

**SECTION 02665  
WATER MAINS AND ACCESORIES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section describes products to be incorporated into the water mains and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

**1.02 QUALIFICATIONS**

If requested by the City, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

**1.03 SUBMITTALS**

Complete shop drawings, product data and engineering data for all products shall be submitted to the City.

**1.04 TRANSPORTATION AND HANDLING**

- A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification. Pipe handled on skids shall not be rolled or skidded against the pipe on the ground.
- B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front end loader. Do not use material damaged in handling. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe.

**1.05 STORAGE AND PROTECTION**

- A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.
- B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.
- C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be

alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.

- D. Stored mechanical and push-on joint gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.
- E. Mechanical-joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

## **1.06 QUALITY ASSURANCE**

The manufacturer shall provide written certification to the City that all products furnished comply with all applicable requirements of these Specifications.

## **1.07 RELATED SECTIONS**

- 1. Section 02200-Basic Pipeline Construction

## **PART 2 PRODUCTS**

### **2.01 PIPING MATERIALS AND ACCESSORIES**

- A. Ductile Iron Pipe (DIP)
  - 1. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall be Pressure Class 350 and have corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings.
  - 2. Pipe and fittings shall be cement lined in accordance with AWWA C104. Pipe and fittings shall be furnished with a bituminous outside coating.
  - 3. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi.
  - 4. Joints: Unless shown or specified otherwise, joints shall be push-on or restrained joint type for pipe and standard mechanical, push-on or restrained joints for fittings. Push-on and mechanical joints shall conform to AWWA C111. Restrainers for bells and couplings shall equal EBBA Iron Works Series 2500 for PVC pipe and Series 6500 for Ductile Iron pipe. No field welding of restrained joint pipe will be permitted.
  - 5. Provide the appropriate gaskets for mechanical and flange joints. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full face type.
  - 6. Bolts and Nuts

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- a. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.
  - b. Bolts and nuts for mechanical joints shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.
  - c. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.
7. Mechanical joint glands shall be ductile iron.
  8. Thrust collars shall be welded-on ductile iron body type designed to withstand thrust due to 250 psi internal pressure on a dead end.
  9. Ductile iron pipe shall be encased in polyethylene film where shown on the Drawings. Polyethylene film shall have a minimum thickness of 8 mils and shall meet the requirements of AWWA C105.
  10. Acceptance will be on the basis of the City's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.
- B. Polyvinyl Chloride (PVC) Pipe and Fittings
1. Pipe
    - a. All PVC pipe shall have integral belled ends for push-on type jointing and shall conform to ASTM D 2241.
    - b. Unless shown otherwise on the Drawings, pipe shall have a Standard Dimension Ratio (SDR) of 26 and shall be capable of withstanding a working pressure of 160 psi, unless indicated otherwise on the Drawings.
    - c. PVC pipe in Georgia DOT right-of-way, the pipe shall have a Standard Dimension Ratio (SDR) of 21 and shall be capable of withstanding a working pressure of 200 psi.
    - d. Pipe shall be supplied in minimum lengths of 20 feet.
  2. All fittings shall be of ductile iron meeting the requirements of AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi. Fittings shall be cement lined in accordance with AWWA C104. Fittings shall be furnished with a bituminous outside coating. Special adapters shall be provided as recommended by the manufacturer to adapt the PVC pipe to mechanical jointing with cast or ductile iron pipe, fittings, or valves.
  3. Acceptance will be on the basis of the City's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved".
- C. High-Density Polyethylene (HDPE) Pipe and Fittings

1. Polyethylene Pipe and Fittings:

- a. Qualification of Manufacturers: The Manufacturer shall have manufacturing and quality assurance facilities capable of producing and assuring the quality of the pipe and fittings required by these Specifications. The Manufacturer's production facilities shall be open for inspection by the Owner or his Authorized Representative. The Project Engineer shall approve qualified Manufacturers.
- b. Approved Manufacturers: Manufacturers that are qualified and approved by the Project Engineer are listed below. Products from unapproved manufacturers are prohibited.

Performance Pipe, a division of Chevron Phillips Chemical Company LP or JM manufacturing out of Adel, Georgia.

- c. Materials: Black PE materials used for the manufacture of polyethylene pipe and fittings shall be PE 4710 high density polyethylene meeting ASTM D 3350 cell classification 445574C/E and shall be Listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4 with a standard grade HDB rating of 1600 psi at 73°F. Color material, when used, shall be the same except for meeting ASTM D 3350 cell classification 445576E. The material shall be listed and approved for potable water in accordance with NSF Standard 61. When requested on the order, the Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.
- d. Interchangeability of Pipe and Fittings: The same Qualified and Approved Manufacturer shall produce polyethylene pipe and fittings. Products such as fittings or flange adapters made by sub-contractors or distributors are prohibited.
- e. Polyethylene Pipe: Polyethylene pipe shall be manufactured in accordance with AWWA C901-96 for sizes 1-1/4" thru 3" IPS diameters and to the requirements of ASTM D3035. Pipe 4" IPS and DIPS sizes 4" and above shall be manufactured to the requirements of ASTM F714 and AWWA C906-99 (IPS).
- f. Optional Service Identification Stripes for IPS Sized Pipe: IPS pipes shall be black. When requested as an option, IPS pipes shall have four, equally spaced, blue color stripes co-extruded into the pipe outside surface. Stripes printed on the pipe outside surface shall not be acceptable.
- g. Service Identification Stripes for DIPS Sized Pipe: DIPS sized pipes shall have three equally spaced pairs of longitudinal blue color stripes co-extruded into the pipe outside surface. Stripes printed on the outside surface shall not be acceptable.

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- h. Optional Color Shell: When requested as an option, a blue color shell co-extruded into the pipe outer surface shall permanently identify IPS or DIPS pipes.
- i. Polyethylene Fittings & Custom Fabrications: Polyethylene fittings and custom fabrications shall be molded or fabricated by the Approved Pipe Manufacturer. All fittings and custom fabrications shall be pressure rated for the same internal pressure rating as the mating pipe.
- j. Molded Fittings: Molded fittings shall be manufactured and tested in accordance with ASTM D 3261 and shall be so marked. Molded fittings shall be tested in accordance with AWWA C906.
  - 1) X-Ray Inspection: The Manufacturer shall submit samples from each molded fittings production lot to x-ray inspection.
- k. Fabricated Fittings: Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe. Fabricated fittings shall be tested in accordance with AWWA C906.
- l. Polyethylene Flange Adapters: 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. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves (serrations) to promote gasketless sealing, or restrain the gasket against blowout.
- m. Back-up Rings & Flange Bolts: Flange adapters shall be fitted with back-up rings that are pressure rated equal to or greater than the mating pipe. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 3 or higher.
- n. MJ Adapters: MJ Adapters 4" thru 16" shall be provided with Stainless Steel Stiffener. MJ Adapters 14" and above shall be provided with Heavy Duty Back-up Ring Kits. All MJ adapters 18" and above must be provided with Stainless Steel stiffeners.
- o. Compliance Tests: Manufacturer's inspection and testing of the materials. In case of conflict with Manufacturer's certifications, the Contractor, Project Engineer, or Owner may request retesting by the Manufacturer or have retests performed by an outside testing service. All retesting shall be at the requestor's expense, and shall be performed in accordance with these Specifications.

## **2.02 GATE VALVES (GV)**

- A. Gate valves shall be mechanical joint end, resilient seat, iron body, bronze mounted, non-rising stem with O-ring stemseals, open left. Gate valves 3" through 12" shall be designed for a water working pressure of 200 psi and a test pressure of 400 psi. Valves 14" and larger shall be designed for a water working pressure of 150 psi and a test pressure of 300 psi. Valves 4" through 12" will be designed for installing in a vertical position. Valves larger than 12" will be designed for a horizontal installation and equipped with bevel gearing, gear case, tracks, rollers, scrapers and by-pass valves. Only American made valves will be accepted.
- B. Gate valves shall conform to AWWA standard specification C-500, latest revision for "Ordinary Water Works Service" and shall be M & H C 509 or Mueller A 2360-20.

## **2.03 FIRE HYDRANTS (FH)**

- A. All fire hydrants shall conform to the requirements of AWWA C 502 for 200 psi working pressure. Hydrants shall be the compression type, closing with line pressure. The valve opening shall match existing hydrants.
- B. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.
- C. The means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight different directions.
- D. Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.
- E. All working parts, including the seat ring shall be removable through the top without disturbing the barrel of the hydrant.
- F. The operating nut shall match standard hydrant. The operating threads shall be totally enclosed in an operating chamber separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or oil reservoir. A stop nut shall be positioned in the top operating mechanism so that the valve cannot contact the bottom of the shoe when fully open.
- G. Hydrant shall be a non-freezing design and provided with a simple, positive, and automatic drain which shall be fully closed whenever the main valve is opened.
- H. Hose and pumper connections shall be breech-locked, pinned, and complete with O-ring seal or threaded and pinned, to seal them permanently into the hydrant barrel. Each hydrant shall have two 2-1/2 inch hose connections, and one 4-1/2 inch pumper connection with National Standard threads. Equip each connection with cap and chain.
- I. Hydrants shall be installed with DI hydrant lead and rodded as detailed.

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- J. Minimum depth of bury shall be 4-1/2 feet. Provide extension section where necessary for vertical installation and in accordance with manufacturer's recommendations.
- K. All outside surfaces of the barrel above grade shall be painted silver with Koppers Glamortex 501 enamel or equal.
- L. Hydrants shall be oil reserved, Mueller A 423 or M.H. 929 reliant.
- M. All new fire hydrants shall be covered with a bag until the water mains and fire hydrants are in service.

### **2.04 VALVE BOXES (VB) AND EXTENSION STEMS**

- A. All valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6-inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve-operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "WATER VALVE" or "WATER" cast into them. Valve boxes shall be manufactured in the United States and shall be equal to U.S. Foundry No. 7500-screw type.
- B. Extension stems shall be provided so as to set the top of the operating nut 30-inches below finished grade. Connection to the valve shall be with a wrench nut coupling and a setscrew to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller A-26441 or M & H Valve Style 3801.
- C. Extension stems shall have a concrete collar (a.k.a. "donut") or approved equal placed around the top of the extension stem after compaction. Area between extension stem and collar shall be grouted in place.

### **2.05 TAPPING SLEEVES AND VALVES (TS&V)**

Tapping sleeves shall be stainless steel of the split-sleeve, mechanical joint type. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve. Valves shall be gate valves furnished in accordance with the specifications shown above, with mechanical joint connection to the tapping sleeve and mechanical joint connection to the branch pipe. Tapping sleeves shall be equal to JCM Industries Model 432.

### **2.06 VALVE MARKERS**

The Contractor shall provide a concrete valve marker with brass plate as detailed on the Drawings for each valve installed. Valve markers shall be stamped "WATER". Contractor shall provide raised pavement markers that meet the specifications and requirements set forth in the most current edition of the State of Georgia Department of Transportation "Standard

Specifications for the Construction of Roads and Bridges”, Section 654. RPM shall be installed as specified in Part 3 of this Section.

**2.07 BACKFLOW PREVENTION**

All non residential backflow prevention devices shall be of a reduced pressure zone type and equipped with replaceable bronze seats and gate valves with levers and/or hand wheels. Backflow prevention devices shall be a Watts Series 909 or approved equal. Additional options may be required by the City on a case by case basis. Residential backflow prevention devices shall meet the requirements in Section 02668: Water Service Connections.

**2.08 RETAINER GLANDS**

- A. Retainer glands for ductile iron pipe shall be Megalug Series 1100, as manufactured by EBAA Iron Sales, Inc.
- B. Retainer glands for polyvinyl chloride pipe shall be Megalug Series 2000 PV, as manufactured by EBAA Iron Sales, Inc.

**2.09 HYDRANT TEES**

Hydrant tees shall be equal to ACIPCO A10180 or U.S. Pipe U-592.

**2.10 ANCHOR COUPLINGS**

Lengths and sizes shall be as shown on the Drawings. Anchor couplings shall be equal to ACIPCO A 10895 or U.S. Pipe U-591.

**2.11 CONCRETE**

Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the City. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

**2.12 DETECTION TAPE & WIRE**

Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Water Systems, Safety Precaution Blue, "Caution: Water Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape Wire. In addition, prior to backfill of trench the Contractor shall furnish and install 12 gauge, stranded, blue coated copper wire. The wire shall be installed along the pipe during the backfill operation. Wire shall be brought up at each hydrant. Wire shall be



spliced together using DRYCONN waterproof connectors.

**PART 3 EXECUTION**

**3.01 LOCATION AND GRADE**

- A. The Drawings show the alignment of the water main and the location of valves, hydrants and other appurtenances. Water mains shall be constructed at a depth as specified in Section 02225, Article 3.01, Paragraph D.
- B. After the Contractor locates and marks the water main centerline or baseline, the Contractor shall perform clearing and grubbing.
- C. Construction shall begin at a connection location and proceed without interruption. Multiple construction sites shall not be permitted without written authorization from the City for each site.

**3.02 LAYING AND JOINTING PIPE AND ACCESSORIES**

- A. Lay all pipe and fittings to accurately conform to the lines and grades established by the engineering plans.
- B. Pipe Installation (DI & PVC)
  - 1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings, valves and hydrants shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.
  - 2. All pipe, fittings, valves, hydrants and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the City, who may prescribe corrective repairs or reject the materials.
  - 3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.
  - 4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
  - 5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
  - 6. It is not mandatory to lay pipe with the bells facing the direction in which work is

progressing.

7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade, shall not be permitted.

C. Pipe Installation (HDPE)

1. General: When delivered, a receiving inspection shall be performed and any shipping damage shall be reported to the manufacturer within 7 days. Installation shall be in accordance with ASTM D 2774, Manufacturer's recommendations and this specification. All necessary precautions shall be taken to ensure a safe working environment in accordance with all applicable safety codes and standards.
2. Excavation: Trench excavations shall conform to the plans and drawings, as authorized in writing by the Project Engineer or his Approved Representative and in accordance with all applicable codes. The Contractor shall remove excess groundwater. Where necessary, trench walls shall be shored or reinforced, and all necessary precautions shall be taken to ensure a safe working environment.
3. Large Diameter Fabricated Fittings: Not more than one plain-end connection of 16" IPS and larger fabricated directional fittings (elbows, tees, etc.) shall be butt fused to the end of a pipe length before placing the assembly into the trench. The remaining fitting connections shall be made in the trench using butt fusion, flange or other connection means in accordance with *Paragraph G, Section 2*. Flange and other mechanical connections shall be assembled, and tightened in accordance with the connection manufacturer's instructions and *Paragraph C, Section 4*. Handling, lifting, moving or lowering a 16" IPS or larger fabricated fitting that is connected to more than one pipe length is prohibited. The installing contractor at his expense shall correct fitting damage caused by such improper handling.
4. Mechanical Joint & Flange Installation: Mechanical joint and flange connections shall be installed in accordance with the Manufacturer's recommended procedure. MJ Adapters and flanges shall be centered and aligned to the mating component before assembling and tightening bolts. In no case shall MJ gland or flange bolts be used to draw the connection into alignment. Bolt threads shall be lubricated, and flat washers should be used under the nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least one (1) hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be as recommended by the Manufacturer.
5. Foundation & Bedding: Pipe shall be laid on grade and on a stable foundation. Unstable trench bottom soils shall be removed, and a 6" foundation or bedding of compacted Class I material shall be installed to pipe bottom grade. Excess groundwater shall be removed from the trench before laying the foundation or bedding for the pipe. A trench cut in rock or stony soil shall be excavated to 6" below pipe bottom grade, and brought back to grade with compacted Class I

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bedding. All ledge rock, boulders and large stones shall be removed.

6. Pipe Handling: When lifting with slings, only wide fabric choker slings capable of safely carrying the load shall be used to lift, move, or lower pipe and fittings. Wire rope and chain are prohibited. Slings shall be of sufficient capacity for the load, and shall be inspected before use. Worn or damaged equipment shall not be used.
7. Backfilling: Embedment material soil type and particle size shall be in accordance with ASTM D 2774. Embedment shall be placed and compacted to at least 90% Standard Proctor Density in 6" lifts to at least 6" above the pipe crown. During embedment placement and compaction, care shall be taken to ensure that the haunch areas below the pipe springline are completely filled and free of voids.
8. Protection against shear and bending loads: In accordance with ASTM D 2774, connections shall be protected where an underground polyethylene branch or service pipe is joined to a branch fitting such as a service saddle, branch saddle or tapping tee on a main pipe, and where pipes enter or exit casings or walls. The area surrounding the connection shall be embedded in properly placed, compacted backfill, preferably in combination with a protective sleeve or other mechanical structural support to protect the polyethylene pipe against shear and bending loads.
9. Final Backfilling: Final backfill shall be placed and compacted to finished grade. Native soils may be used provided the soil is free of debris, stones, boulders, clumps, frozen clods or the like larger than 8" in their largest dimension.

### D. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.
2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

E. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the City.

### F. Joint Assembly (DI & PVC)

1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.
2. The Contractor shall inspect each pipe joint within 500 feet on either side of main line

valves to insure 100 percent seating of the pipe spigot, except as noted otherwise.

3. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.

G. Joining (HDPE)

1. Heat Fusion Joining: Joints between plain end pipes and fittings shall be made by butt fusion. Joints between the main and saddle branch fittings shall be made using saddle fusion. The butt fusion and saddle fusion procedures used shall be procedures that are recommended by the pipe and fitting Manufacturer. The Contractor shall ensure that persons making heat fusion joints have received training in the Manufacturer's recommended procedure. The Contractor shall maintain records of trained personnel, and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.
  - a) Butt Fusion of Unlike Wall Thickness: Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, SDR 13.5 to SDR 17, or SDR 11 to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or electrofusion. SDR's for polyethylene pipe are 7.3, 9, 11, 13.5, 17, 21, 26, 32.5 and 41.
  - b) Heat Fusion Training Assistance: Upon request and at the requestor's expense, training personnel from the Manufacturer or his Representative shall be made available.
2. Joining by Other Means: Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and back-up rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, (c) MJ Adapters or (d) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.
  - a) ID Stiffener and Restraint: A stiffener shall be installed in the bore of the polyethylene pipe when an OD compression mechanical coupling is used and when connecting plain end PE pipe to a mechanical joint pipe, fitting or appurtenance. External clamp and tie rod restraint shall be installed where PE pipe is connected to the socket of a mechanical joint pipe, fitting or appurtenance except where an MJ Adapter is used.
3. Branch Connections: Branch connections to the main shall be made with saddle fittings or tees. Polyethylene saddle fittings shall be saddle fused to the main pipe per Paragraph G, Section 1 listed above.

- H. Cutting Pipe: Cut ductile iron pipe using an abrasive wheel saw. Cut PVC pipe using a

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suitable saw; remove all burrs and smooth the end before jointing. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.

- I. Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the City. Installation shall be at locations shown on the Drawings.
- J. Valve and Fitting Installation
1. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected or held for inspection by the City. Valves shall be closed before being installed.
  2. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying and joining pipe, except that 12-inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.
  3. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 60-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the City.
  4. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.
  5. A valve marker shall be provided for each underground valve. Unless otherwise detailed on the Drawings or directed by the City, valve markers shall be installed 6-inches inside the right-of-way or easement. Raised pavement markers (RPM's) shall be provided and installed along the appropriate roadway centerline for each in-line valve on City owned right-of-way. RPM's for in-line valves shall be Type I, two-way, and white in color.
- K. Hydrant Installation
1. After staking the location of hydrants, Contractor shall contact City for final approval of hydrant location regardless of location shown on construction drawings.

2. Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating nut and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage and cracks. Defective hydrants shall be corrected or held for inspection by the City.
3. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the roadway, with pumper nozzle facing the roadway, except that hydrants having two-hose nozzles 90 degrees apart shall be set with each nozzle facing the roadway at an angle of 45 degrees.
4. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle at least 18-inches above the ground, no more than 30-inches above the ground or as directed by the City.
5. Each hydrant shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve. When a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least 6-inches above the drain port opening in the hydrant to a distance of 18-inches around the elbow.
6. When a hydrant is set in clay or other impervious soil, a drainage pit 2 x 2 x 2 feet shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant and to a level of 6-inches above the drain port.
7. Hydrants shall be located as shown on the Drawings or as directed by the City. In the case of hydrants that are intended to fail at the ground-line joint upon vehicle impact, specific care must be taken to provide adequate soil resistance to avoid transmitting shock moment to the lower barrel and inlet connection. In loose or poor load bearing soil, this may be accomplished by pouring a concrete collar approximately 6-inches thick to a diameter of 24-inches at or near the ground line around the hydrant barrel.
8. Raised pavement markers (RPM's) shall be provided and installed along the appropriate roadway centerline for each fire hydrant on City owned right-of-way. RPM's for in-line valves shall be Type I, two-way, and blue in color.

### **3.03 CONNECTIONS TO WATER MAINS**

- A. Make connections to existing pipe lines with tapping sleeves and valves, unless specifically shown otherwise on the Drawings.
- B. Location: Before laying pipe, locate the points of connection to existing water mains and uncover as necessary for the City to confirm the nature of the connection to be made.
- C. Interruption of Services: Make connections to existing water mains only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the City.
- D. Tapping Saddles and Tapping Sleeves

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1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted.
  2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.
  3. Before performing field machine cut, the water tightness of the saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. An air compressor shall be attached, which will induce a test pressure as specified in this Section. No leakage shall be permitted for a period of five minutes.
  4. After attaching the saddle or sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one percent hypochlorite solution.
- E. Connections and Repairs: Where connections or repairs are required, Contractor shall only use solid sleeves and provide all materials and labor necessary to make the connection or repair to the existing pipeline, excluding service lines 2" or smaller.

### 3.04 THRUST RESTRAINT

- A. Provide restraint at all points where hydraulic thrust may develop.
- B. Retainer Glands: Provide retainer glands where shown on the Drawings and on fire hydrants and all associated fittings, valves and related piping. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly, the required torque of the set screws. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.
- C. Harnessing
1. Provide harness rods only where specifically shown on the Drawings or directed by the City.
  2. Harness rods shall be manufactured in accordance with ASTM A 36 and shall have an allowable tensile stress of no less than 22,000 psi. Harness rods shall be hot dip galvanized or field coated with bitumastic before backfilling.
  3. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, provide 90 degree bend eye bolts.
  4. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.
- D. Hydrants: Hydrants shall be attached to the water main as shown on the Standard Detail.
- E. Thrust Collars: Collars shall be constructed as shown on the Drawings. Concrete and

reinforcing steel shall meet the requirements as specified in this Section. The welded-on collar shall be designed to meet the minimum allowable load shown on the Drawings. The welded-on collar shall be attached to the pipe by the pipe manufacturer.

F. Concrete Blocking

1. Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the Drawings.
2. Concrete shall be as specified in this Section.
3. Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the City. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.

**3.05 DETECTION TAPE & WIRE**

Provide detection tape and wire for all water mains.

**3.06 INSPECTION & TESTING - PRESSURE & LEAKAGE TESTING (DI & PVC)**

- A. All sections of the water main subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling.
- B. Each segment of water main between main valves shall be tested individually.
- C. Test Preparation
  1. Flush sections thoroughly at flow velocities, greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats.
  2. Partially operate valves and hydrants to clean out seats.
  3. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.
  4. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Insert corporation cocks at highpoints to expel air as main is filled with water as necessary to supplement automatic air valves. Corporation stops shall be constructed as detailed on the Drawings with a meter box.
  5. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure.
  6. The differential pressure across a valve or hydrant shall equal the maximum possible, but not exceed the rated working pressure. Where necessary, provide temporary backpressure to meet the differential pressure restrictions.



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7. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.
- D. Test Pressure: Test the pipeline at 150 psi or 1.5 times the operating pressure, whichever is greater, measured at the lowest point for at least two hours. Maintain the test pressure within 5 psi of the specified test pressure for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gauge with graduation not greater than 5 psi.
- E. Leakage
  1. Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section, to maintain pressure within 5 psi of the specified test pressure for the test duration. Leakage shall be the total cumulative amount measured on a water meter.
  2. The City assumes no responsibility for leakage occurring through existing valves.
- F. Test Results: No test section shall be accepted if the leakage exceeds the limits determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{133,200}$$

Where: L = allowable leakage, in gallons per hour  
S = length of pipe tested, in feet  
D = nominal diameter of the pipe, in inches  
P = average test pressure during the leakage test, in pounds per square inch (gauge)

As determined under Section 4 of AWWA C600.

If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

- G. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.
- H. Re-Testing: Any alterations made to pipeline performed after initial testing shall be re-tested and passed again, regardless of initial test results.
- I. Notification: The City of Thomasville shall be notified 24-hours in advance prior to Contractor performing pressure and leakage testing.

### **3.07 INSPECTION & TESTING (HDPE)**

- A. Fusion Quality: The Contractor shall ensure the field set-up and operation of the fusion equipment, and the fusion procedure used by the Contractor's fusion operator while on site. Upon request by the Owner, the Contractor shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely; then test straps

shall be cut out and bent strap tested in accordance with ASTM D 2657. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The Contractor at his expense shall make all necessary corrections to equipment, set-up, operation and fusion procedure, and shall re-make the rejected fusions.

- B. Leak Testing: Hydrostatic leak testing shall be conducted in accordance with Performance Pipe Technical Note 802 *Leak Testing*. Pneumatic pressure testing is prohibited.

### **3.08 DISINFECTING PIPELINE**

- A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these Specifications.
- B. Specialty Contractor: Disinfection shall be performed by an approved specialty contractor. Before disinfection is performed, the Contractor shall submit a written procedure for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated water.
- C. Chlorination
  - 1. Apply chlorine solution to achieve a concentration of at least 25 milligrams per liter free chlorine in new line. Retain chlorinated water for 24 hours.
  - 2. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24 hour period.
  - 3. After 24 hours, all samples of water shall contain at least 10 milligrams per liter free chlorine. Re-chlorinate if required results are not obtained on all samples.
- D. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to less than one milligram per liter if discharged directly to a body of water or to less than two milligrams per liter if discharged onto the ground prior to disposal. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.
- E. Bacteriological Testing
  - 1. After final flushing and before the water main is placed in service, the Contractor shall collect samples from the line and have tested for bacteriological quality in accordance with the rules of the Georgia Department of Natural Resources, Environmental Protection Division.
  - 2. The Contractor shall give the City 48-hour written notice of the planned bacteriological testing. A City representative must be present when samples are taken. The Contractor shall be responsible for delivering the samples to the laboratory for testing. The bacteriological samples shall be analyzed for both coliform and non-coliform growth. Testing shall be performed by a laboratory certified by the State of Georgia and approved by the City.
  - 3. All sampling and testing costs shall be paid for by the Contractor prior to final

acceptance.

4. Re-chlorinate lines until required results are obtained.

**END OF SECTION**

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