of equipment connection fittings.
        - b) No transmission of any shear to the thrust rods.
        - c) Allows full development of thrust restraint at thrust rod tension take-ups.
        - d) Number and diameter selected as recommended by the manufacturer for the working pressure of the coupling.
  3. Materials:
    - a. Flanged spool: AWWA C207 steel pipe:
      - 1) ASTM A53 for sizes 3 inches to 12 inches.
      - 2) ASTM A36 for sizes 14 inches to 72 inches.
    - b. End ring and body:
      - 1) For sizes 3 inches to 12 inches: Ductile iron in accordance with ASTM A536.
      - 2) For sizes 14 inches to 72 inches: Steel in accordance with ASTM A36 or ASTM A53.
    - c. Bolts and hex nuts:
      - 1) Aboveground: Type 316 stainless steel bolts in accordance with ASTM F593.
    - d. Tie rods: Type 316 stainless steel in accordance with ASTM A193 B8M.
    - e. Flange design: Class D steel ring flange in accordance with AWWA C207, compatible with ANSI Class 125 and 150 bolt circles.
    - f. Harness lugs: ASTM A36 steel.
    - g. Coating and lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.
- C. Flanged coupling adapters: 12-inch size and smaller:
1. Manufacturers: One of the following or equal:
    - a. Dresser, Inc., Style 227.
    - b. Romac Ind., Inc., Style FCA501.
    - c. Smith-Blair, Inc., Series 912.



2. Materials:
    - a. Flanged body: Ductile iron in accordance with ASTM A536.
    - b. Follower ring: Ductile iron in accordance with ASTM A536.
    - c. Bolts and hex nuts:
      - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
      - 2) Buried and underwater: Type 316 stainless steel bolts in accordance with ASTM F593.
  3. Flange design: Class D steel ring flange in accordance with AWWA C207, compatible with ANSI Class 125 and 150 bolt circles.
  4. Coating and lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.
- D. Flanged coupling adapters: Greater than 12-inch size:
1. Manufacturers: One of the following or equal:
    - a. Dresser, Inc., Style 128-W.
    - b. Romac Ind., Inc., Style FC400.
    - c. Smith-Blair, Inc., Series 913.
  2. Materials:
    - a. Flange and flanged body: Ductile iron or low carbon steel having a minimum yield strength of 30,000 pounds per square inch.
    - b. Follower ring: Low carbon steel having a minimum yield strength of 30,000 pounds per square inch.
    - c. Bolts and hex nuts:
      - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
      - 2) Buried and underwater: Type 316 stainless steel bolts in accordance with ASTM F593.
  3. Flange design: Class D steel ring flange in accordance with AWWA C207, compatible with ANSI Class 125 and 150 bolt circles.
  4. Coating and lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.
- E. Flexible couplings:
1. Manufacturers: One of the following or equal:
    - a. Dresser, Inc., Style 253.
    - b. Romac Ind., Inc., Style 501.
    - c. Smith-Blair, Inc., Series 441.
  2. Materials:
    - a. Center rings: Ductile iron in accordance with ASTM A536.
    - b. Follower rings: Ductile iron in accordance with ASTM A536.
    - c. Bolts and hex nuts:
      - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
      - 2) Buried and underwater: Type 316 stainless steel in accordance with ASTM F593.
  3. Coating and lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.

4. Center sleeve dimensions: Provide center sleeves with lengths in accordance with the following table:

Nominal Pipe Size	Sleeve Length
3 inch and smaller	Manufacturer's standard
4 inch through 8 inch	7 inches
10 inch through 14 inch	12 inches
Greater than 16 inch	Use steel flexible coupling per pipe couplings for steel piping

- F. Flexible couplings (gravity flow):
1. Manufacturers: The following or equal:
    - a. Fernco Flexible Coupling.
  2. Materials:
    - a. In accordance with ASTM D5926, ASTM C1173, and applicable portions of ASTM C443, C425, C564, and D1869.
  3. Requirements:
    - a. In underground and underwater installations, couplings shall be corrosion resistant or coated with a fusion applied epoxy coating in accordance with AWWA C213.
    - b. Bolts and hardware shall be stainless steel 18-8 Type 316.
- G. Restrained flange coupling adapter:
1. Manufacturers: One of the following or equal:
    - a. Romac Ind., Inc., Style RFCA.
    - b. Star Pipe Products, 3200 StarFlange™.
  2. Materials:
    - a. Flange and flanged body: Ductile iron in accordance with ASTM A536.
    - b. Follower ring: Lug type restraint system.
      - 1) Follower ring: Ductile iron in accordance with ASTM A536.
      - 2) Restraining lugs: Ductile iron in accordance with ASTM A536.
        - a) Designed to contact the pipe and apply forces evenly.
      - 3) Restraining bolts:
        - a) Ductile iron in accordance with ASTM A536.
        - b) Bolt heads shall be designed to twist off when the proper torque has been applied.
    - c. Bolts and hex nuts:
      - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
      - 2) Buried and underwater: Type 316 stainless steel bolts in accordance with ASTM F593.
  3. Flange design: Class D steel ring flange in accordance with AWWA C207, compatible with ANSI Class 125 and 150 bolt circles.
  4. Coating and lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. In underground and underwater installations, coat the exterior of coupling with a protective coating in accordance with the manufacturer's instructions.
- B. Joints and flexible connections shall be installed centered with no angular deflection unless otherwise indicated on the Drawings.
- C. Flexible couplings and flange coupling adapters: Install with gap between pipe ends in accordance with the following table unless a greater gap is indicated on the Drawings. Maximum gap tolerance shall be within 1/8 inch.
  - 1. Install flexible coupling with pipe gap located in middle of center sleeve.
  - 2. Install flanged coupling adapter with end of plain end pipe in middle of flanged coupling body.

Center Ring Length	Gap Dimension and Tolerance
4 inch through 6 inch	3/8 inch
7 inch	5/8 inch
10 inch and greater	7/8 inch

- D. Provide harnesses (tie-downs) for flexible couplings unless otherwise indicated on the Drawings with a written note.
  - 1. Design harnesses (tie-downs) for the test pressures as specified in the Pipe Schedule in Section 02001 - Common Work Results for General Piping.
- E. Grooved joint couplings:
  - 1. Grooved ends: Clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
  - 2. Gaskets: Elastomer grade suitable for the intended service, and molded and produced by the coupling manufacturer.
- F. Bolted, split-sleeve couplings:
  - 1. Inspect each coupling to ensure that there are no damaged portions of the coupling.
    - a. Pay particular attention to the sealing pad/sealing plate area.
    - b. Before installation, thoroughly clean each coupling of any foreign substance which may have collected thereon and shall be kept clean at all times.
  - 2. Wrenches:
    - a. Conform to manufacturer instructions.
    - b. Bolts and studs shall be tightened so as to secure a uniform gasket compression between the coupling and the body of the pipe with all bolts or studs tightened approximately the same amount.
    - c. Final tightening shall be done by hand (no air impact wrenches) and is complete when the coupling is in uniform contact with the outside surface of the pipe all around the circumference of the pipe.
  - 3. No joint shall be misfit in any plane.
  - 4. On fixed ends of bolted, split-sleeve couplings, shoulders shall bear on restraint rings all around with no visible gap.

5. Ends of piping where coupler are installed shall be smooth and free of defects.
  - a. Remove weld splatter and grind smooth.
  - b. Grind pipe seam welds flush with pipe wall and smooth.

END OF SECTION

## SECTION 02009

### PIPING SYSTEMS TESTING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes:
  - 1. Test requirements for piping systems.

##### 1.02 REFERENCES

- A. American Water Work Association (AWWA):
  - 1. C600-17 - Installation of Ductile Iron Mains and Their Appurtenances.
  - 2. C605-21 - Underground Installation of PVC and PVCO Pressure Pipe and Fittings.
- B. Underwriters Laboratories Inc. (UL).

##### 1.03 TESTING REQUIREMENTS

- A. General requirements:
  - 1. Testing requirements are stipulated in laws and regulations, specified in the Pipe Schedule in Section 02001 - Common Work Results for General Piping, specified in the Specifications covering the various types of piping, and are specified in this Section.
  - 2. Requirements in laws and regulations supersede other requirements of the Contract Documents, except where requirements of the Contract Documents are more stringent, including higher test pressures, longer test times, and lower leakage allowances.
  - 3. When testing with water, the specified test pressure is considered to be the pressure at the lowest point of the piping section under test.
    - a. Lower test pressure as necessary (based on elevation) if testing is performed at a higher point of the pipe section.
- B. Furnish necessary personnel, materials, and equipment, including bulkheads, restraints, anchors, temporary connections, pumps, water, pressure gauges, and other means and facilities required to perform tests.
- C. Water for testing, cleaning, and disinfecting:
  - 1. As specified in Section 01500 - Temporary Facilities and Controls.
- D. Pipes to be tested:
  - 1. Test only those portions of pipes that have been installed as part of this Contract.
  - 2. Test new pipe sections prior to making final connections to existing piping.

3. Furnish and install test plugs, bulkheads, and restraints required to isolate new pipe sections.
  4. Do not use existing valves as test plug or bulkhead.
- E. Unsuccessful tests:
1. Correct defects or remove defective piping and appurtenances and install piping and appurtenances that comply with the specified requirements.
  2. Repeat testing until tests are successful.
- F. Test completion: Drain and leave piping clean after successful testing.
- G. Test water disposal:
1. Dispose in accordance with requirements of federal, state, county, and city regulations governing disposal of wastes in the location of the Project and disposal site.
  2. Requirements and costs associated with notifications and obtaining any discharge permit or approvals shall be the responsibility of the Contractor.

#### 1.04 SUBMITTALS

- A. Furnish Submittals as specified in Section 01330 - Submittal Procedures.
- B. Schedule and notification of tests:
1. Submit a list of scheduled piping tests by noon of the working day preceding the date of the scheduled tests.
  2. Notification of readiness to test: Immediately before testing, notify the Engineer in writing of readiness, not just intention, to test piping.
  3. Have personnel, materials, and equipment specified in place before submitting notification of readiness.
- C. Pipe system test report:
1. Submit a report for all piping tested. At a minimum, the test report shall include the following information:
    - a. Description of piping being tested:
      - 1) Pipe material.
      - 2) Section of piping being tested:
        - a) Date and time of pipe test.
        - b) Name of person performing the pipe test.
        - c) Specified test method and testing requirements (low-head, high-head, test pressure, test duration, etc.).
        - d) Initial test pressure and time of pressure.
        - e) Final test pressure and time of pressure.
        - f) Status of test: Pass or fail.
        - g) Signature of the Contractor and Owner's representative that witnessed the pipe test.

#### 1.05 SEQUENCE

- A. Clean piping before pressure or leak tests.

- B. Test gravity piping underground, including sanitary sewers, for visible leaks before backfilling and compacting.
- C. Underground pressure piping may be tested before or after backfilling when not indicated or specified otherwise.
- D. Backfill and compact trench or provide blocking that prevents pipe movement before testing underground piping with a maximum leakage allowance.
- E. Test underground piping before encasing piping in concrete or covering piping with slab, structure, or permanent improvement.

## **PART 2 PRODUCTS (NOT USED)**

## **PART 3 EXECUTION**

### **3.01 TESTING ALIGNMENT, GRADE, AND DEFLECTION**

- A. Alignment and grade:
  - 1. Visually inspect the interior of gravity piping with artificial light, reflected light, or laser beam.
  - 2. Consider inspection complete when no broken or collapsed piping, no open or poorly made joints, no grade changes that affect the piping capacity, or no other defects are observed.
- B. Deflection test:
  - 1. Pull a mandrel through the clean piping section under test.
  - 2. Perform the test not sooner than 30 days after installation and not later than 60 days after installation.
  - 3. Use a 9-rod mandrel with a contact length of not less than the nominal diameter of the pipe within 1 percent plus or minus.
  - 4. Consider test complete when the mandrel can be pulled through the piping with reasonable effort by 1 person, without the aid of mechanical equipment.

### **3.02 AIR TESTING METHOD FOR PRESSURE PIPING**

- A. Air test piping, indicated with "AM" in the Pipe Schedule, with air or another nonflammable or inert gas.
- B. Test gas, air, liquefied petroleum gas, liquid chlorine, and chlorine gas piping by the air test method:
  - 1. Test chlorine piping with dry air or nitrogen having a dew point of -40 degrees Fahrenheit or less. Supply temporary air dryers as necessary.
- C. Test at pressure as specified in the Pipe Schedule in Section 02001 - Common Work Results for General Piping:
  - 1. Provide temporary pressure relief valve for piping under test:
    - a. Set at 110 percent of the test pressure.

2. Gradually increase test pressure to an initial pressure of 1/2 the test pressure and inspect joint seals for leaks. If no leaks are found, gradually increase test pressure in 10 percent increments until target pressure is reached.
3. At each step in the pressure, examine and test piping for leaks with soap solution.
4. Consider examination complete when the piping section under test holds the test pressure for 15 minutes without losses.


### 3.03 TESTING GRAVITY FLOW PIPING

- A. Test gravity flow piping, indicated with “GR” in the Pipe Schedule, as follows:
1. Unless specified otherwise, subject gravity flow piping to the following tests:
    - a. Alignment and grade.
    - b. For plastic piping test for deflection.
    - c. Visible leaks and pressure with maximum leakage allowance, except for storm drains and culverts.
  2. Inspect piping for visible leaks before backfilling.
  3. Provide temporary restraints when needed to prevent movement of piping.
  4. Pressure test piping with maximum leakage allowance after backfilling.
  5. With the lower end plugged, fill piping slowly with water while allowing air to escape from high points. Keep piping full under a slight head for the water at least 24 hours:
    - a. Examine piping for visible leaks. Consider examination complete when no visible leaks are observed.
    - b. Maintain piping with water or allow a new water absorption period of 24 hours for the performance of the pressure test with maximum leakage allowance.
    - c. After successful completion of the test for visible leaks and after the piping has been restrained and backfilled, subject piping to the test pressure for a minimum of 4 hours while accurately measuring the volume of water added to maintain the test pressure:
      - 1) Consider the test complete when leakage is equal to or less than the following maximum leakage allowances:
        - a) For concrete piping with rubber gasket joints: 80 gallons per day per inch of diameter per mile of piping under test:
          - (1) Advise the manufacturer of concrete piping with rubber gasket joints of more stringent than normal maximum leakage allowance.
        - b) For vitrified clay piping: 500 gallons per day per inch of diameter per mile of piping under test.
        - c) For polyvinyl chloride (PVC) gravity sewer pipe: 25 gallons per day per inch diameter per mile of piping under test.
        - d) For other piping: 80 gallons per day per inch diameter per mile of piping under test.

### 3.04 TESTING HIGH-HEAD PRESSURE PIPING

- A. Test piping for which the specified test pressure in the Pipe Schedule is 20 pounds per square inch gauge or greater, by the high head pressure test method, indicated with “HH” in the Pipe Schedule.



- B. General:
1. Test connections, hydrants, valves, blowoffs, and closure pieces with the piping.
  2. Do not use installed valves for shutoff when the specified test pressure exceeds the valve's maximum allowable seat differential pressure. Provide blinds or other means to isolate test sections.
  3. Do not include valves, equipment, or piping specialties in test sections if test pressure exceeds the valve, equipment, or piping specialty safe test pressure allowed by the item's manufacturer.
  4. During the performance of the tests, test pressure shall not vary more than plus or minus 5 pounds per square inch gauge with respect to the specified test pressure.
  5. Select the limits of testing to sections of piping. Select sections that have the same piping material and test pressure.
  6. When test results indicate failure of selected sections, limit tests to piping:
    - a. Between valves.
    - b. Between a valve and the end of the piping.
    - c. Less than 500 feet long.
  7. Test piping for a minimum of 2 hours for visible leaks test and a minimum of 2 hours for the pressure test with maximum leakage allowance.
- C. Testing procedures:
1. Fill piping section under test slowly with water while venting air.
  2. Before pressurizing for the tests, retain water in piping under slight pressure for a water absorption period of a minimum of 24 hours.
  3. Raise pressure to the specified test pressure and inspect piping visually for leaks:
    - a. Consider visible leakage testing complete when no visible leaks are observed.
- D. Pressure test with maximum leakage allowance: 
1. Leakage allowance is zero for piping systems using flanged, National Pipe Thread threaded and welded joints.
  2. Pressure test piping after completion of visible leaks test.
  3. For piping systems using joint designs other than flanged, threaded, or welded joints, accurately measure the makeup water necessary to maintain the pressure in the piping section under test during the pressure test period:
    - a. Consider the pressure test to be complete when makeup water added is less than the allowable leakage and no damage to piping and appurtenances has occurred.
    - b. Successful completion of the pressure test with maximum leakage allowance shall be achieved when the observed leakage during the test period is equal or less than the allowable leakage and no damage to piping and appurtenances has occurred.
    - c. When leakage is allowed, calculate the allowable leakage in accordance with AWWA C605-21 or AWWA C600-17 by using the following formula:

$$L = \frac{SD\sqrt{P}}{148,000}$$

wherein the terms shall mean:

L = Allowable leakage in gallons per hour.

S = Length of the test section in feet.

D = Nominal diameter of the piping in inches.

P = Average observed test pressure in pounds per square inch gauge, at the lowest point of the test section, corrected for elevation of the pressure gauge.

### 3.05 TESTING LOW-HEAD PRESSURE PIPING

- A. Test piping for which the specified test pressure is less than 20 pounds per square inch gauge, by the low head pressure test method, indicated with "LH" in the Pipe Schedule.
- B. General:
  - 1. Test pressures shall be as scheduled in Section 02001 - Common Work Results for General Piping.
  - 2. During the performance of the tests, test pressure shall not vary more than plus or minus 2 pounds per square inch gauge with respect to the specified test pressure.
  - 3. Test connections, blowoffs, vents, closure pieces, and joints into structures, including existing bell rings and other appurtenances, with the piping.
  - 4. Test piping for a minimum of 2 hours for visible leaks test and a minimum of 2 hours for the pressure test with maximum leakage allowance.
- C. Visible leaks test:
  - 1. Subject piping under test to specified pressure measured at the lowest end.
  - 2. Fill piping section under test slowly with water while venting air:
    - a. Use potable water for all potable waterlines and where noted on the Pipe Schedule.
  - 3. Before pressurizing for the tests, retain water in piping under slight pressure for the water absorption period of a minimum of 24 hours.
  - 4. Raise pressure to the specified test pressure and inspect piping visually for leaks. Consider testing complete when no visible leaks are observed.
- D. Pressure test with maximum leakage allowance:
  - 1. Pressure test piping after completion of visible leaks test.
  - 2. Accurately measure the makeup water necessary to maintain the pressure in the piping section under test during the pressure test period:
    - a. Consider the pressure test to be complete when makeup water added is less than the allowable leakage of 80 gallons per inch of nominal diameter, per mile of piping section under test after 24 hours, and no damage to piping and appurtenances has occurred.
    - b. Successful completion of the leakage test shall have been achieved when the observed leakage is equal or less than the allowable leakage and no damage to piping and appurtenances has occurred.
- E. Optional joint test:
  - 1. When joint testing is allowed by note in the Pipe Schedule, the procedure shall be as follows:
    - a. Allowed only for low head pressure piping.

- b. Does not replace and is not in lieu of any testing of the piping system or trust restraints.
2. May be performed with water or air.
3. Joint test piping after completion of backfill and compaction to the top of the trench.
4. Joint testing with water:
  - a. Measure test pressure at the invert of the pipe. Apply pressure of 4 feet plus the inside diameter of the pipe in water column within 0.20 feet in water column.
  - b. Maintain test pressure for 1 minute.
  - c. Base the allowable leakage per joint on 80 gallons per inch nominal diameter, per mile of piping, per 24 hours equally distributed to the actual number of joints per mile for the type of piping.
  - d. Consider the pressure test to be complete when makeup water added is less than the allowable leakage.
  - e. Successful completion of the joint test with water shall have been achieved when the observed leakage is equal or less than the allowable leakage.
5. Joint testing with air:
  - a. Apply test pressure of 3 pounds per square inch gauge with a maximum variation of plus 0.20 and minus 0.00 pounds per square inch.
  - b. Maintain test pressure for 2 minutes.
  - c. Consider the pressure test to be complete when the test pressure does not drop below 2.7 pounds per square inch for the duration of the test.

END OF SECTION



## SECTION 02050

### SOILS AND AGGREGATES FOR EARTHWORK

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes:
  - 1. Material requirements for soils and aggregates.

##### 1.02 REFERENCES

- A. ASTM International (ASTM):
  - 1. C117 - Standard Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing.
  - 2. C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - 3. C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - 4. C535 - Standard Test Method for Resistance to Degradation of Larger-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - 5. D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
  - 6. D2844 - Standard Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils.
  - 7. D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  - 8. D4829 - Standard Test Method for Expansion Index of Soils.
  - 9. D5821 - Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.
- B. Florida Department of Transportation (FDOT):
  - 1. Standard Specifications for Road and Bridge Construction (Standard Specifications).

##### 1.03 SUBMITTALS

- A. Product data:
  - 1. Material source.
  - 2. Gradation.
  - 3. Testing data.
- B. Quality control for aggregate base course:
  - 1. Test reports: As required by Sections of Standard Specifications.
  - 2. Certificates of compliance: As required by Sections of Standard Specifications.

## **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Storage and protection: Protect from segregation and excessive moisture during delivery, storage, and handling.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS - GENERAL**

- A. Provide material having maximum particle size not exceeding 4 inches and that is free of trash, lumber, debris, leaves, grass, roots, stumps, and other organic matter.
- B. Materials derived from processing demolished or removed asphalt concrete are not acceptable.

### **2.02 NATIVE MATERIAL**

- A. Native soil-select:
  - 1. Sound earthen material.
  - 2. Sum of plasticity index when tested in accordance with ASTM D4318 and the percent of material by weight passing a No. 200 sieve shall not exceed 23 when tested in accordance with ASTM C136.
  - 3. Organic content not be greater than 3 percent by volume.
  - 4. Corrosion resistance requirements:
    - a. Resistivity minimum (wet aggregates): 5,000 ohm-cm.
    - b. pH: 5.0 to 12.0.
    - c. Chlorides maximum: 100 parts per million.
    - d. Sulfates maximum: 200 parts per million.

### **2.03 AGGREGATE BASE COURSE**

- A. Material requirements:
  - 1. Graded aggregate base, Group 1 or 2, as specified in the Standard Specifications.
  - 2. Use graded aggregate material which yields a satisfactory mixture meeting the requirements of the Standard Specifications after it has been crushed and processed as a part of the mining operations.
  - 3. Contractor may furnish the material in 2 sizes of such gradation that, when combined in a central mix plant pugmill, the resultant mixture meets the required specifications.
  - 4. Use graded aggregate base material of uniform quality throughout, substantially free from vegetable matter, shale, lumps and clay balls, and having a Limerock Bearing Ratio (LBR) value of not less than 100.
  - 5. Use material retained on the No. 10 sieve composed of aggregate meeting the following requirements:
    - a. Soundness loss, sodium, sulfate (AASHTO T 104): 15 percent.
    - b. Percent wear (AASHTO T 96, Grading A):
      - 1) Group 1 aggregates: 45 percent.
      - 2) Group 2 aggregates: 65 percent.

- c. Group 1: This group of aggregates is composed of limestone, marble, or dolomite.
  - d. Group 2: This group of aggregates is composed of granite, gneiss, or quartzite.
6. Use graded aggregate base material meeting the following gradation:

Sieve Sizes (Square Openings)	Percent by Weight Passing Sieve
2 inch	100
1 1/2 inch	95 - 100
3/4 inch	65 - 90
3/8 inch	45 - 75
No. 4	35 - 60
No. 10	25 - 45
No. 50	5 - 25
No. 200	0 - 10

**2.04 GRAVEL (NOT USED)**

**2.05 CLASS 2 PERMEABLE FILL (NOT USED)**

**2.06 SAND**

- A. Clean, coarse, natural sand.
- B. Non-plastic when tested in accordance with ASTM D4318.
- C. Conforms to size and grade within the following limits when tested in accordance with ASTM C117 and ASTM C136:

Sieve Size (Square Openings)	Percent by Weight Passing Sieve
1/2 inch	100
No. 200	0 - 20

**2.07 SHELL ROCK (NOT USED)**

**2.08 LIMEROCK**

- A. May be used as a base course for roadways, and for other applications as approved by the Engineer.
- B. Material requirements:
  - 1. Shall consist of unconsolidated or partly consolidated limestone of marine origin.
  - 2. Limerock bearing ratio (LBR):
    - a. Average result per lot: 100, minimum.
    - b. Individual results: 90, minimum.
  - 3. Liquid limit: Not to exceed 35.

4. Plastic properties:
  - a. For base material: Non-plastic.
  - b. For stabilized base: Plasticity not to exceed 10.
5. Percentage of carbonates (calcium and magnesium): 70 percent minimum.
6. Gradation:
  - a. For base material: At least 97 percent shall pass a 3-1/2-inch sieve.
  - b. For stabilized base: At least 97 percent shall pass a 1-1/2-inch sieve.

**PART 3 EXECUTION (NOT USED)**

END OF SECTION



## SECTION 02552

### TEMPORARY BYPASS PUMPING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section describes the requirements for temporary bypass pumping of wastewater flows as needed to complete the Work.

##### 1.02 REFERENCES

- A. American Water Works Association (AWWA):
  - 1. C110 – Ductile-Iron and Gray-Iron Fittings.
  - 2. C150 - Standard for Thickness Design of Ductile-Iron Pipe.
  - 3. C151 - Standard for Ductile-Iron Pipe, Centrifugally Cast.
- B. ASTM International (ASTM):
  - 1. B241 - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
  - 2. D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material.
- C. National Fire Protection Association (NFPA):
  - 1. 820 - Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

##### 1.03 REQUIREMENTS

- A. Provide all services related to, but not limited to, mobilization, setup, around-the-clock operations and maintenance, demobilization, traffic control, permits, and all other materials, labor, and equipment to install, maintain, and operate a complete continuous pumping and transport system for wastewater 24 hours per day, 7 days per week, until the portion(s) of the Work have been completed to the satisfaction of the Engineer.
- B. The means and methods of accomplishing and maintaining the temporary bypass pumping and associated facilities is the sole responsibility of Contractor.
- C. The temporary bypass pumping system shall be installed as a complete standalone system.
  - 1. Provide power, fuel, and backup power supply and/or backup pumps for operation of the system.
- D. The temporary bypass pumping operation shall be limited to the months or seasons indicated in the Work, unless approved in writing by the Owner.
- E. The temporary bypass pumping shall be continuously monitored.

- F. Contractor shall be responsible for bypassing wastewater in a way that ensures that no wastewater is allowed to leak outside of the sanitary sewer system or the bypass pipelines.
  - 1. Bypass pumping shall be done in such a manner as not to damage private or public property, or create a nuisance or public menace.
  - 2. The pumped wastewater shall be in an enclosed pipe that is adequately protected from traffic, and shall be redirected into sanitary sewer system.
- G. No bypassing to the ground surface, receiving waters, storm drains, or bypassing that results in soil or groundwater contamination or any potential health hazards shall be permitted.
  - 1. Contractor shall adhere to all agency restrictions regarding the transport and conveyance of wastewater.
- H. Contractor shall be liable for all cleanup, damages, and resultant fines in the event of spills, leaks, or backups associated with bypass pumping activities, which includes commissioning, operation, and decommissioning of bypass pumping facilities.
- I. No interruption of wastewater flow shall be permitted throughout the duration of the project. Contractor is responsible for all sanitary sewer overflows during construction of this Work and bypass operations.
- J. Coordinate the placement of the bypass piping and pumping equipment with Owner.
- K. Where bypass pipelines are required to cross traffic lanes, and will be in place for more than 3 days, the piping and fittings shall be buried a minimum of 4 inches below the pavement surface and backfilled with temporary asphalt concrete surfacing or use an approved flow-through drivable apparatus approved by Engineer.
  - 1. At no time shall traffic lanes be blocked or closed, unless specifically allowed in writing by Owner.
- L. For purposes of bypass pumping lateral flows, right of entry onto private property is not permitted without right-of-entry/right-of-access agreement, as specified in Section 01140 - Work Restrictions.
  - 1. Laterals indicated on the Drawings are from the best-available records from Owner or provided by property owners.
  - 2. Not all laterals are indicated on the Drawings.
- M. Contractor is responsible to identify additional laterals not indicated on the Drawings that may require bypass pumping.
- N. After the Work is completed, flow shall be returned to the existing force main piping until the new force main piping is online and all temporary equipment removed.

#### 1.04 SUBMITTALS

- A. Contractor shall submit a temporary bypass pumping plan as required to complete the Work to Engineer and Owner, 10 days prior to bypass pipe installation, for review as specified in Section 01330 - Submittal Procedures.

- B. The temporary bypass pumping plan submittal shall be satisfactory to Engineer and Owner prior to Contractor commencing the bypass pumping operation.
  - 1. Contractor shall notify Engineer and Owner 24 hours prior to commencing the bypass pumping operation.
  
- C. The temporary bypass pumping plan must provide for accessibility to pedestrians and vehicular traffic in accordance with Owner requirements.
  
- D. The temporary bypass pumping plan shall include the following at a minimum:
  - 1. Number, type, capacity, and size of pumps, standby equipment, pipe material, pipe layout with pressure relief, and air/vacuum valves locations, and power requirements, if applicable.
  - 2. Design calculations of the system and selected equipment, including flow, TDH with static head including all friction and minor losses, and pump curves showing operating range of flow and TDH.
  - 3. Standby power generator size and location for electrically driven bypass pumps.
  - 4. Downstream Discharge Plan.
  - 5. Pipe thrust and restraint block sizes and locations.
  - 6. Temporary pipe supports and anchoring required.
    - a. The bypass corridor lies within a flood zone, therefore buoyancy restraint is required.
    - b. Buoyancy calculations are required.
  - 7. Schedule that shows duration of temporary bypass pumping including milestones for installation, maintenance, and removal of equipment and accessories.
  - 8. Means and methods of installing, operating, monitoring, and maintaining the temporary bypass pumping shall be provided.
  - 9. Plan indicating bypass pumping line locations.
    - a. Plan shall include details showing methods used to protect and identify the bypass pumping lines through the length of the bypass corridor.
  - 10. Plans for access to bypass pumping locations.
  - 11. Detailed plans of a redundant backup system.
  - 12. Address access for pedestrians and vehicular traffic.
  - 13. Mechanical plan showing equipment, valves, pipe sizes and locations, pipe materials, dimensions, vehicle access (where applicable), pedestrian access (where applicable).
  - 14. Proposed type, catalog cutsheets, and location of piping plugs.
  - 15. Emergency Response Plan.
  - 16. Staffing Plan.
  - 17. Spill prevention and cleanup plan.
  - 18. Method of noise control.
  - 19. Health and Safety Plan.
  - 20. Catalog cutsheets for all pumping equipment including pump performance curves, all pipe and fittings, all valves, noise reduction system, and health and safety plan.

## 1.05 QUALITY ASSURANCE

- A. Contractor's qualifications:



1. Minimum 5 years of experience in performing substantially similar temporary bypass pumping operations.
  2. Submit list of at least 5 separate construction projects completed within the last 10 years that include the satisfactory setup, operation, and maintenance of a pumping and piping system used to bypass wastewater during construction similar to the specified Work.
- B. Fulfillment of the specified experience requirements shall be a condition of acceptance.

## **PART 2 PRODUCTS**

### **2.01 DESIGN AND PERFORMANCE CRITERIA**

- A. Contractor shall collect flow data or request flow data from Owner to determine the appropriate range of design flows and design total dynamic head (TDH).
- B. Contractor shall contact Owner's representative to confirm all proposed flow values prior to the Work.

### **2.02 CAPACITY**

- A. Pumps, piping, and accessories shall be of adequate capacity and size to handle the range of wastewater flows from Minimum Flow to Peak Flow.
- B. All piping, fittings, and all accessories shall withstand 2.0 times the maximum pressure.
- C. Contractor shall maintain on site sufficient equipment and materials to ensure continuous and successful operation of the bypass system.
  1. Contractor shall have standby pump(s) incorporated into the system that provide 100-percent redundancy of the bypass system design Peak Flow.
    - a. The redundant pump(s) shall be plumbed, fueled, and available for operation in 10 minutes upon emergency backup.
  2. Contractor shall install sufficient bypass lines to provide 100 percent redundancy of the bypass system design Peak Flow.
    - a. The bypass lines and separate redundant lines shall be connected via a combined header that enables the shutdown and isolation of each individual line should a leak or rupture occur.
  3. Contractor shall maintain on site a sufficient number of valves, tees, elbows, connections, tools, pipe plugs, piping, and other parts or system hardware to ensure immediate repair or modification of any part of the bypass system as necessary.

### **2.03 BYPASS PUMPS**

- A. A minimum of 2 pumps shall be provided, each capable of transporting 100 percent of the peak flow.

- B. Pump capacity shall be sufficient to pump the anticipated peak hour flow with the largest pump out of service.
- C. Pumps shall be a packaged unit with a skid base or 2-wheel trailer.
- D. Pumps shall be fully automatic, self-priming, close-coupled centrifugal units that do not require use of foot valves or vacuum pumps for priming.
- E. Pumps shall utilize oil-lubricated mechanical seal.
- F. Pump materials shall be as follows:
  - 1. Volute: Cast iron.
  - 2. Impeller: Cast iron.
  - 3. Pump shaft: Type 431 stainless steel.
  - 4. Mechanical seal faces: Silicon carbide.
- G. Pumps shall be capable of passing 4-inch diameter solids, rags, rocks, hair, and other debris encountered in municipal wastewater.
- H. Pumps shall be operated by diesel engine or 480-volt electric engine and include the following:
  - 1. Minimum 24-hour capacity diesel fuel tank as defined by fuel consumption during peak pumping rate.
  - 2. Fuel gauge with red warning light when tank approaches empty.
- I. Pumps shall be capable of dry operation for up to 5 hours to accommodate large fluctuations in flow.
- J. Maximum pump speed shall not exceed 2,200 revolutions per minute.
- K. The system shall include the following features:
  - 1. START/STOP operation.
  - 2. Instrumentation and controls for operation and monitoring for each pump.
- L. All electrical equipment, instrumentation, and accessories shall be suitable for Class 1 Division 1 service in accordance with NFPA 820.

#### **2.04 BYPASS PIPING**

- A. Contractor shall use piping material appropriate for sanitary wastewater applications and pressures for the temporary bypass pumping system.
- B. All piping shall have no leakage and shall include spill containment vessels or "spill guards" in areas indicated on the Drawings.
- C. HDPE Piping shall be as follows:
  - 1. In accordance with ASTM D3350.
  - 2. Minimum SDR of 17.
  - 3. Joints shall be butt-fusion welded.

- D. Ductile Iron Piping shall be as follows:
  - 1. In accordance with AWWA C151.
  - 2. Fittings in accordance with AWWA C110.
  - 3. Joints shall be EPDM gasketed push-on in accordance with AWWA C111.
- E. Aluminum piping:
  - 1. In accordance with ASTM B241 or approved by Engineer.
  - 2. Fittings: Standard pipe fittings made of aluminum alloy suitable for 30 percent above maximum shutoff pressure.
  - 3. Joints shall be EPDM.

## **2.05 PIPE PLUGS**

- A. Pipe diameters [24] inches and smaller shall use mechanical plugs with EPDM gaskets.
- B. Pipe diameters larger than 24 inches shall use inflatable bag stoppers with 2 or more pieces.

## **2.06 NOISE CONTROL**


- A. Pump equipment shall be equipped with devices or enclosures for noise attenuation, which includes, but is not limited to, mufflers and/or plywood/Styrofoam noise panels.
- B. The noise level shall be at or below 75 dBA at 50 feet from the pumping equipment for the duration of the Work.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Contractor shall notify Owner a minimum of 20 days prior to the Work requiring temporary bypass pumping and notify Engineer at least 72 hours prior to bypassing or diverting flow in any of the pipelines or laterals or structures.
- B. All pumps, generators, and other equipment shall be placed on a plastic tarp to protect against spills of petroleum products used by the equipment.
- C. Before taking interceptor out of service, Contractor shall verify that bypass system is fully operational and acceptable to Engineer.
- D. Traffic control as specified in **Section 01550 - Traffic Control**.
- E. Flow in the existing sewers shall not be restricted or dammed for any period of time without the approval of Engineer.
- F. All wastewater facilities, including laterals, shall remain in continuous and full operation during construction.

### 3.02 PROTECTION

- A. All pumps and piping shall be sized to adequately convey the flows anticipated at each bypass application.
  - 1. The bypass system shall be watertight; no leakage will be allowed.
- B. Contractor shall be responsible for all bypass flows.
  - 1. Contractor shall inspect the entire bypass pumping and piping system for leaks or spills at a frequency of not less than 1 times per hour.
  - 2. The temporary bypass system shall not be shut down between shifts, on holidays or weekends, or during work stoppages without written permission from Engineer.
- C. The temporary bypass system will have trained and qualified attendants available 24 hours per day 7 days per week whose only duty is to maintain the bypass system until the bypassing of the system is no longer required. The attendants shall:
  - 1. Be capable of performing pump and piping maintenance required.
  - 2. Have a cellular phone for communication with Contractor and Engineer  the event of emergencies.
- D. In the event of any wastewater spill, Contractor shall be responsible for the prompt cleanup and disinfecting of the spill as called for in the temporary bypass pumping plan.
  - 1. Contractor shall compensate Owner for the cost of any fines levied as the result of a spill or unauthorized discharge.
- E. Contractor shall implement measures to prevent interference between the public and the bypass pumping equipment, pipelines, and wastewater.
- F. Contractor shall take precautions to protect all bypass lines from damage.
  - 1. Any aboveground portions of the bypass lines shall be clearly identified by flashers, fencing, or other means to warn the public of their presence.

### 3.03 FIELD QUALITY CONTROL

- A. Hydrostatic Pressure Test:
  - 1. Prior to operation, test each section of discharge piping with maximum pressure equal to 2.0 times the maximum operating pressure.
  - 2. The test shall run for a duration of 4 hours.
  - 3. Contractor shall fill the line with water.
  - 4. The line shall be sealed on the discharge end.
  - 5. The line may be put in service if, after the specified test duration, the pressure has been maintained and there are no observable leaks.
  - 6. Notify Engineer at least 48 hours prior to testing.
- B. Inspection:
  - 1. An attendant/operator shall inspect temporary bypass piping system at a minimum of every hour 24 hours per day.
  - 2. An attendant/operator shall be present to monitor the operation of the bypass pumps at all times, 24 hours per day.
  - 3. Inspection Log: Keep at each pumping location.

### **3.04 CLEAN-UP**

- A. The temporary bypass pumping system shall be cleaned and drained prior to being dismantled.
- B. Contractor shall alternate pigging and purging of the system to remove all loose material.
  - 1. After Contractor has cleaned the pipe, and prior to dismantling of the piping for removal from the project site, Contractor shall disinfect the pipe with 10-percent chlorine solution.
- C. Disturbed Areas:
  - 1. Upon completion of bypass pumping operation, clean disturbed areas, restoring to original condition, including pavement restoration, at least equal to that which existed prior to start of Work.
  - 2. As specified in Section 02952 - Pavement Restoration and Rehabilitation.

### **3.05 SCHEDULING**

- A. The temporary bypass pumping system shall not be shut down between shifts, on holidays or weekends, or during work stoppages.
- B. The bypass system shall have trained and qualified attendants 24 hours per day, 7 days per week whose only duty is to maintain the bypass system from the start of bypass until the bypassing of the system is no longer required.

END OF SECTION



## SECTION 02554

### TEMPORARY LINE PLUGGING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: Tapping, sleeves, and installation for mechanical plug deployment in pipelines with diameters greater than 36 inches.
- B. The Work under this Section consists of providing all labor, materials, tools, equipment, and services required to install and test tapping sleeves, tapping valves, and plug existing pipeline as indicated on the Drawings and as specified within this Section to allow temporary plugging of pipeline.

##### 1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME).
- B. American Water Works Association (AWWA):
  - 1. C213 - Fusion-Bonded Epoxy Coating and Linings for Steel Water Pipe and Fittings.
  - 2. M11 Steel Pipe - A Guide for Design and Installation.
- C. ASTM International (ASTM):
  - 1. A36 - Standard Specification for Carbon Structural Steel.
  - 2. A285 - Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength.
  - 3. D2000 - Standard Classification System for Rubber Products in Automotive Applications.

##### 1.03 REQUIREMENTS

- A. Plugging system shall have the capability to plug the pipeline and be left in place without requiring continuous monitoring. The plug must be capable of removal and reinsertion as needed.
- B. Tapping sleeve, valve, and plugging system shall be designed at 200 percent of the operating pressure of the pipeline.
- C. The means and methods of accomplishing and maintaining the plugging system and associated facilities is the sole responsibility of the Contractor.
- D. Plugging equipment may not bear upon the existing pipe or joints. Support plan must be provided to transfer loads if necessary.
- E. Contractor shall be liable for all cleanup, damages, and resultant fines in the event of spills, leaks, or backups associated with the plugging system, which includes commissioning, operation, and decommissioning of the plugging system.

- F. Contractor will need to field verify pipe diameter or provide plan for tapping and plugging pipe without detailed dimensions.
- G. Plug must be capable of removal within 1-hour of notice to remove in the case of bypass pump failure. Equipment and staff must be available to meet this removal requirement 24 hours a day/7 days a week during plug deployment.

#### **1.04 SUBMITTALS**

- A. Submit as specified in **Section 01330 - Submittal Procedures**.
- B. Experience summary and references for specialty contractor to perform work.
- C. Submit qualifications and certificate from equipment manufacturer certifying operators are qualified to operate manufacturer's hot tap and plugging equipment.
- D. Product data:
  - 1. Description of tapping valves/plugging procedure and equipment to be used.
  - 2. Identify any special procedures required during and or after tapping procedure for the specified pipe material being tapped.
- E. Shop drawings for tapping saddle, completion plug, tapping valves, blind flange, and associated appurtenances.
- F. Execution plan:
  - 1. Identify excavation size and clearances required.
  - 2. Schematic of deployed equipment and plan for securing the excavation while plug is installed.
  - 3. Tapping procedure to retain coupon.
- G. Bypass pumping plan.
- H. Monitoring and emergency removal plan including removal time and number of personnel required.

#### **1.05 QUALITY ASSURANCE**

- A. Contractor's qualifications:
  - 1. Tapping and plug deployment work shall be performed by a specialty contractor that has successfully performed 24-inch diameter and larger hot taps and plugs on past projects.
  - 2. On-site field technician shall have a minimum 5 years of experience with performing hot tap/plug deployment.
  - 3. Submit list of at least 3 separate, qualifying projects completed within the last 10 years that include the satisfactory set-up, operation, and maintenance of a plugging system.

## **PART 2 PRODUCTS**

### **2.01 TAPPING SLEEVE**

- A. Manufacturers: One of the following or equal.
  - 1. JCM Industries.
  - 2. Romac .
- B. Sleeve shall consist of segments that bolt together on the pipe; 1 segment shall incorporate a sealing gasket around the nozzle opening to seal against the pipeline.
  - 1. Segments of the sleeve shall be fabricated to accurately conform to the outside diameter of the host pipe and to provide reinforcement.
  - 2. The sleeve shall be in accordance with AWWA Manual M11 for Steel Water Pipe - A Guide for Design and Installation.
- C. Body: Minimum 1/2-inch thick ASTM A285 Grade C or ASTM A36 carbon steel.
- D. Nozzle:
  - 1. Diameter: 48 inches.
  - 2. Flange: ASME 150 pound drilling, carbon steel.
  - 3. Test port: 3/4-inch National Pipe Taper (NPT).
- E. Hardware: Type 304 (18-8) stainless steel.
- F. Finish: Fusion-bonded epoxy coating in accordance with AWWA C213 Standard.
- G. Gasket:
  - 1. Nitrile butadiene rubber (NBR, Buna-N) in accordance with ASTM D2000.
  - 2. Molded rubber with a pressure-activated hydro-mechanical design.
  - 3. Gasket is bonded into a cavity for internal and external retention.
- H. Temporary isolation valve: Per plug manufacturer.
- I. Bleed tap: 12-inch tap with AWWA gate valve and plug on side of fitting to confirm isolation, to bleed air from system and to equalize pressure.

### **2.02 PLUGGING MACHINERY**

- A. Furnish folding-head plug capable of pressure-tight seal against inside diameter of existing pipe designed at 200 percent the operating pressure of the pipeline.
- B. Plugging mechanism is advanced and retracted from the pipeline by means of hydraulic or mechanical actuator.
- C. When retracted, the plug head is housed in pressure-tight chamber between the actuator and tapping valve.
- D. Plug shall be capable of displacing accumulated grit deposits in interior of the pipe while advancing to its final position, have molded rubber or polyurethane sealing element around its perimeter, and supply workable seal with interior diameter when fully advanced.

- E. The tapping procedure to retain the coupon shall be presented at time of submittal.
- F. The equipment shall be folding-type assembly to allow for a reduced entry hole instead of a full size cut to retain the pipe stability.
- G. Installer shall provide means to address sealing issues caused by out of round and pipe imperfections.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Upon providing the required advance notice to the Owner and receiving authorization, Contractor shall excavate the existing pipe at the proposed tap locations prior to ordering the tapping sleeve or saddle.
- B. Contractor shall fully expose the pipe within the limits of the proposed tapping sleeve or saddle and shall verify the type of existing pipe, the outside diameter, roundness, joint length, and condition of the pipe on which the tapping sleeve/saddle is to be installed.
- C. If any existing joint, fitting, tap, or other obstruction is located at the proposed tap location, Contractor shall coordinate with Engineer to determine the appropriate adjustment to the proposed tap location.

### **3.02 INSTALLATION**

- A. Operating conditions (e.g., flow rates, operating pressure, etc.) shall be confirmed with Owner or Engineer prior to ordering materials. Equipment and methods used to perform the tap shall be appropriate for the operating conditions.
- B. Install the sleeve and valve in strict accordance with the manufacturers' instructions and requirements of the Contract Documents. Tapping sleeve/saddle outlets shall be installed vertical.

### **3.03 FIELD QUALITY CONTROL**

- A. Perform a hydrostatic test of the tapping sleeve and valve assembly after installation of the tapping sleeve and valve, but prior to making the tap.
  - 1. Test to a pressure equal to 1.5 times the maximum operating pressure.
  - 2. Test duration: 2 hours.
- B. All bolts and nuts shall be kept clean and shall be handled carefully.
  - 1. Bolts and nuts shall be kept free of nicks and shall not be tossed or thrown.
  - 2. Bolts/nuts shall not be over-torqued.
  - 3. Stainless steel bolts and nuts shall be assembled with an anti-seize coating to prevent galling.

END OF SECTION

## SECTION 02707

### HIGH DENSITY POLYETHYLENE (HDPE) PIPE: AWWA C906

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: High Density Polyethylene Pipe (HDPE), and fittings, 4-inch through 63-inch size.

##### 1.02 REFERENCES

- A. American Water Works Association (AWWA):
  - 1. C906 – Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 63 in., for Water Distribution.
- B. ASTM International (ASTM):
  - 1. D1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
  - 2. D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.
  - 3. D1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings.
  - 4. D1603 - Standard Test Method for Carbon Black Content in Olefin Plastics.
  - 5. D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
  - 6. D2290 - Standard Test Method for Apparent Hoop Tensile Strength of Plastic or Reinforced Plastic Pipe by Split Disk Method.
  - 7. D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
  - 8. D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material.
  - 9. F645 - Standard Guide for Selection, Design, and Installation of Thermoplastic Water-Pressure Piping Systems.
  - 10. F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- C. International Organization of Standardization (ISO):
  - 1. 10863 - Non-destructive testing of welds - Ultrasonic testing - Use of time-of-flight diffraction technique (TOFD).
- D. Plastic Pipe Institute (PPI):
  - 1. PE 4710.

##### 1.03 ABBREVIATIONS

- A. HDPE: High-density polyethylene.

- B. ID: Inside diameter of piping or tubing.
- C. OD: Outside diameter.
- D. SDR: Standard dimension ratio.

#### **1.04 SUBMITTALS**

- A. Submit as specified in Section 01330 - Submittal Procedures.
- B. Shop drawings:
  - 1. Detailed layout drawings showing alignment of pipes, location of valves, fittings, and appurtenances, types of joints, and connections to pipelines or structures.
- C. Product data: As specified in Section 02001 - Common Work Results for General Piping:
  - 1. Describe materials and installation equipment including fusion machine.
    - a. Include optimum range of fusion conditions such as fusion temperature, interface pressure, and cooling time.
  - 2. Pipe loads and structural calculations.
  - 3. Installation instructions.
- D. Qualifications of installation crew for high-density polyethylene pipe including qualifications of the fusion machine technician. Furnish proof of training in the use of fusion equipment.

#### **1.05 QUALITY ASSURANCE**

- A. Markings on the pipe shall be in accordance with AWWA C906.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect piping materials from sunlight, scoring, and distortion.
- B. Do not allow surface temperatures on pipe and fittings to exceed 120 degrees Fahrenheit.
- C. Store and handle HDPE pipe and fittings as recommended by manufacturer in published instructions.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL**

- A. In accordance with AWWA C906.

#### **2.02 MATERIALS**

- A. Fittings: Same material as the pipe and of equal or greater pressure rating.

## 2.03 HDPE PIPING

### A. General:

1. Pipe and fittings: High-density polyethylene.
2. Dimensions of pipe and fittings: Based on controlled outside diameter in accordance with ASTM F714:
  - a. SDR: As given in Piping Schedule, in Section 02001 - Common Work Results for General Piping; or, if not given, minimum thickness shall be SDR 11.
  - b. Pipe Diameter: DIPS dimensions as specified in Section 02001 - Common Work Results for General Piping Pipe Schedule.
3. Pipe, fittings, and adapters: Furnished by the same manufacturer, or compatible with components in the same system and with components of other systems to which connected.

### B. Materials:

1. Manufacturers: One of the following or equal:
  - a. Performance Pipe (Chevron Phillips Chemical Company): DriscoPlex 4000/4100 Series.
  - b. ISCO Industries.
2. Polyethylene: As listed by the PPI under the designation PE 4710; and have a minimum cell classification, in accordance with ASTM D3350, of 445574C:
  - a. Pipe and fittings: Manufactured from material with the same cell classification.
  - b. Manufacturer shall certify that pipe and fittings meet the above classifications.
3. Polyethylene fittings and custom fabrications:
  - a. Molded or fabricated.
  - b. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe.
  - c. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe.
  - d. Pressure de-rated fabricated fittings are prohibited.
4. Molded fittings:
  - a. Manufactured in accordance with ASTM D3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, and shall be so marked.
  - b. Each production lot of molded fittings shall be subjected to the tests required under ASTM D3261.
5. X-ray inspection: The Manufacturer shall submit samples from each molded fittings production lot to x-ray inspection for voids, and shall certify that voids were not found.
6. Fabricated fittings:
  - a. Made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings.
  - b. Rated for internal pressure service at least equal to the full service pressure rating of the mating pipe.
7. Polyethylene flange adapters:
  - a. Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion joining machine without the use of a stub-end holder.

- b. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves to provide gasketless sealing, or to restrain the gasket against blowout.
- 8. Back-up rings and flange bolts:
  - a. Flange adapters shall be fitted with Type 304 or 316 stainless steel back-up rings pressure rated equal to or greater than the mating pipe.
    - 1) Back-up rings shall be convoluted style for 150-pound bolt hole pattern.
  - b. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius.
  - c. Flange bolts and nuts shall be the same material as backing flange as specified in Section 02001 - Common Work Results for General Piping.

## 2.04 SOURCE QUALITY CONTROL

- A. HDPE piping:
  - 1. Manufacturer's quality control: The pipe and fitting manufacturer shall have an established quality control program responsible for inspecting incoming and outgoing materials.
  - 2. Incoming polyethylene materials:
    - a. Inspected for density, melt flow rate, and contamination.
    - b. The cell classification properties of the material shall be certified by the supplier and verified by manufacturer's quality control.
    - c. Approved by quality control before processing into finished goods.
  - 3. Outgoing materials shall be checked for:
    - a. Outside diameter, wall thickness, and eccentricity in accordance with ASTM D2122 at a frequency of at least once per hour.
    - b. Out of roundness at a frequency of at least once per hour.
    - c. Straightness, inside and outside surface finish, markings and end cuts shall be visually inspected in accordance with ASTM F714 on every length of pipe:
      - 1) Quality control shall verify production checks and test for:
        - a) Density in accordance with ASTM D1505 at a frequency of at least once per extrusion lot.
        - b) Melt Index in accordance with ASTM D1238 at a frequency of at least once per extrusion lot.
        - c) Carbon content in accordance with ASTM D1603 at a frequency of at least once per day in accordance with extrusion line.
        - d) Quick burst pressure in accordance with ASTM D1599 at a frequency of at least once per day per line.
        - e) Ring Tensile Strength in accordance with ASTM D2290 at a frequency of at least once per day per line.
    - d. X-ray inspection shall be used to inspect molded fittings for voids, and knit line strength shall be tested. All fabricated fittings shall be inspected for joint quality and alignment.
  - 4. Permanent records: The manufacturer shall maintain permanent QC and QA records.
  - 5. Compliance tests:
    - a. Manufacturer's inspection and testing of the materials.



- 1) In case of conflict with manufacturer's certifications, the Contractor, Engineer, or Owner may request retesting by the manufacturer or have retests performed by an outside testing service.
- 2) All retesting shall be at the requestor's expense and shall be performed in accordance with this Section.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

#### **A. General:**

1. Where not otherwise specified, install piping in accordance with ASTM F645, or manufacturer's published instructions for installation of piping, as applicable to the particular type of piping.
2. Provide molded transition fittings for transitions from HDPE to metal or IPS pipe. Do not thread or solvent weld HDPE pipe.

#### **B. Installation of HDPE piping:**

1. Joining:
  - a. Heat fusion joining:
    - 1) Joints between plain end pipes and fittings shall be made by butt fusion, and joints between the main and saddle branch fittings shall be made utilizing saddle fusion employing only procedures that are recommended by the pipe and fitting manufacturer.
    - 2) The Contractor shall certify, in writing, that persons making heat fusion joints have received training in the manufacturer's recommended procedure and have had at least 3 years current experience in the heat fusion butt welding process.
    - 3) The Contractor shall maintain records of trained personnel and shall certify that training was received not more than 12 months before commencing construction.
    - 4) External and internal beads shall not be removed.
  - b. Heat fusion training services: The manufacturer shall provide training in the manufacturer's recommended butt fusion and saddle fusion procedures to the Contractor's installation personnel, and to the inspector(s) representing the Owner, prior to the start of construction.
  - c. Mechanical joining:
    - 1) Unless otherwise indicated on the Piping Schedule, HDPE pipe and fittings may be joined together or to other materials by means of flanged connections (flange adapters and back-up rings) or, where specifically indicated on the Drawings, flexible couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material.
    - 2) Flexible couplings shall be fully pressure rated and fully thrust restrained such that when installed in accordance with manufacturer's recommendations, a longitudinal load applied to the mechanical coupling will cause the pipe to yield before the mechanical coupling disjoins.

2. Installation:
  - a. General:
    - 1) The Manufacturer shall package products for shipment in a manner suitable for safe transport by commercial carrier.
    - 2) When delivered, a receiving inspection shall be performed, and any shipping damage shall be reported to the Manufacturer within 7 days.
    - 3) Damaged pipe shall be promptly removed from the job site.
    - 4) Installation shall be in accordance with Manufacturer's recommendations, and this specification.
    - 5) Prior to making a terminal connection of each individual run of HDPE pipe, the temperature of the pipe should be allowed to approach the service temperature at which the pipe is intended to operate.
    - 6) All necessary precautions shall be taken to ensure a safe working environment in accordance with applicable codes and standards.
  - b. Large diameter fabricated fittings: Fabricated fittings shall be butt fused to the end of a pipe.
  - c. Mechanical joint and flange installation:
    - 1) Mechanical joints and flange connections shall be installed in accordance with the manufacturer's recommended procedure.
    - 2) Flange faces shall be centered and aligned to each other before assembling and tightening bolts.
    - 3) Every effort shall be made to ensure that the opposing faces of the flange assemblies mate up securely at a temperature approximately the same as the service temperature.
    - 4) In no case shall the flange bolts be used to draw the flanges into alignment.
    - 5) Bolt threads shall be lubricated, and flat washers shall be fitted under the flange nuts.
    - 6) Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the manufacturer.
    - 7) At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the manufacturer.
    - 8) The final tightening torque shall be 100 feet-pounds or less as recommended by the manufacturer.
  - d. Pipe handling:
    - 1) Lift, move, or lower pipe and fittings only with wide fabric choker slings.
    - 2) Wire rope or chain shall not be used.
    - 3) Slings shall be of sufficient capacity for the load, and shall be inspected before use.
    - 4) Worn or defective equipment shall not be used.
  - e. Excavation, backfill material and backfilling and compacting:

### 3.02 FIELD QUALITY CONTROL

- A. Butt fusion testing on pipe size 14 inches and larger:
  1. The first fusion of each day shall be a trial fusion.
    - a. The trial fusion shall be allowed to cool completely.
    - b. Fusion test straps shall be cut out.

- 1) The test strap shall be 12 inches (minimum) or 30 times the wall thickness in length with the fusion in the center, and 1 inch (minimum) or 1.5 times the wall thickness in width.
  - c. Bend the test strap until the ends of the strap touch.
  2. If the fusion fails at the joint, a new trial fusion shall be made, cooled completely and tested.
  3. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed the bent strap test.
- B. Data logging and test data:
1. A data logger shall be installed on the fusion heated joining machine. Data on each joint shall be recorded by the data logger. Data to be recorded shall be minimum temperature of joint fusion and interface pressure of the fused joint.
  2. Recorded data from the fusion data logger and the TOFD shall be transmitted to the Owner daily.
- C. Pressure testing:
1. Conduct in accordance with MAG Specification Section 610.14 - Testing.
  2. Test pressures as specified in the Piping Schedule in Section 02001 - Common Work Results for General Piping.
  3. Temperature of test water shall be no more than 73 degrees Fahrenheit.

END OF SECTION





## SECTION 15110

### COMMON WORK RESULTS FOR VALVES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes:
  - 1. Basic requirements for valves.

##### 1.02 REFERENCES

- A. American Water Works Association (AWWA):
  - 1. C111/A21.11 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe Fittings.
- B. ASTM International (ASTM):
  - 1. A126 - Standard Specification for Gray Iron Casting for Valves, Flanges, and Pipe Fittings.
  - 2. A480 - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
  - 3. A536 - Standard Specification for Ductile Iron Castings.
- C. NSF International (NSF):
  - 1. 61 - Drinking Water System Components - Health Effects.
- D. Society for Protective Coatings (SSPC):
  - 1. SP 7 - Brush-Off Blast Cleaning.
  - 2. SP 10 - Near-White Blast Cleaning.

##### 1.03 SUBMITTALS

- A. Furnish Submittals as specified in **Section 01330 - Submittal Procedures.**
- B. Product data:
  - 1. Submit the following information for each valve:
    - a. Type, size, pressure rating, Cv factor.
    - b. Coatings.
    - c. Power valve actuators:
      - 1) Information on valve actuator, including size, manufacturer, model number, limit switches, mounting and motor enclosure, seating and unseating torque coefficient, dynamic torque, and bearing friction for calculation of maximum operating torque.
      - 2) Complete wiring diagrams and control system schematics.
    - d. Manual valve actuators:
      - 1) Information on valve actuator, including size, manufacturer, and model number.



- e. Certified drawings with description of component parts, dimensions, weights, and materials of construction.
  - f. Certifications of reference standard compliance:
    - 1) Submit certification that the valves and coatings are suitable in potable water applications in accordance with NSF 61.
  - g. Clearly mark Submittal information to show specific items, materials, and accessories or options being furnished.
  - h. Factory test data.
- C. Provide vendor operation and maintenance manual as specified in **Section 01782 - Operation and Maintenance Manuals**.
- 1. Furnish bound sets of installation, operation, and maintenance instructions for each type of manual valve 4 inches in nominal size and larger, and non-manual valves. Include information on valve operators.
- D. Provide Manufacturer's Certificate of Source Testing as specified in **Section 01756 - Commissioning**.
- E. Provide Manufacturer's Certificate of Installation and Functionality Compliance as specified in **Section 01756 - Commissioning**.

#### 1.04 QUALITY ASSURANCE

- A. Manufacturer qualifications:
- 1. Valves manufactured by manufacturers whose valves have had successful operational experience in comparable service.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect valves and protective coatings from damage during handling and installation. Repair coating where damaged.

### PART 2 PRODUCTS

#### 2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Pressure rating:
- 1. Suitable for service under minimum working pressures of 150 pounds per square inch gauge.
  - 2. When a piping system is specified in the Pipe Schedule to be tested at a pressure greater than 150 pounds per square inch gauge, provide valves for that piping system with design working pressure which is sufficient to withstand the test pressure.
- B. Valve to piping connections:
- 1. Metallic valves:
    - a. 3 inches nominal size and larger: Flanged ends.
    - b. Less than 3 inches nominal size: Screwed ends.
  - 2. Plastic valves in plastic piping systems:

- a. Up to 4 inches: Provide solvent or heat welded unions, except for plastic butterfly valves.
  - 1) Plastic butterfly valves shall be flanged as specified in Section 15112 - Butterfly Valves.
- b. 6 inches and larger: Provide solvent or heat-welded flanges.

## 2.02 MATERIALS

- A. Stainless steel: In accordance with ASTM A480, Type 316 or Type 304, UNS Alloy S31600 or S30400.
- B. Valve and operator bolts and nuts, not including flange bolts and nuts as specified in Section 02001 - Common Work Results for General Piping:
  - 1. Fabricated of stainless steel for the following installation conditions:
    - a. Submerged in sewage or water.
    - b. In an enclosed space above sewage or water.
    - c. In structures containing sewage or water, below top of walls.
    - d. At openings in concrete or metal decks.
  - 2. Where dissimilar metals are being bolted, use stainless steel bolts with isolation bushings and washers.
  - 3. Underground bolts: Low-alloy steel in accordance with AWWA C111/A21.11.
- C. Bronze and brass alloys: Not more than 6 percent zinc and not more than 2 percent aluminum in the manufacture of valve parts.
  - 1. UNS Alloy C83600 or C92200 unless specified otherwise.
- D. Cast iron valve bodies: In accordance with ASTM A126, Class 30 minimum.
- E. Ductile iron valve bodies: In accordance with ASTM A536, Grade 65-45-12 minimum, unless specified otherwise.

## 2.03 INTERIOR PROTECTIVE LINING

- A. When specified in the particular valve Specification, provide valves with type of protective lining specified in the particular valve Specification.
- B. Apply protective lining to interior, non-working surfaces, except stainless steel surfaces.
- C. Lining types:
  - 1. Fusion bonded epoxy:
    - a. Manufacturers: The following or equal:
      - 1) 3-M Company, ScotchKote 134; certified in accordance with NSF 61 for drinking water use.
    - b. Clean surfaces in accordance with SSPC-SP 7 or SSPC-SP 10, as recommended by the epoxy manufacturer.
    - c. Apply in accordance with the manufacturer's published instructions.
    - d. Lining thickness: 0.010 to 0.012 inch, except that:
      - 1) In grooves for gaskets: 0.005 inch.
      - 2) Do not coat seat grooves in valves with bonded seat.

- e. Quality control:
  - 1) Lining thickness: Measured with a non-destructive magnetic type thickness gauge.
  - 2) Verify lining integrity with a wet sponge-testing unit operating at approximately 60 volts, or as recommended by the lining manufacturer.
  - 3) Consider tests successful when lining thickness meets specified requirements and when no pinholes are found.
  - 4) Correct defective lining disclosed by unsuccessful tests and repeat test.
  - 5) Repair pinholes with liquid epoxy recommended by the manufacturer of the epoxy used for lining.
- 2. High solids epoxy:
  - a. Product equivalent to high solids epoxy.
    - 1) Certified in accordance with NSF 61 for drinking water use.
    - 2) Interior: Coat valve interior with the manufacturer's equivalent high performance high solids epoxy coating system with a certifiable performance history for the service conditions and as approved by the Engineer.
  - b. Clean surfaces in accordance with SSPC-SP 7 or SSPC-SP 10, or as recommended by the coating manufacturer.
  - c. Quality control: After coating is cured, check coated surface for porosity with a holiday detector set at 1,800 volts, or as recommended by the coating manufacturer.
    - 1) Repair holidays and other irregularities and retest coating.
    - 2) Repeat procedure until holidays and other irregularities are corrected.

## 2.04 EXTERIOR PROTECTIVE COATINGS

- A. HIGH SOLIDS EPOXY AND POLYURETHANE COATING SYSTEM (for above ground and vaulted valves)
  - 1. Preparation:
    - a. Prepare surfaces in accordance with general preparation requirements and as follows:
      - 1) Touch up shop-primed steel and miscellaneous iron.
      - 2) Abrasive blast ferrous metal surfaces at jobsite prior to coating. Abrasive blast clean rust and discoloration from surfaces.
      - 3) Degrease or solvent clean, whip abrasive blast, power tool, or hand tool clean galvanized metal surfaces.
      - 4) Lightly sand (de-gloss) fiberglass and PVC pipe to be coated and wipe clean with dry cloths, or solvent clean in accordance with coating manufacturer's instructions.
      - 5) Abrasive blast clean ductile iron surfaces.
  - 2. Application:
    - a. Apply coatings in accordance with general application requirements and as follows:
      - 1) Apply a 3-coat system consisting of:
        - a) Primer: 4 to 5 mils DFT high solids epoxy.
        - b) Intermediate coat: 4 to 5 mils DFT high solids epoxy.
        - c) Topcoat: 2.5 to 3.5 mils DFT aliphatic or aliphatic-acrylic polyurethane topcoat.



- b. Recoat or apply succeeding epoxy coats within 30 days or within time limits recommended by manufacturer, whichever is shorter. Prepare surfaces for recoating in accordance with manufacturer's instructions.
- B. HIGH SOLIDS EPOXY SYSTEM (for buried valves)
- 1. Preparation:
    - a. Prepare surfaces in accordance with general preparation requirements and as follows:
      - 1) Abrasive blast ferrous metal surfaces to be submerged at jobsite in accordance with SSPC SP 5 prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP10.
      - 2) Abrasive blast non-submerged ferrous metal surfaces at job site in accordance with SSPC SP 10, prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP 6.
      - 3) Abrasive blast clean ductile iron surfaces at jobsite in accordance with SSPC SP 7.

## 2.05 UNDERGROUND VALVES

- A. Provide underground valves with flanged, mechanical, or other type of joint required for the type of pipe to which the valve is to be connected.
- B. Coating and wrapping:
  - 1. After installation, encase valves in polyethylene wrap as specified for ductile iron piping in Section 15211 - Ductile Iron Pipe: AWWA C151.
    - a. Ensure polyethylene wrapping does not affect operation of valve.

## 2.06 STEAM VALVES

- A. In steam or steam condensate piping: Ductile iron body in accordance with ASTM A536, Grade 65-45-12 minimum or cast steel or forged steel.

## 2.07 VALVE BOXES

- A. Provide cast-iron valve boxes at each buried valve to access valve and valve operators.
- B. Do not support boxes on valve, valve operator, or pipe.
- C. Boxes:
  - 1. 2-piece, fabricated of cast iron; provide cover, with asphalt varnish or enamel protective coating.
  - 2. Adjustable to grade, install centered around the upper portions of the valve and valve operator.
- D. Manufacturers: One of the following or equal:
  - 1. Neenah Foundry Co.
  - 2. Tyler Pipe Industries, Inc.

## 2.08 VALVE OPERATORS

- A. Valve operator "Open" direction: Open counterclockwise.
- B. Provide valves located below operating level or deck with extensions for key operation or floor stands and handwheels, as indicated on the Drawings.
- C. Provide manually operated valves located not more than 6 feet above the operating level with tee handles, wrenches, or handwheels.
  - 1. Make the valve operator more conveniently accessible by rolling valves, located more than 5 feet but less than 6 feet above the operating level, toward the operating side.
  - 2. Secure tee handles and wrenches to the valve head or stem, except where a handle or wrench so secured constitutes a hazard to personnel; in which case, stow handle or wrench immediately adjacent to the valve on or in a suitable hanger, bracket, or receptacle.
- D. Fit valves located more than 6 feet above operating level with chain-operated handles or valve wheels.
  - 1. Chains: Sufficient length to reach approximately 4 feet above the operating level.
  - 2. Where chains constitute a nuisance or hazard to operating personnel, provide holdbacks or other means for keeping the chains out of the way.
- E. Provide an operator shaft extension from valve or valve operator to finished grade or deck level when buried valves and other valves located below the operating deck or level are specified or indicated on the Drawings to be key operated.
  - 1. Provide 2 inches square AWWA operating nut, and box and cover as specified, or a cover where a box is not required.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Preparation prior to installation:
  - 1. Determine after flanged valves and flanged check valves are selected, the face-to-face dimensions of flanged valves and flanged check valves.
- B. Fabricate piping to lengths taking into account the dimensions of flanged valves and flanged check valves.

### 3.02 INSTALLATION

- A. Install the valves in accordance with the manufacturer's installation instructions.
- B. Provide incidental work and materials necessary for installation of valves, including flange gaskets, flange bolts and nuts, valve boxes and covers, concrete bases, blocking, and protective coating.

- C. Provide additional valves for proper operation and maintenance of equipment and plant facilities under the following circumstances:
  - 1. Where such additional valves are required for operation and maintenance of the particular equipment furnished by the Contractor.
  - 2. Where such additional valves are required as a result of a substitution or change initiated by the Contractor.
  
- D. Valve and actuator orientation:
  - 1. Coordinate with the valve supplier final orientation of valve and actuator assembly based on the Contractor's selection of equipment manufacturers and the valve and piping arrangement as indicated on the Drawings.
    - a. Rotate valve and/or actuator mounting orientation as specified in this Section unless otherwise indicated on the Drawings.
  - 2. Install valves with their stems in vertical position above the pipe, except as follows:
    - a. Butterfly valves, gate valves aboveground, globe valves, ball valves, and angle valves may be installed with their stems in the horizontal position.
    - b. Install buried plug valves with geared operators with their stems in a horizontal position.
  - 3. Install valves so that handles clear obstructions when the valves are operated from fully open to fully closed.
  
- E. Place top of valve boxes flush with finished grade or as otherwise indicated on the Drawings.
  
- F. Valves with threaded connections:
  - 1. Install valves by applying wrench on end of valve nearest the joint to prevent distortion of the valve body.
  - 2. Apply pipe joint compound or Teflon™ tape on external (male) threads to prevent forcing compound into valve seat area.
  
- G. Valves with flanged connections:
  - 1. Align flanges and gasket carefully before tightening flange bolts.
  - 2. When flanges are aligned, install bolts and hand tighten.
  - 3. Tighten nuts opposite each other with equal tension before moving to the next pair of nuts.
  
- H. Valves with soldered connections:
  - 1. Do not overheat connection to prevent damage to resilient seats and metal seat rings.
  - 2. Position valves in full open position before starting soldering procedure.
  - 3. Apply heat to piping rather than to valve body.

### **3.03 FIELD APPLIED COATING OF VALVE EXTERIOR**

- A. Match color and be compatible with the manufacturer's coating system and as specified:
  - 1. When shop-applied finish coating matches field applied coating on adjacent piping, touch up shop coating in damaged areas in accordance with instructions recommended by the paint manufacturer.

2. When shop-applied coating does not match field coating on adjacent piping, or when damage has occurred to the shop-applied coating that requires more than touchup, blast clean valve surfaces or utilize other surface preparation recommended by the manufacturer of the coating material and apply the coating system used for coating adjacent piping.

### **3.04 COMMISSIONING**

- A. As specified in Section 01756 - Commissioning, and this Section.
- B. Manufacturer services from each manufacturer for all valves supplied:
  1. Provide Manufacturer's Certificate of Source Testing.
  2. Provide Manufacturer's Certificate of Installation and Functionality Compliance.
- C. As specified elsewhere for specific valve types, sizes or actuators.
  1. Source testing.
  2. Manufacturers on-site services for Owner Training, Installation Testing, Functional Testing, and during the Process Operational Period.

END OF SECTION

## SECTION 15116

### PLUG VALVES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes:
  - 1. Non-lubricated plug valves.
  - 2. Lubricated plug valves.
  - 3. Multi-port plug valves.

##### 1.02 REFERENCES

- A. American Water Works Association (AWWA):
  - 1. C517 - Resilient-Seated Cast Iron Eccentric Plug Valves.
  - 2. C606 - Grooved and Shouldered Joints.
- B. ASTM International (ASTM):
  - 1. A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - 2. A536 - Standard Specification for Ductile Iron Castings.

##### 1.03 SUBMITTALS

- A. Submit as specified in **Section 01330 - Submittal Procedures** and Section 15110 - Common Work Results for Valves.
- B. Product data: As specified in Section 01601 - Product Requirements.
- C. Shop Drawings: Installation arrangement of major component assemblies.
- D. Calculations.
- E. Vendor operation and maintenance manual as specified in Section 01782 - Operation and Maintenance Data.
- F. Commissioning Submittals:
  - 1. Provide Manufacturer's Certificate of Source Testing as specified in Section 01756 - Commissioning:
    - a. Interior coating.
  - 2. Provide Manufacturer's Certificate of Installation and Functionality Compliance as specified in Section 01756 - Commissioning.

##### 1.04 WARRANTY

- A. Provide warranty as specified in **Section 01783 - Warranties and Bonds**.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. As specified in Section 01601 - Product Requirements and Section 15110 - Common Work Results for Valves.

### 2.02 NON-LUBRICATED PLUG VALVES

- A. Manufacturers: One of the following or equal:

1. Clow Valve.
2. DeZurik, PEC.
3. Milliken Valve, Model 600/601.

- B. Design:

1. Type: Non-lubricated eccentric type, in accordance with AWWA C517.
2. Plug face: Resilient material that operates satisfactorily at a temperature of 180 degrees Fahrenheit continuous and 215 degrees Fahrenheit intermittent, except for valves in compressed air or digester gas service.
  - a. Valves in compressed air service: Resilient material suitable for continuous duty at 250 degrees Fahrenheit.
  - b. Valves in digester gas service: Resilient material suitable for petroleum or digester gas at continuous duty at 180 degrees Fahrenheit.
3. Compression washer: Provide flat compression washer made of Teflon™, or of a material having equal physical characteristics on valve stem between plug and bonnet.
4. Stem seals: Provide stem seals serviceable without unbolting the valve bonnet assembly.
5. Grit excluders: Provide PTFE grit excluders at upper plug journals to prevent entry of foreign solids in bearing area.
6. Clearly mark valves to indicate their open and closed positions.
7. Provide valves with ends as required by piping details indicated on the Drawings.
  - a. Grooved end body valves:
    - 1) Usage: Plug valves with grooved ends may be used in piping systems specified in the Pipe Schedule to have grooved end joints and as indicated on the Drawings.
    - 2) Grooved end joint design: In accordance with AWWA C606.

- C. Materials:

1. Body and plug: ASTM A536, Grade 65-45-12, ductile iron, with plug face of EPDM material suitable for the intended service as specified under the "Design" article above.
2. Body seats in valves 3-inch size and larger: Provide with overlay of not less than 90-percent nickel and minimum thickness of 1/8 inch on surfaces contacting the plug face.
3. Stem bearing and bottom bearing: Type 316 stainless steel.

4. Internal parts, except the body and plug: Type 316 stainless steel.
5. Exposed nuts, bolts, and washers: Zinc plated. Exception: Exposed nuts, bolts, and washers for buried service: Stainless steel.

### **2.03 VALVE OPERATORS**

- A. Furnish valves with an operating wrench or worm gear operator:
  1. Equip valves 4-inch nominal size and smaller with a lever operator.
  2. Equip valves 6-inch nominal size and larger with a worm gear operator.

### **2.04 COATING**

- A. Coat and test interior metal surfaces as specified in Section 15110 - Common Work Results for Valves.
- B. Field applied coating of valve exterior:
  1. Match color and be compatible with the manufacturer's coating system.
    - a. When shop applied finish coating matches field applied coating on adjacent piping, touch up shop coating in damaged areas in accordance with instructions recommended by the paint manufacturer.
    - b. When shop applied coating does not match field coating on adjacent piping, or when damage has occurred to the shop applied coating that requires more than touchup, blast clean valve surfaces or utilize other surface preparation recommended by the manufacturer of the coating material and apply the coating system used for coating adjacent piping.

### **2.05 SHIPMENT, SPARE PARTS, MAINTENANCE PRODUCTS, AND SPECIAL TOOLS**

- A. As specified in Section 01601 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install valves as specified in Section 15110 - Common Work Results for Valves and the manufacturer's instructions.
  1. Unless otherwise indicated on the Drawings, install valves so that in the closed position the pressure in the pipeline applies a seating head on the valves.
  2. Install valves so that in the open position, the plug is located in the top half of the valve body.
  3. Furnish Manufacturer's Certificate of Installation Verification.
- B. Valves requiring lubrication: Lubricate and fill extended lubricant pipes with lubricant suitable for service intended.

### **3.02 COMMISSIONING**

- A. As specified in Section 01756 - Commissioning and this Section.

- B. Functional Testing:
1. Tests: Witnessed.
  2. Conduct pressure and leak test as specified in Section 15110 - Common Work Results for Valves.
  3. Furnish Manufacturer's Certificate of Functional Compliance.

END OF SECTION