

SECTION 22 11 13 - WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for combined water service and fire service mains.
- B. Section includes the following:
 - 1. Provide all labor, materials, and equipment necessary for fabrication and production of the items specified in this Section and as shown on Drawings or listed on Schedule.
 - 2. Dismantling of existing piping and supports, where required or shown or noted on Drawings; piping connections to existing piping, structures, valves, gates, measuring devices, pumps and other equipment, including equipment erected under other Contracts, are included in Work of this Section. Piping shall contain necessary unions or companion flanges to allow ease of equipment removal.
 - 3. Complete all the demolition work and repair thereof to existing walls and slabs as required for the installation of this Work including grouting of all sleeves and castings. Provide all necessary joint and coupling materials, including bolts, nuts and gaskets, wall castings or sleeves, and standard or special fittings. Furnish hangers, supports, anchors, blocking, harnesses, and other necessary closure pipe sections and special fittings. Provide and secure in proper alignment, all sleeve and casting openings in existing walls and slabs, including repair thereof.
 - 4. Provide all shop-applied interior and exterior pipe linings and coatings. Provide plugs in open ends of pipe, temporary bulkheads, protection of surface and subsurface improvements, cleaning, painting, testing, and disinfection, as required to accomplish Work as specified and shown on Drawings.

1.2 DEFINITIONS

- A. DIP: Ductile Iron Pipe
- B. HDPE: High Density Polyethylene Pipe
- C. PE: Polyethylene plastic.
- D. PVC: Polyvinyl chloride plastic.

1.3 REFERENCE STANDARDS

- A. Where noted in these specifications, all referenced standards refer to the latest revisions to the following specifications.
 - 1. AWWA meaning the American Water Works Association.
 - 2. ASTM meaning the American Society for Testing and Materials.
 - 3. ANSI meaning the American National Standards Institute.
 - 4. UNI - BELL meaning the Uni-Bell PVC Pipe Association.

5. Recommended Standards for Water Works (Ten States Standard) Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers.
6. PPI meaning the Plastic Pipe Institute, Inc.
7. NSF meaning the National Sanitation Foundation
8. Environmental Protection Agency Safe Drinking Water Act (SDWA)

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Submit in accordance with Section 01 33 00 Submittals covering the items included under this Section. Shop Drawing submittals shall include:
 1. Shop Drawings shall be fully dimensioned Drawings showing the piping in full detail with exact locations, dimensions, and schedules of all pipe, fittings, hangers, supports, and appurtenances. They shall be made in accordance with the general information shown on Drawing and special information furnished by the several manufacturers of equipment. Where special fittings are required, they shall be shown in large detail with all necessary dimensions.
 2. Design details of joints and joint restraint shall be submitted to Engineer for Engineer's consideration and approval before ordering any pipe.
- C. Record Drawings: At Project closeout, submit Record Drawings of installed products, in accordance with requirements of MHOG Standards.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Regulatory Requirements:
 1. Comply with standards requirements of MHOG for potable-water-service piping, including materials, installation, testing, and disinfection.
 2. Comply with standards requirements of local Fire Department (Marion, Howell, Ocoola or Genoa Township) for building-related fire suppression water service piping, including materials, hose threads, installation, and testing.
 3. Comply with the Recommended Standards for Water Works (Ten States Standard) Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

- D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire service main piping for fire suppression.
- E. NSF Compliance:
 - 1. DIP shall comply with NSF372 and NSF 61 Annex G for materials for water-service piping and specialties for domestic water.
- F. All Work under this Section shall be done in accordance with standard practices as recommended by manufacturer and AWWA.
- G. Codes, Ordinances, and Standards: Manufacture, storage, and erection of equipment under this Contract shall be in accordance with current ASA (ANSI), AWWA, and ASTM Standards. Standards and Specifications referenced herein shall be the current published edition. The manufacturer of the pipe and fittings shall furnish Engineer a certified statement that all pipe and fittings furnished by manufacturer meet the material requirements and have been inspected and tested in accordance with the applicable Specification and Standard.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flange faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.
- H. Disinfection compounds shall be stored in well-ventilated areas protected from moisture and fire.

1.9 PROJECT CONDITIONS

- A. Interruption of Existing Water Distribution Service: Contractor is not to operate any MHOG water distribution valves. All water system shut downs are to be coordinated with MHOG a minimum of 48 hours before the planned shutdown. All valves to be closed as part of the shutdown are to be operated by MHOG staff.
- B. Existing Conditions: The Drawings are not intended to show every detail of construction or location of piping or equipment. Where existing conditions make it necessary or advisable to change location of piping or equipment, Contractor shall so inform Engineer for Engineer's approval. Engineer shall be allowed 48 hours to respond to any discrepancy without being responsible for any delay in the Work.

PART 2 - PRODUCTS

Refer to Design Standards Part IV - Approved Procedures for a list of all approved materials.

2.1 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
 - 1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 - 2. Copper, Pressure-Seal Fittings:
 - a. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - b. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
- B. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- C. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 DUCTILE-IRON PIPE AND FITTINGS

- A. All ductile iron water main pipe shall conform to ANSI/AWWA C151/A21.51-02 and contain a cement mortar lining which shall conform to ANSI/AWWA C104/A21.4-95. All ductile iron water main pipe with a nominal inside diameter of sixteen inches (16") or smaller shall be Pressure Class 350 or Thickness Class 52.
- B. Fittings; All bends, tees, wyes and other special fittings used on water main pipe shall be ductile iron Thickness Class 52, or Pressure Class 350 which shall conform to ANSI/AWWA C153/A21.53-00 and contain a cement mortar lining which shall conform to ANSI/AWWA C104/A21.4-95. All ductile iron water main pipe fitting joints shall be the push-on type and shall conform to ANSI/AWWA C111/A21.11-00.
- C. Mechanical-Joint, Ductile-Iron Pipe: with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Approved Products: Refer to Part IV - Approved Procedures for a list of all approved products.
 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts. Gasket material for contaminated areas shall be specified for resistance to the specific chemical contamination.
 3. Flanged joints shall not be used on ground-buried pipe.
- D. Push-on-Joint, Ductile-Iron Pipe: with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Approved Products: Refer to Part IV - Approved Procedures for a list of all approved products.
 2. Gaskets: ANSI/AWWA C111/A21.11-00, rubber.
 3. Flanged joints shall not be used on ground-buried pipe.
- E. Flanges: ASME 16.1, Class 125, cast iron.
- F. Fasteners: Type 316 stainless steel.
- G. All ductile iron piping shall comply with the requirements NSF/ANSI 372.
- H. All ductile iron pipe to be buried shall be wrapped in polyethylene encasement per manufacturer's recommendations.

2.3 PVC PIPE AND FITTINGS

- A. Use of PVC pipe must be approved by Authority Engineer.
- B. Water main shall be ductile iron pipe. PVC pipe may be installed in special situations when approved by the Authority Engineer or Utility Director. Special applications may include:
- Surface water crossings
 - Highway crossings
 - Wetlands
 - Unstable soil areas
 - Areas that would require high restoration costs due to conventional construction
 - Corrosive soils or anode beds.
- C. Pipe Sizes 12-inches or Less in diameter: PVC, AWWA Pipe: AWWA C900 and shall meet the requirements of ASTM-2241-00 and ASTM D1784-03, minimum working Pressure Class 235 (DR 18), with bell end with gasket, and with spigot end. The Authority Engineer must approve use of PVC pipe in any water main project.

- D. Pipe Sizes 14 inches through 48 inches in diameter: PVC, AWWA Pipe: AWWA C905 and shall meeting the requirements of ASTM-12454 and ASTM D1784-03, Pressure Class 235 (DR 18) with bell end with gasket, and with spigot end. Wall thickness in the bell section shall conform to the requirements of ASTM D3139, “Standard Specification for Joint for Plastic Pressure Pipes Using Flexible Elastomeric Seals.”
- E. General:
1. Comply with NSF Standard 14. ANSI/NSF Standard 14 meets the requirements of ANSI/NSF Standard 61 and be stamped “NSF-pw” on the exterior pipe wall.
 2. Pipe shall have an integral wall-thickened bell end designed for joint assembly using a factory installed elastomeric gasket conforming to ASTM F477 to affect the pressure seal.
 3. Pipe shall be designed for direct connection into ductile iron pipe and fittings.
 4. Each piece of pipe and fitting shall be clearly labeled to identify its size, pressure class and manufacture date.
 5. Pipe joints shall meet the requirements of ASTM D-3212-9 for push-on joints.
 6. Gaskets shall meet the requirements of ASTM F-77-02 regarding elastomeric seals for joining plastic pipe.
 7. PVC pipe shall have the same outside diameter as ductile iron water main pipe. The internal diameters of the proposed PVC pipe shall be equivalent to the comparable ductile iron internal diameters.
 8. All bends, wyes and other fittings for PVC water main pipe shall be ductile iron.
 9. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111, rubber.
 - b. Approved Manufacturer: Refer to Part IV - Approved Procedures for a list of all approved products.
 10. PVC pipe shall be provided in standard 20 foot lengths, unless otherwise specified, detailed or required on the approved construction plans. Shorter lengths up to 10 feet, will be permitted when authorized by the Authority. Field cut lengths of pipe used as closures may not be shorter than 2 feet in length and must be approved by the Authority.
 11. All PVC pipe entering or exiting a fitting shall be a minimum length of 10 feet.
- F. Solid Sleeves; Contractor shall provide bolted solid sleeves manufactured of ductile iron with a restraint designed for PVC water main pipe. The nuts and bolts for the solid sleeves shall be low carbon steel and conform to ASTM A307, Grade B.
- G. Joint Restraint; Refer to Part IV - Approved Procedures for a list of all approved products.

2.4 HDPE PIPE AND FITTINGS

- A. HDPE pipe must be approved by Authority Engineer.
- B. Water main shall be ductile iron pipe. HDPE pipe may be installed in special situations when approved by the Authority Engineer or Utility Director. Special applications may include:
- Surface water crossings

- Highway crossings
 - Wetlands
 - Unstable soil areas
 - Areas that would require high restoration costs due to conventional construction
 - Corrosive soils or anode beds.
- C. High density polyethylene pipe conforming to ASTM D1598 and D3350, AWWA C906 and ANSI/NSF-14 and 61, material shall be comprised of PE 3408 Resin with a cell classification of PE334434C. All pipe shall be stamped “NSF-pw” on the exterior pipe wall.
1. Product shall be from one of the following manufacturers or an approved equal: Refer to Part IV - Approved Procedures for a list of all approved products. No installations shall exceed ten feet (10') of cover unless approved by the Engineer or as directed by the plans and specifications. The Authority Engineer must approve the use of HDPE pipe in any water main project.
 2. Pipe shall have a wall thickness of DR-11 and a working pressure rating of 160 psi, with approval of Utility Director and/or Authority Engineer.
 3. Materials and workmanship shall be as required by AWWA M55, PE Pipe Design and Installation Manual and ASTM F714 Manufacturing requirements.
 4. HDPE pipe, appurtenances, and installation methods shall conform to the latest addition of AWWA C906. The AWWA Standard Code C906 identification must appear on the exterior wall print line of the HDPE pipe proposed for potable use and installation. All HDPE materials must be listed and approved for use with potable water under ANSI/NSF Standard 14. ANSI/NSF Standard 14 meets the requirements of ANSI/NSD Standard 61. The exterior wall print lines of all HDPE pipe proposed for installation and potable use must bear the NSF-pw identification.
 5. Pipe shall be furnished in ductile iron pipe sizes (DIPs).
 6. Pipe shall be handled and installed in accordance with manufacturer's recommendations.
 7. Pipe shall be furnished with continuous, permanent print line identifying pipe size, pressure rating, trade name, material classification, ASTM and NSF standards, pipe test category, plant location and shift, date of manufacture, operator and extruder numbers, and supplier of raw materials.
 8. Exterior wall print line must bear NSF – PW identification.
- D. Fittings and Couplings: Fittings and specials shall be of the same construction and design as the pipe. The manufacturer of the pipe shall be the same as the manufacturer of the fittings and other fabrications.
- E. Joints: Joints shall be thermally butt-fused according to the recommendations of the manufacturer.

2.5 JOINING MATERIALS

- A. Refer to Section 33 05 00 Common Work Results for Utilities for commonly used joining materials.
- B. Mechanical Joint Restraints: Shall be provided at all valves, reducer fittings and as noted on the Standard Water Main Details and Notes sheets. Restrainers must accommodate the full

working pressure ratings and associated safety factor of the specified class of pipe and must be UL or FM approved. Mechanical joint restraints shall meet and or exceed the specification requirements of the pipe material specifications as previously stated. Refer to Part IV - Approved Procedures for a list of all approved products. In addition to certification, a copy of manufacturer's recommendations for installation must be supplied to the Authority Engineer. Restrained mechanical joints shall be provided at all main line valves, all hydrant branch pipe joints and/or as called out in the construction plans.

C. HDPE Restraint Methods;

1. Restrained joints include butt fusions, electro-fusions, socket fusions, bolted flange connections, MJ Adapter connections or other restrained mechanical connections.
2. Provide joint restraints on long string of butt fused HDPE to bell and spigot or mechanical sleeve joint.
 - a. Wall Anchor;
 - 1) Restrain the transition connection by butt fusing a Wall Anchor in the HDPE pipeline close to the connection and pouring a concrete anchor around it as shown in Details. Refer to the pipe manufacturer's recommendations on anchor size and pull out loads.
 - b. Mechanical Joint.
 - 1) Restrain the transition connection and several non-PE bell and spigot joints down line from the transition connection.
 - 2) Distance of pipe restraint needs to be identified on the drawings and noted in the HDPE to DIP Connection Detail. At minimum the Contractor shall provide pipe restraint per the requirements of a "Dead End" pipe as noted in the "Pipe Restraint Schedule" or 3 Pipe Lengths, whichever is greater.

D. HDPE to DIP and DIP Fittings;

1. MJ (mechanical joint) Adapters are to be used to connect polyethylene pipe to mechanical joint fittings and appurtenances that meet AWWA C111/ANSI A21.11.
2. Slip the Gland Ring over the pipe end and then butt fuse the HDPE MJ Adapter to the end of the pipe using the PPI Generic Butt Fusion Joining Procedure TR-33. Install the Gasket over the MJ Adapter and align the fitting with the socket hub of the ductile iron fitting. Lubricate the gasket, the end of the MJ adapter, and the inside of the socket hub with an approved pipe lubricant meeting AWWA C111. Do not use soapy water.
3. Insert the MJ Adapter into the socket hub. Make sure it is evenly and completely seated in the socket hub. The MJ Adapter and the socket hub must be aligned straight into each other. Insert the gland bolts, and run the nuts up finger tight. Tighten the gland bolts evenly to the fitting manufacturer's recommended procedures.
4. When connecting to a valve with an MJ connection, longer T-bolts may be required. If the T-bolts that come with the kit are not long enough for the assembly, use a coupling nut and Grade 5 all thread to make up the length required.

E. HDPE Flanged Connection to DI Fittings:

1. Flanged joints can be used to attach HDPE pipe to valves or DI fittings using HDPE Flange Adapter, Back-Up Ring, Gaskets and Bolts, Nuts and Washers.
2. Connection is made by sliding the Back-Up Ring over the pipe end and then butt fusing the HDPE Flange Adapter to the end of the pipe using the PPI Generic Butt Fusion Joining Procedure TR-33. Align the flanges and back-up rings and follow the fitting manufacturer's recommended procedures for bolting the flanges together. The service pressure rating for the back-up ring should meet or exceed the service pressure in the pipe.

3. Gaskets are required for connections between polyethylene and non-polyethylene flanges. The gasket manufacturer should recommend the gasket to use with polyethylene pipe. This is considered a “fully restrained joint” and typically does not need external restraint devices.
- F. Solid DI Sleeve Connections to HDPE pipe:
1. Solid Sleeves are ductile iron fittings designed to connect DI/PVC pipe to other piping materials including HDPE pipe. The solid sleeve is to have a flange or MJ hub to attach to the HDPE pipe. On the ductile iron pipe side, a Megalug flange is attached to the pipe and a gasket is installed over the pipe and into the sleeve before bolting the Megalug to the Sleeve flange. A standard HDPE MJ Adapter kit is used on the HDPE pipe side to complete the assembly.
 2. Contractor is to follow manufacturer’s recommended procedures for this assembly.
- G. HDPE Pipe Connection to DI or PVC Bell End:
1. Flex restraint pieces are electro-fused to the HDPE pipe to achieve the proper stab depth in the PVC or DI bell and the restraint harness plate is attached behind them. The opposite end of the restraint harness is attached behind the DI /PVC hub.
 2. Install the HDPE pipe in the PVC/DI bell until it bottoms out on the flex restraints and tighten the tie rods to prevent the assembly from pulling apart.
 3. A stiffener is to be installed in the HDPE pipe end.
 4. Contractor is to follow manufacturer’s recommended procedures for this assembly
- H. Mechanical Connection – HDPE to PVC:
1. Provide coupling on plain-end PVC pipe to plain-end HDPE pipe without special adapters.
 2. When connecting HDPE pipe to a mechanical coupling, the fitting unless otherwise stated by the coupling manufacturer.

2.6 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tracer wire is to be installed on all water main distribution lines and service lines.
1. For directional bores tracer wire shall be:
 - a. Directionally drilled tracer wire to be Copperhead ‘Soloshot’ Extra High Strength Directional Drill Wire 1150# Break Load or equal.
 2. For conventional open cut construction tracer wire shall be:
 - a. Direct bury tracer wire to be Copperhead 10 CCS High Strength 600# Break Load or equal.
 3. Tracer wire shall be installed in a continuous fashion. Install tracer wire on top of pressure process piping and secure to main every five (5) feet with tape.
 4. The wire shall be brought to the surface at bore pits, valves, fittings or manholes through utility markers or tracer wire terminal boxes which may serve as access points. Trace wire shall be brought to the surface at least every five hundred (500) feet unless noted by the Owner. Care should be taken not to damage the wire coating. If wire coating is damaged, the Contractor shall repair the damaged coating with electrical tape.
 5. Tracer wire shall terminate in boxes when at paved surfaces. Refer to Part IV - Approved Procedures for a list of all approved products.

6. Tracer wire systems in rural areas shall terminate in tracing wire stations. Terminals shall be external and colored blue for water distribution systems. Terminals should be located at least every one thousand (1,000) feet or as shown on the drawings. Refer to Part IV - Approved Procedures for a list of all approved products.
 7. Contractor shall test the locator system for continuity upon completed installation. Should tracer wires fail to test for continuity then the test shall be considered a failure.
 8. Failure of the tracer wire shall result in the installation of utility markers at no additional cost to Owner.
- C. Bolts, Nuts and Washers
1. All bolts, nuts and washers used by the manufacturer to fabricate and assemble hydrants, tapping sleeves, resilient seated gate valves and butterfly valves shall be #316 stainless steel. All portions of these fasteners exposed after installation must be field coated with rust preservative spray paint (bituminous base non-toxic undercoat spray paint), which is approved by the Authority.
 2. Refer to Part IV - Approved Procedures for a list of all approved products. All bolts, nuts and washers used for the installation of sleeves, couplings, and mechanical joint fittings shall be COR-BLUE approved equal.

2.7 CORROSION-PROTECTION PIPING ENCASEMENT

- A. Standards: AWWA C105
- B. High-density, crosslaminated PE film of 0.004-inch minimum thickness, colored black.

2.8 GATE VALVES

- A. AWWA, Cast-Iron Gate Valves:
 1. Nonrising-Stem, Resilient-Seated Gate Valves, for water main pipe sixteen inches (16") and smaller in diameter:
 - a. Description: Gray or ductile iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut. Gate valve stems shall be high tensile strength, non-rising type with double O-Ring stem seals. The gate valve wedge shall be ductile iron encased in an EPDM rubber covering which shall form the sealing surface and provide sealing in either direction.
 - 1) Standard: AWWA C515-01.
 - 2) Minimum Working Pressure Rating: 250 psig.
 - 3) End Connections: Mechanical joint.
 - 4) Operating Nut: 2-inch
 - 5) Interior Coating: Complying with AWWA C550.
 - 6) All nuts, bolts and washers for installation on sleeves, couplings and mechanical joint connections shall be Cor-Blue or approved equal.
 - 7) All nuts, bolts and washers used by manufacturer to fabricate and assemble gate valves shall be #316 stainless steel and exposed portions shall be field coated with pipe mastic or an approved corrosion protective spray.
 - 8) Provide one operating wrench of suitable length.
 - b. Direction of Open: Open valve by turning operating nut to left or counterclockwise.
 - c. Refer to Part IV - Approved Procedures for a list of all approved products including gate valves.

2.9 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Tapping-Sleeve Assemblies:
1. Valve
 - a. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.
 - b. All nuts, bolts and washers for installation on sleeves, couplings and mechanical joint connections shall be Cor-Blue or approved equal.
 - c. All nuts, bolts and washers used by manufacturer to fabricate and assemble gate valves shall be #316 stainless steel and exposed portions shall be field coated with pipe mastic or an approved corrosion protective spray.
 - d. All tapping-sleeve valve assemblies shall use a well instead of a valve box.
 2. Pressure Tapping Sleeve
 - a. All pressure tapping sleeves shall be installed in an appropriately sized valve manhole. All pressure tapping sleeves shall be push on restrained joints by flanged outlet, stainless steel or ductile iron built in two (2) parts.
 - b. Refer to Part IV - Approved Procedures for a list of all approved products including approved mechanical joint sleeves.
 - c. No live taps will be allowed where the outlet is the same size as the main without consultation with the Authority Engineer.
 - d. There shall be no direct taps on PVC or HDPE watermain. Saddles must be used for all tapping operations. When tapping pressurized PVC watermain, the Contractor is to use a heavy protective blanket 4 foot by 6 foot with a hole for the tapping machine or a tapping shield. System pressures shall be reduced during tapping. Contractor assumes all liability relative to the safety and injury resulting from tapping PVC Pipe.
 - e. All pressure tapping-sleeve assemblies shall use a well.
- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
1. Provide #6 base with valves 8-inches or less.
 2. Provide #8 base with valves greater than 8-inches.
 3. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.10 CHECK VALVES

- A. AWWA Check Valves:
1. Refer to Part IV - Approved Procedures for a list of all approved check valves
 2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
 - a. Standard: AWWA C508.
 - b. Pressure Rating: 175 psig.

2.11 BUTTERFLY VALVES

- A. AWWA Butterfly Valves:
1. Description: Rubber seated.
 - a. Standard: AWWA C504.

- b. Body: Cast or ductile iron.
 - c. Body Type: Wafer.
 - d. Pressure Rating: 150 psig.
2. Refer to Part IV - Approved Procedures for a list of all approved Butterfly Valves.

2.12 PLUG VALVES

- A. Plug Valves:
- 1. Description: Resilient-seated eccentric.
 - a. Standard: MSS SP-108.
 - b. Body: Cast iron.
 - c. Pressure Rating: 175-psig minimum CWP.
 - d. Seat Material: Suitable for potable-water service.
 - 2. Refer to Part IV - Approved Procedures for a list of all approved Plug Valves.

2.13 CORPORATION VALVES AND CURB VALVES

- A. Manufacturers:
- 1. Refer to Part IV - Approved Procedures for a list of all approved corporation stops, curb stops, and curb boxes.
 - 2. All corporation valve, curb valves, and fittings shall contain no lead in compliance with Safe Drinking Water Act amendment 1417 of 2011 and NSF 61 Annex G.
- B. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material. The minimum size of curb valves shall be 1-inch.
- C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
- 1. Service Box Rods: Steel, stem of length to operate deepest buried valve, curved to have top centered in box with slotted end matching curb valve. Rods are not to be used on valve boxes with an access way greater than 1-inch.

2.14 WATER METERS

- A. Water meters will be furnished by MHOG at the Contractor's expense.

2.15 FIRE HYDRANTS

- A. Fire Hydrants:
- 1. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron or ductile-iron body, compression-type valve opening against pressure and closing with pressure. Hydrants shall have a 6-foot bury depth.

- a. Refer to Part IV – Approved Procedures for approved fire hydrants and accessories.
- b. Fittings: 5-inch Storz Nozzle and Cap integral with fire hydrant assembly.
- c. Bibs: Two (2) 2- 1/2 –inch National Thread Standard (NTS)
- d. Standard: AWWA C502.
- e. Pressure Rating: 250 psig.
- f. All nuts, bolts and washers for installation on sleeves, couplings and mechanical joint connections shall be Cor-Blue or approved equal.
- g. All nuts, bolts and washers used by manufacturer to fabricate and assemble gate valves shall be #316 stainless steel and exposed portions shall be field coated with pipe mastic or an approved corrosion protective spray.
- h. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
- i. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
- j. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.
- k. Hydrant flag: Hydrant markers shall be heavy-duty galvanized spring steel hydrant markers 6' high with flat mounting bracket and spring.

2.16 PRESSURE-REDUCING VALVES

- A. Water Control Valves:
 - 1. Description: Pilot-operation, diaphragm-type, single-seated main water control valve with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
 - a. Pressure Rating: Initial pressure of 150 psig minimum.
 - b. Main Valve Body: Cast-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
 - 1) Size: See Drawings.
 - 2) Pattern: Angle or Globe-valve design as required by design.
 - 3) Trim: Stainless steel.
 - c. Design Flow Rate: See Drawings.
 - d. Design Inlet Pressure: See Drawings.
 - e. Design Outlet Pressure Setting: See Drawings.
 - f. End Connections: ANSI 125 lb. flanged connections.

2.17 PLUGGING DEAD ENDS

- A. Standard plugs shall be inserted into the bells of all dead ends of pipes, tees or crosses, and spigot ends shall be capped. Plugs or caps shall be joined to the pipe or fitting in the manner specified and shall be secured with mechanical joint restraints.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Section 31 20 00 Earth Moving, for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping NPS 1 to NPS 3 shall be any of the following:
 - 1. Soft copper tube, ASTM B 88, Type K; copper, pressure-seal fittings; and pressure-sealed joints.
- F. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 shall be any of the following:
 - 1. Ductile iron, mechanical joint pipe; ductile iron, mechanical joint fittings; and mechanical.
 - 2. PVC, AWWA Class 200 pipe listed for fire protection service; PVC fabricated or molded fittings of same class as pipe; and gasketed joints.

3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, high-pressure, resilient-seated gate valves with valve box.
 - 2. Use the following for valves in vaults and aboveground:
 - a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising stem.
 - b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated.
 - c. Check Valves: AWWA C508, swing type.
 - 3. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
 - 4. Relief Valves: Use for water-service piping in vaults and aboveground.
 - a. Air-Release Valves: To release accumulated air.
 - b. Combination Air Valves: To release or admit air.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Section 33 05 00 Common Work Results for Utilities for piping-system common requirements.

3.5 PIPING INSTALLATION

- A. Water-Main Connection: Must notify MHOG a minimum 48 hours prior to making any water main connections or taps of any size.
- B. Make connections larger than NPS 2 with tapping machine according to the following:
 - 1. Install tapping sleeve and tapping valve according to MSS SP-60.
 - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
 - 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
 - 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- C. Make connections NPS 2 and smaller with drilling machine according to the following:
 - 1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
 - 2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
 - 3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
 - 4. Install corporation valves into service-saddle assemblies.
 - 5. Install manifold for multiple taps in water main.
 - 6. Install curb valve in water-service piping with head pointing up and with service box.
- D. Comply with NFPA 24 for fire-service-main piping materials and installation.
 - 1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
 - 2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- F. Install PE pipe according to ASTM D 2774 and ASTM F 645.
- G. Install PVC, AWWA pipe according to AWWA C605 and AWWA M23.
- H. Bury piping with depth of cover over top at least 5.5 feet and no greater than 7.5 feet below finished grade.
- I. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- J. To prevent unwanted water intrusion, open ends of pipe shall be closed temporarily with a watertight bulkhead.
- K. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 - 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

- L. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- M. Copper service piping gooseneck shall be pre-formed prior to connection to the corporation. Bending of copper service after connection to main line is prohibited.

3.6 JOINT CONSTRUCTION

- A. See Section 33 05 00 Common Work Results for Utilities, for basic piping joint construction.
- B. Make pipe joints according to the following:
 - 1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
 - 2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 - 3. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
 - 4. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
- C. Joint Harnessing
 - 1. Pipe and fittings that require harnessing shall be provided with standard lugs ASTM A 283, Grade B, or A 285, Grade C, or equal, meeting the requirements of AWWA Specification C111 or AWWA Manual M11, unless otherwise noted.
 - 2. Harness tie rods and nuts shall be mild steel meeting the requirements of ASTM A 193, Grade B7, or A 307, Grade B, or equal with American Standard threads. The nuts shall seat on steel plate washers. The rod, washers, and nuts shall be hot-dip galvanized ASTM A 153.

3.7 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Locking mechanical joints.
 - 2. Set-screw mechanical retainer glands.
 - 3. Bolted flanged joints.
 - 4. Heat-fused joints.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 - 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
 - 3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box if in yard. In pavement, install in protective valve box. Curb stop box top access way opening threads shall be greased with synthetic food grade grease in compliance with NSF 60.
- D. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves
- E. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.9 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. AWWA Fire Hydrants: Comply with AWWA M17.
- C. Each fire hydrant shall be tagged with its distinguishing mark letter and number. Mark letter and number and tag as provided by MHOG.
- D. Each hydrant assembly shall be tested by CONTRACTOR; the test shall consist of flushing the hydrant for a minimum of ten minutes. During the test period, the 6-inch gate valve shall be closed and opened. CONTRACTOR shall furnish hoses for the proper disposal of OWNER-furnished water.
- E. Contractor shall plug hydrant weep holes prior to installation.

3.10 CONNECTIONS TO EXISTING FACILITIES

- A. Where shown on the drawings, connections to existing mains shall be done only after the new mains are shown to be disinfected by the results of the bacteriological analysis. Care should be taken to prevent debris from entering water main during cutting and connection work.

3.11 CLEANING

- A. All mains shall be cleaned using a poly-pig cleaning system. All equipment and temporary piping materials shall be provided by the Contractor. Prior to connecting to any existing valves, the Contractor shall check that the existing valve doesn't leak and if so, must notify the Owner immediately prior to making any connections. The pig shall be inserted into the first segment of pipe installed at the existing or proposed valve as described in the locations listed below. At the end of the segment of pipe to be cleaned, prior to pressure testing and chlorination, the Contractor shall install a 45-degree bend and a segment of pipe to accommodate flushing of the pig. The main shall be filled with water by means other than

opening the valve prior to flushing the pig. Once the water main is full the existing or proposed valve may be opened until the pig is retrieved from the end of the line. After the pig has been removed from the line, the contractor shall remove the 45-degree bend and terminate the portion of the water main for other testing. Contractor shall propose pigging/testing locations to the Engineer for acceptance prior to capping and filling the pipe. Below are the recommended segments of pipeline to be pigged; any changes to the following locations shall be submitted to the Engineer for approval prior to beginning pipe construction:

1. At point of connection to existing water main.
2. At any tees or crosses.
3. Other locations as recommended by MHOG based on the proposed water main layout.

3.12 CLOSING ABANDONDED WATERMAIN SYSTEMS

- A. Close open ends of abandoned underground piping indicated to remain in place. Fill abandoned pipe with grout. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads, grouted in place.
 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Backfill to grade according to Section 31 20 00 Earth Moving.

3.13 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests after all pipe has been backfilled. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Flushing: Water main flushing shall be conducted at a rate of 3.0 ft/sec to achieve adequate scour flushing in the main. Contractor shall coordinate with MHOG for completion of flushing.
- C. After completion, each run of pipe shall be tested by Contractor in the presence of Engineer. All appurtenances such as service connections, corporation stops, and curb stops shall be tested with the run of pipe.
 1. Any leaks shall be made tight.
 2. Under this Work, Contractor shall furnish all piping, bulkheads, pumps or compressors, gauge, and other equipment required for the test. When possible, Contractor to request MHOG to furnish water for testing. Any water used for testing will require use of a reduced-pressure zone backflow preventer and meter.
 3. The section of pipe to be tested shall be cleaned and isolated by valves or plugs, and shall not exceed 2,000 feet for any individual test. Such valves or plugs shall be designed to hold against the test pressure. Sections of pipe shall have an opening through which air or water can be introduced. The supply line shall be fitted with suitable control valves and a pressure gauge for continually measuring the pressure. The pressure gauge shall have a minimum diameter of 3-1/2 inches and a range compatible with the test pressure. Pipelines that cannot be closed for a direct pressure test shall be tested by filling the tanks to which they are connected to the highest operating level or installing temporary test bulkheads. After completion of tests, all

pipes shall be drained. Buried pipelines shall be pressure tested with all pipe joints exposed for visual inspection unless otherwise directed by Engineer.

4. If requested by Engineer, Contractor shall furnish proposed test procedures for approval including pipe identification, test pressure and a description of the method of testing.
 5. In the event that the leakage exceeds the specified amount, the joints in the line shall be carefully inspected for leaks and repaired where necessary. Any pipes or special castings found to be cracked shall be removed and replaced with new pieces by Contractor. After this Work has been done, the test shall be repeated. Final acceptance of the lines will not be made until satisfactory tests have been passed.
- D. All PVC pipe shall be in accordance with ASTM D1599.
1. The manufacturer of each shipment of pipe may be required to supply a statement certifying that each lot or load of pipe has been subjected to the tests specified for PVC pipe and has been found to meet all the requirements of AWWA C909 and AWWA C905 as applicable.
 2. PVC pipe which has been gouged shall not be used. Any scratch or gouge in the pipe that is measured as 10% or more of the wall thickness shall be cause for rejection of that pipe. This shall be monitored by the owner during all phases of construction. PVC pipe which has received minor scratches during handling may be used solely at the discretion of the Authority. PVC pipe shall not be rolled off delivery trucks or other transporting vehicles.
 3. Contractor to install PVC water main in strict accordance with the manufacturer's installation guide, AWWA C605 and AWWA M23 latest revisions thereof. If any of these documents are found to conflict, the most restrictive of the requirements shall be met.
 4. Do not install any PVC pipe contaminated with a petroleum product (inside or out). Do not install any PVC pipe that shows evidence⁴ of exposure to sunlight, age, surface deterioration or other physical damage.
 5. PVC pipe shall be supported uniformly will be stored and not stacked with weight on the bells. All pipe shall be stored in such a way to protect it from exposure from direct sunlight. The pipe may be covered with an opaque material will permitting adequate air circulation above and around the pipe. Gaskets shall be stored in a cold, dark place out of the direct rays of the sun. No pipe showing evidence of sun burning shall be installed.
- E. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure.
1. Hydrostatic Testing (except HDPE): The section of pipe to be tested shall be filled with water, the entrained air within the line shall be removed, and water shall be pressurized up to test pressure at the pipe low point within 5 to 10 minutes.
 - a. The test period shall start immediately after initial pressurization. The line shall be maintained under the test pressure for a continuous 2-hour period.

- b. The section of pipe to be tested shall hold the test pressure with no more than a 5 percent loss in pressure over the test period or the leakage per hour under the conditions of test shall not exceed values determined by the following equation:

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

Where L = allowable leakage per hour (gallons)
S = length of pipe in test (feet)
D = nominal diameter of pipe (inches)
P = average test pressure (psi, gauge)

- c. Piping with flanged, grooved coupling, screwed, socket type, and welded joints shall be completely tight at the designated test pressure.
- d. The test pressure shall not vary by more than 5 psi throughout the entire test period.
2. Hydrostatic Testing of HDPE Pipe: The section of pipe to be tested shall be filled with water, the entrained air within the line shall be removed, and water shall be pressurized up to test pressure at the pipe low point within 5 to 10 minutes. To compensate for expansion after initial pressurization, sufficient make-up water shall be added into the pipe system at hourly intervals for 3 hours to raise the pressure back up to the test pressure.
- a. After completion of this initial phase, approximately 4 hours after start of the testing procedure, the actual test shall begin.
- b. The system shall be pressurized up to the test pressure and by make-up water held continuously at the test pressure for at least 1 hour, but no more than 3 hours.
- c. The make-up water used during the test shall be measured and shall not exceed the allowance given in the table below.
3. The Contractor shall not pressure test against a closed valve unless the new main has already been disinfected and the bacteriological samples have passed.
4. All water used during testing shall be metered.

ALLOWANCE FOR EXPANSION OF HDPE PIPE UNDER TEST PRESSURE

Allowance for Expansion
(U.S. Gallons per 100 Feet of Pipe)

| Nominal Pipe Size (In.) | 1-Hour Test | 2-Hour Test | 3-Hour Test |
|-------------------------|-------------|-------------|-------------|
| 3 | 0.10 | 0.15 | 0.25 |
| 4 | 0.13 | 0.25 | 0.40 |
| 6 | 0.30 | 0.60 | 0.90 |
| 8 | 0.50 | 1.0 | 1.5 |
| 10 | 0.75 | 1.3 | 2.1 |
| 11 | 1.0 | 2.0 | 3.0 |
| 12 | 1.1 | 2.3 | 3.4 |
| 14 | 1.4 | 2.8 | 4.2 |
| 16 | 1.7 | 3.3 | 5.0 |
| 18 | 2.2 | 4.3 | 6.5 |
| 20 | 2.8 | 5.5 | 8.0 |
| 22 | 3.5 | 7.0 | 10.5 |
| 24 | 4.5 | 11.1 | 16.8 |
| 28 | 5.5 | 11.1 | 16.8 |
| 32 | 7.0 | 14.3 | 21.5 |
| 36 | 9.0 | 18.0 | 27.0 |
| 40 | 11.0 | 22.0 | 33.0 |
| 48 | 15.0 | 27.0 | 43.0 |
| 54 | 22.0 | 35.0 | 55.0 |

- a. If there are no visible leaks or pressure drops greater than 5 psi during the actual test period, the system passes the test. If leakage is revealed, however, the defect shall be corrected and a retest shall be made after a 24-hour minimum depressurized recuperation period.
- 5. Pneumatic Testing: The section of pipe to be tested shall be filled with air and pumped up to test pressure.
 - a. Sufficient time shall be allowed for the air pressures to stabilize at the test pressure. After the stabilization period, the air control valve shall be closed and the test period started. The section of pipe shall be maintained under the test pressure for a continuous 4-hour period with no more than a 10 percent loss in pressure over the entire test period.
 - b. Pneumatic testing of HDPE pipe shall not be allowed.
- 6. Each valve assembly shall be tested by Contractor; the test shall consist of opening and closing the valve.
- 7. Each hydrant assembly shall be tested by Contractor; the test shall consist of flushing the hydrant for a minimum of ten minutes. During the test period the 6-inch gate valve shall be closed and opened. Contractor shall furnish necessary hoses for the disposal of Owner-furnished water.

F. Prepare reports of testing activities.

3.14 IDENTIFICATION

- A. Install continuous underground electronic detectable tracer wire during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly on top of the piping. Tracer wire requirements are specified in this section.

3.15 DISINFECTION

- A. Disinfection Products:
 - 1. Liquid Chlorine shall not be allowed.
 - 2. Use NSF 60 certified granular chlorine for disinfection.
- B. Clean and disinfect water-distribution piping according to procedures detailed in Design Standards Part IV – Approved Procedures.

END OF SECTION 22 11 13