

SECTION 01300

WATER LINES

PART I - GENERAL

1. APPLICABLE STANDARDS:

- 1.1 All materials/products that contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61.
- 1.2 All chemicals/products added to the public water supply must be third party certified as meeting the specifications of ANSI/NSF Standard 60.
- 1.3 All products, installation and testing of water lines shall meet the requirements of the "STATE PRIMARY DRINKING WATER REGULATIONS" - R.61-58.
- 1.4 Natural rubber or other materials which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing pipes, setting meters or valves, or other appurtenances which will expose the material to the water.

Lubricants which will support microbiological growth shall not be used for slip-on joints. Vegetable shortening shall not be used to lubricate joints.

- 1.5 All water main pipe shall be white or blue colored. Under no condition shall a water main be green colored pipe.
- 1.6 Reference made to the following ANSI/AWWA Standards: ANSI/AWWA C104/A21.4, ANSI/AWWA C105/A21.5, ANSI/AWWA C110/A21.10, ANSI/AWWA C111/A21.11, ANSI/AWWA C115/A21.15, ANSI/AWWA C150/A21.50, ANSI/AWWA C151/A21.51, ANSI/AWWA C153/A21.53, ANSI/AWWA C600, ANSI/AWWA C606, and ANSI/AWWA D11.2, latest standards.

1.7 Quality Assurance:

Require submitted evidence that the ductile iron pipe and fitting manufacturer has a minimum of ten years experience in material production of diameters noted on the plans and specifications. All pipe material suppliers shall be ISO registered or provide the services of an independent inspection agency. Prior to the start of manufacturing, any manufacturer not meeting the ISO registration shall submit to the owner and owner's engineer the names of an independent inspection agency for approval. The independent inspection agency shall be responsible for sample monitoring of chemical and mechanical test, sample visual inspection of quality assurance tests performed on inprocess pipe and fittings, and sample visual and dimensional inspection or finished product for this project. A certified inspection report from the independent inspection agency of all witnessed tests shall be supplied to the owner or owner's engineers within ten (10) days of the completion of pipe manufacturing. Chemical samples shall be taken from each ladle of iron and the manufacturers' chemical control limits shall be maintained for at least the following elements: carbon, sulfur, phosphorus, silicon, magnesium, chromium,

manganese, tin, aluminum, cerium, copper, and lead. When chemical values fall outside the manufacturer's control limits, additional mechanical property tests shall be performed to assure minimum mechanical properties are met.

PART II - MATERIALS

2. **MATERIALS:** All materials for water line shall be new and shall be furnished in accordance with the following requirements unless shown otherwise on the approved plans. All pipe material, solder, and flux shall be lead free.

2.1 Water Lines, 4 Inch Through 64 Inch:

2.1.1 Ductile Iron Pipe, (4 Inch):

Pipe:	AWWA C151 "Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds, for Water and Other Liquids." Pressure Class 350 unless shown otherwise on the approved drawings.
Fittings:	AWWA C110, ductile iron.
Joints:	AWWA C111 push-on or mechanical for general buried service; flanged for exposed service unless approved otherwise.
Linings:	AWWA C104 cement lining, standard thickness, bituminous exterior seal coat.

Ductile Iron Pipe, 6 Inch Through 64 Inch:

Pipe:	AWWA C151 "Ductile Iron Pipe, Centrifugally Cast in Metals Molds or Sand Lined Molds, for Water and Other Liquids." Pressure Class 350 for 6 inch to 12 inch pipe, Pressure Class 250 for 14 inch to 20 inch pipe, Pressure Class 200 for 24 inch pipe and Pressure Class 150 for 30 inch to 64 inch pipe.
Fittings:	AWWA C110, ductile iron.
Joints:	AWWA C111 push-on or mechanical for general buried service; flanged for exposed service unless shown otherwise.
Linings:	AWWA C104 cement lining, standard thickness, bituminous exterior seal coat.

2.1.2 PVC Pipe, 3 Inches and Smaller:

Pipe:	ASTM D-2241 Polyvinyl Chloride (PVC) Pressure Water Pipe. Pipe provided shall be iron pipe sized. Pipe shall be pressure rating 200 (SDR 21) unless otherwise shown on the approved drawings. All PVC pipe shall bear the NSF potable water logo. Solvent weld PVC pipe and fittings shall not be allowed.
Fittings:	PVC, Class 200. IPS with bells conforming to ASTM 3139 and gaskets conforming to ASTM F477.
Joints:	Pipe; elastomeric gasket, push-on joints, conforming to ASTM F477 and ASTM 3139. Joints shall be integral bell

and spigot. Solvent-Weld pvc pipe and fittings shall not be used.

2.1.3 PVC Pipe, 4 Inch Through 12 Inch:

- Pipe: ASTM D1785 or ASTM D2241 and AWWA C900 "Polyvinyl Chloride (PVC) Pressure Pipe for Water." Pipe provided shall be cast iron pipe equivalent O.D. Pipe shall be working pressure rated class 150 (DR18) unless shown otherwise on the approved drawings. All PVC pressure pipe shall bear the National Sanitation Foundation Seal (NFS).
- Fittings: Cement lined, ductile iron fittings conforming to AWWA C110.
- Joints: Pipe; elastomeric gasket, push-on joints, conforming to AWWA C900 and C111. Joints shall be integral bell and spigot.

2.1.4 PVC Pipe (14-Inch and Greater – Minimum Requirements)

- Pipe: AWWA C905 SDR 18 Polyvinyl Chloride (PVC) pressure pipe. Pipe provided shall be cast iron pipe equivalent OD. Pipe shall be pressure Class 150.
- Fittings: Cement lined, cast or ductile iron fittings conforming to AWWA C110.
- Joints: Pipe; elastomeric gasket, push-on joints, conforming to AWWA C905 SDR 25. Joints may be integral bell and spigot or couplings. Fittings: AWWA CI 11, push-on.
- Installation: ASTM D-2321.

2.1.5 Steel Pipe will not be allowed.

2.2 Welded-on Outlets:

Welded-on outlets may be used in lieu of the tees shown on the plans. All welded-on outlets shall be rated for a working pressure of 250 psi and shall have a minimum safety factor of 2.0; except that 36" welded-on outlets for 54"-64" parent pipe diameters shall be rated at 200 psi. Welded-on outlets may be provided as a radial (tee) outlet, a tangential outlet, or a lateral outlet. Parent pipe and branch pipe shall meet hydrostatic test requirements in accordance with AWWA C151, section 51-9, prior to fabrication.

All joints on welded-on branch outlets shall be provided in accordance with the latest revision of ANSI/AWWA C111/21.11 and/or ANSI/AWWA C115/A21.15, as applicable. All outlets shall be fabricated from centrifugally cast ductile iron pipe designed in accordance with ANSI/AWWA C150/A21.50 and manufactured in accordance with ANSI/AWWA C151/A21.51. All welds must be produced using 55% nickel iron welding rod or wire. Carbon steel electrodes will not be acceptable. Both branch and parent outlet pipe shall be class 53. After fabrication each outlet pipe shall be air tested to 15 psi to insure weld integrity. A soap and water solution shall be applied during the testing procedure to inspect the weld for leakage. Any welds that show air

seepage shall be re-fabricated and retested. Welded-on bosses will not be permitted. All welded-on outlets shall be done at manufacturer's plant.

The type of pipe end for the branch outlet shall be specified or indicated on the drawings. The maximum size and laying length of the welded-on branch outlet shall be recommended by the pipe manufacturer and acceptable to the Engineer for the field conditions and connecting pipe or valve. Pipe embedment material and trench backfill shall be placed and compacted under and around each side of the outlet to hold the pipe in proper position and alignment during subsequent pipe jointing, embedment, and backfilling operations.

2.3 Valves:

- 2.3.1 Gate Valves - 2" through 12": shall be resilient-seated, ductile iron body, conforming to AWWA C509, latest revision. Sealing mechanism shall provide zero leakage at the water working pressure against the line flow from either direction and be designed such that no exposed metal seams, edges, screws, etc. are within the waterway in the closed position. The gate shall not be wedged into a pocket nor slide across the seating surface to obtain tight closures. All internal and external ferrous surfaces of the valve, including the interior of the gate, shall be coated with a protective coating conforming to AWWA C550, latest revision. Coating shall be applied to castings prior to assembly to assure all exposed areas will be covered. Valves shall be rated at 200 psi working pressure. Unless otherwise approved, underground valves shall have an operating nut and exposed valves shall have a hand wheel operator. Valves shall open to the left, or counter-clockwise.
- 2.3.2 Gate Valves Greater than 12": shall be double-disk, parallel seat, ductile iron body, bronze mounted, bottom-wedge type conforming to AWWA C500, latest revision. Valves 16" and larger, for working pressures greater than 50 psi shall be provided with a spur or bevel gear operator and a bypass. Bypass valves shall be the same design as the parent valve. Gear ratios and bypasses shall conform to AWWA C500. Valves shall be rated at 150 psi working pressure. Valves shall open to the left, or counter-clockwise.
- 2.3.3 Tapping Sleeves and Valves: shall be the type designed for making connections to existing water lines without loss of water or interruption of service. Sleeves for size-on-size shall be the ductile iron split repair type suitable for 200 psi working pressure. If reducing size, sleeve may be epoxy-coated with stainless steel bolts. Joints shall be suitable for the intended use. Valves shall be the same construction as standard AWWA gate valves, complete with operating nut and suitable for 200 psi working pressure less than 12" and 150 psi for valves 12" and greater.
- 2.3.4 Butterfly Valves: All butterfly valves shall be of the rubber-seated tight-closing type. They shall meet or exceed AWWA Standard C504.
 - 2.3.4.1 Both valve ends shall be mechanical-joint type per AWWA Standard C111. Accessories such as bolts, glands, and gaskets shall be supplied by the valve manufacturer.

- 2.3.4.2 All valves must be full AWWA C504, Class 150B valve shaft diameter and full Class 150B underground service operator torque in emergency service. All valves shall be NSF approved.
- 2.3.4.3 Valve body shall be high-strength cast-iron ASTM A126, Class B with 18-8 Type 304 stainless steel body seat. Valve vane shall be high-strength cast-iron ASTM A48, Class 40, having rubber seat mechanically secured with an integral 18-8 stainless steel clamp ring and 18-8 stainless steel self-locking screws.
- 2.3.4.4 Valve operator shall be of the traveling-nut type, sealed, gasketed and lubricated for underground service. It shall be capable of withstanding an overload input torque of 450 ft./lbs at full open or full closed position without damage to the valve or valve operator.
- 2.3.4.5 Standard coating shall be applied to all surfaces of valve body and vane to an average minimum thickness of 5 mils, conforming to AWWA C550 Standard.

2.3.5 Valve Boxes:

2.3.5.1 Valve Boxes for Main Line Extensions and Tapping Valves

- (a) Valve boxes shall be provided for buried valves. Valve boxes shall be one complete assembled unit composed of the valve box and extension stem. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. Valve box assembly shall be adjustable to accommodate variable trench depths. The entire assembly shall be made of heavy wall high density polyethylene. All exterior components shall be joined with stainless steel screws. The valve box top section shall be adaptable to fit inside a valve box upper section. The stem assembly shall be of the telescoping design that allows for variable adjustment length. The stem material shall be of plated steel square tubing. The stem assembly shall have a built in device that keeps the stem assembly from disengaging at its full extended length. The extension stem must be torque tested to 1000 foot pounds. Valve box shall have gray iron lid and top. Valve box shall be American Flow Control's Trench Adapter or approved equal.

2.3.5.2 Valves Boxes for Standard Applications in Distribution Lines

- (a) Each valve buried in the ground shall be provided with an approved type of valve box and cover. The boxes shall be adjustable slip-joint or screw type.
- (b) Valve boxes shall be made of close-grained gray cast iron. They shall consist of three pieces; comprising the lower or base pieces which shall be belled at the bottom to fit around the stuffing box gland and rest on the valve bonnet, the upper part of which shall be flared on the lower end to telescope on a socket to receive the cap or cover. The cap or cover shall have the word "Water" cast on the upper surface in raised letters. All castings shall be thoroughly cleaned and heavily coated with asphalt or coal-tar varnish.

- (c) Each Valve box shall be provided with a concrete valve marker/protector as detailed herein.
- (d) Each valve box shall be fitted with an extension stem for use with the buried service non-rising stem valves. The stem shall be of metal and used to extend the position of the 2" operating nut within 6 inches of grade. Each stem shall be fitted with a self-centering disk below the operating nut to keep the stem aligned in the valve box and minimize the amount of grit that can enter the valve box.

2.3.6 Air Release Valves:

It is a SCDHEC requirement [R61-58.4.D.(10)(a)] that automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.

Air release valves shall be the type shown on plans and as approved by the Commission. Combination Air Valves shall be installed on all significant high points of the system. Air/Vacuum Valves shall be installed on prolonged uphill or downhill segments that are subject to vacuum collapse from rupture of the water main. Air Release Valves shall be installed on all other high points of the system.

2.3.6.1 Combination Air Release Valves shall be designed to permit automatic escape of large quantities of air from a pipeline when the line is being filled, and permit air to enter to pipeline when the line is being drained. It will also allow accumulating air to escape while the line is in operation. This shall be accomplished through the functioning of a compound lever system in conjunction with a large and small orifice in one integral body casting. Materials shall include cast iron body and cover, bronze float stem and guide, rubber seat and stainless steel float. Valve shall be designed for working pressure of 150 psi and required venting rates. Combination Air Release Valve shall be Golden Anderson Fig. 945, Crispin or approved equal.

2.3.6.2 Air/Vacuum Valves in Air/Vacuum Mains: Shall be the type specifically designed for use with water. Valves shall be designed to vent large quantities of air when the line is being filled and to allow air to re-enter the line when it is being drained. Materials shall include cast iron body and cover, bronze float stem and guide, rubber seat and stainless steel float. Valve shall be designed for working pressure of 150 psi and required venting rates. Air/Vacuum Valve shall be Golden Anderson Fig. 930, Crispin or approved equal.

2.3.6.3 Air Release Valves Water Mains: shall be the type designed for use with water. Valves shall be designed to operate (open) while pressurized allowing entrained air in a water main to escape through the air release orifice. Materials shall include cast include cast iron body and cover, rubber seat, stainless steel float stem and internal linkages. The valve shall be designed for working

pressures of 150 psi and required venting rates. Air Release Valves shall be Golden Anderson Fig. 905, Crispin or approved equal.

- 2.3.7 Air Release Valve Vault: Air Valve Manholes shall be 4 feet in diameter precast concrete sections conforming to ASTM C-478. Flat tops shall be provided unless otherwise approved. Frame and cover shall be good quality domestic manufacture conforming to ASTM A48, Class 30 or better. Cover shall be a solid heavy duty casting with the word "Water" cast in the lid. Cover shall be set off center to facilitate access. Heavy duty hard rubber MH steps shall be provided in all manholes. The vault shall be installed on a gravel bed (8" min. thickness), with sufficient clearance between the valve and gravel to remove or service the valve.

2.4 Fire Hydrants:

- 2.4.1 Fire Hydrants shall conform to the standard specifications of the American Water Works Association (C502-latest revision) and shall be of the three (3) way type. Rated working pressure shall be 250 psi. The hydrant valve opening shall not be less than five and one-quarter (5-1/4) inches. Each hydrant shall be equipped with two (2) two and one-half (2-1/2) inch hose connections and one (1) steamer connection. The hydrants shall be fitted with bell ends to accommodate the spigot end of six (6) inch Ductile Iron Pipe and have the standard one and one-half inch pentagon operating nut. **Hydrant shall open to the left, or counter clockwise. All hydrants shall be factory painted Federal Safety Blue Sherwin Williams 15092. Hydrant base shall be epoxy coated.**
- 2.4.2 The barrel of the hydrant shall be of proper length to permit a three-and - one half (3-1/2) foot bury. The valve shall be designed to close against the pressure of the distribution system and remain closed in the event of the upper part of the barrel being broken. All Bolts and nuts shall be stainless steel.
- 2.4.3 A flange shall be provided, above ground level, to permit adjusting the facing of the hydrant. The hydrant shall be so designed and constructed as to permit replacement of the upper portion of the barrel without digging.
- 2.4.4 Each nozzle shall have a cast iron cap, suitably attached to the hydrant barrel by means of a chain. Nozzle caps shall be provided with leather gaskets.
- 2.4.5 Hose nipples shall be of the removable type and shall conform to the existing hose nipples in use by the Owner. On a new system they shall have National Standard Threads on the hose connection side.
- 2.4.6 All fire hydrants furnished shall be of the type known as "breakable" in order that the hydrant barrel may be broken without damaging the lower portion of the hydrant in case of an accident.

- 2.4.7 All fire hydrants furnished shall be American Darling 5 1/4" B-84-B Fire Hydrant. All replacement parts shall be only those recommended by the manufacturer.
- 2.4.8 All hydrants and hydrant's valves shall be rodded or restrained (megalugs) to hydrant tees. Hydrant leads shall be Ductile Iron (DI) pipe.
- 2.3.8.1 Clamps, Straps, and Washers: ASTM A 506, steel.
 - 2.3.8.2 Rods: ASTM 575, steel.
 - 2.3.8.3 Rod Couplings: ASTM A 197, malleable iron.
 - 2.3.8.4 Bolts: ASTM A 307, steel.
- 2.5 Steel Encasing Pipe shall be smooth wall, meeting or exceeding ASTM A-139 Grade B 35,000 psi minimum yield strength with minimum wall thickness as defined below:
- | Steel Encasing
Pipe Size O.D. | Wall Thickness
(Inches) | For Use with Carrier
Pipes of the Following
Diameters |
|----------------------------------|----------------------------|---|
| 12" | 0.188 | 4" |
| 16" | 0.188 | 6" |
| 20" | 0.188 | 8" |
| 24" | 0.250 | 12" & 10" |
| 30" | 0.312 | 16" & 18" |
- 2.6 Carrier Pipe Supports Within Steel Casing: shall be steel plate, cold formed structural collar with flanges and a minimum of four support legs welded to the collar. Each support leg shall have a foot or skid welded on the end extending beyond the front and back edge of the collar. The front and rear of each foot shall be angled inwardly towards the collar to serve as a stable, effective skid during installation of the carrier pipe. The carrier support shall be securely fastened to the carrier pipe with a heavy duty 1/2" grade 5 bolt and locking nut passing between the flanges, compressing the collar against the carrier pipe. The support device shall be a "Spider" or approved equal.
- 2.7 End Seals:
- 2.7.1 Provide 1/8" thick rubber end seal to seal each end of the casing.
 - 2.7.2 Secure to casing and carrier pipe with Type 316 stainless steel bands.
 - 2.7.3 Acceptable product: Cascade Manufacturing or approved equal.
- 2.8 Bedding Material: shall consist of washed coarse gravel. Gravel material shall be crushed stone or gravel of strong durable nature and shall conform to the standard size No. 57 per SCOT Section 800 as published in the "Standard Specifications for Highway Construction".
- 2.9 Utility Line Marking Wire: where PVC or polyethylene pipe is used in water main construction, a continuous #12 gauge insulated copper tracer wire with blue insulation, approved by the manufacturer for direct burial, shall be installed in the trench. The wire shall terminate at each valve or meter and be arranged to allow the connection of equipment for tracing pipe, and preventing interference for operation of the valve or meter.

2.10 Valve Markers: approved plastic or fiberglass valve markers shall be furnished to the Owner. A marker shall be required for each air release valve and every main line valve or cluster.

2.11 Dedicated Fire Lines: dedicated fire lines shall comply with all NFPC requirements. Minimum size shall be six inches. All dedicated fire lines shall have a double check valve assembly near the connection point to the system. The valve assembly shall be housed above or below ground level in an appropriate concrete enclosure with an aluminum service hatch.

2.12 Blow-off Valves: **Post hydrants shall be utilized as blow-off valves for 4" mains (see Detail WL002).**

M & H Hydrant Style 33 shall be utilized complying with AWWA Standard C-502 (latest revision) and shall produce a minimum velocity of 2.5 Ft./sec. (3.0 Ft./sec. for PVC pipe) and maintain a residual pressure of twenty-five (25) pounds per square inch. Post Hydrants shall be factory painted Federal Safety Blue Sherwin Williams 15092.

2" Water mains shall be a blow-off assembly in a jumbometer box (see Detail WL002A).

Additional requirements by SCDHEC:

- a. Blow-off should not be directed towards roads or so water will flow into creeks, etc. At stream crossings direct away from streams, over ground.
- b. Orifice sized as follows:

Pipe Diameter	Minimum Flow Required	Orifice Size
2.0 inch	25gpm	0.75 inch
2.5 inch	40gpm	1.00 inch
3.0 inch	60gpm	1.25 inch
4.0 inch	100gpm	1.50 inch
6.0 inch	220gpm	2.00 inch
8.0 inch	400gpm	2.50 inch
10 inch	612gpm	Fire Hyd.
12 inch	882gpm	Fire Hyd.
14 inch	1200gpm	Sp. Blow-off
16 inch	1570gpm	Sp. Blow-off

2.13 Water Pressure Reducing Stations: Each water pressure reducing station to consist of two pressure reducing valves piped in parallel and valved for isolation as shown in the drawings. On valve to be full lined size, the second to be sized per the manufacturer's design criteria to handle low flows.

Both valves to be diaphragm style, fluid actuated, automatic control valves piloted to function as water pressure reducing valves. **Valves to be Watts Regulator Series 115A.**

Valves 4" and larger to have flanged end connections. Valves 3" and smaller to have threaded end connections. Valves shall be fusion bond epoxy coated and outfitted with the following extra options:

1. Wye strainer blowdown (4" and larger).
2. Wye strainers with blowdown (3" and smaller).
3. Isolation cocks 3" and smaller (standard 4" and larger).
4. Pilot line blowdown.
5. Cover airbleed/blowdown.
6. #ARD pilot regulator (30-300# adjustable outlet range).
7. All piloting shall be stainless steel.
8. Opening speed control (4" and larger-included as "standard" on 3" and smaller).
9. Closing speed control.

Extra repair parts/kits (one each) shall be furnished with EACH valve (two valves per station) per the following schedule:

1. Main valve elastomer repair kit.
 2. Opening speed control.
 3. Closing speed control.
 4. #ARD pilot regulator.
- 2.14 Isolation Valves (In water pressure reducing stations): Valves 4" and larger shall be wafer style butterfly valves. Watts Regulator #BF04-121-15-M2.

Valves 3" and smaller shall be full port, full flow ball valves or wafer style butterfly valves. Watts Regulator #FBV-3 (ball valves) or #BF04-121-15-M2 (butterfly valves).

- 2.15 Altitude Valves: Valves to be diaphragm style, fluid actuated, automatic control valves piloted to function as one-way flow altitude valves (level control valves). Valves to have flanged end connections. Valves shall be fusion bond epoxy coated and outfitted with the following extra options:

1. Wye strainer with blowdown.
2. Cover blowdown.
3. Isolation cocks.

Extra repair parts/kits (one each) to be furnished with EACH valve per the following schedule:

1. Main valve elastomer repair kit.

2. Opening speed control.
3. Closing speed control.
4. Pilot accelerator valve repair kit.
5. Altitude Control rubber parts repair kit.

Valves to be Watts Regulator series 127-1A only.

- 2.16 Valve and Meter Housing: All meter, pressure reducing valve or altitude valve assemblies larger than 4" shall be installed in housing as detailed in Section 01600.
- 2.17 Backflow Prevention Device: Refer to the "Lexington County Joint Municipal Water and Sewer Commission Backflow Prevention Manual" (latest edition).

PART III - EXECUTION

3.0 INSTALLATION:

- 3.1 Handling: Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Owner. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place. Poly (vinyl chloride) pipe and fittings shall be handled and stored in accordance with the manufacturers recommendations.
- 3.2 Cutting of Pipe: Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Owner, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Squeeze type mechanical cutters shall not be used for ductile iron.
- 3.3 Adjacent Facilities:
- 3.3.1 Sewer Lines and Force Mains: The water pipe shall not be laid closer horizontally than 10 feet from an existing or proposed sewer. Distance

shall be measured edge to edge. All crossings shall maintain a minimum clearance of 18" between the invert of the water main and the top of the sewer. Where water lines cross under gravity-flow sewer lines or the minimum separation can not be maintained, the sewer pipe and water main joints shall be spaced between the mains as far as possible. Adequate structural support shall be provided to the sewer line to prevent damage to the water main. Water lines shall in all cases cross above sewage force mains or inverted siphons. No water main shall come in contact with sewer manholes or catch basin or storm drain structures.

When water main crosses storm drainage lines, ductile iron pipe shall be used with a minimum of 6' on either side of the centerline of the storm drain pipe. When it is impossible to maintain the 10 foot horizontal and 18 inch vertical separation, the following design alternatives shall be submitted to SCDHEC for approval:

- i. maximize the distances between the water main and sewer line and the joints of each;
- ii. ensure the use of materials which meet the requirements R.61.58.4(D)(1) for the sewer line; and,
- iii. allow enough distance to make repairs to one of the lines without damaging the other

- 3.3.2 Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.
- 3.3.3 Water lines shall not be laid within twenty-five (25) feet horizontally from any portion of a wastewater tile/sprayfield unless previously approved by SCDHEC. All water mains shall be located out of all contaminated areas, or shall be otherwise protected by an acceptable method approved by SCDHEC.
- 3.3.4 Nonferrous Metallic Pipe: Where nonferrous metallic pipe, e.g., copper tubing, crosses any ferrous piping material, a minimum vertical separation of 12 inches must be maintained between pipes.

3.4 Joint Deflection:

- 3.4.1 Ductile-Iron Pipe: The maximum allowable deflection will be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.
 - 3.4.2 Flexible Plastic Pipe: Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Engineer, but in no case shall it exceed 3 degrees.
- 3.5 Placing and Laying: Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Under no circumstances shall any of the water line materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Except where necessary in making connections with other lines or as authorized by the Engineer, pipe shall be laid with the bells facing in the direction

of laying. The full length of each section of pipe shall rest solidly upon a continuous and uniform pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Stones, other than bedding material, shall not come in contact with the pipe and shall not be within six (6) inches of the pipe. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joining is completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored. Backfill and compaction shall be in accordance with Section 01500.

- 3.5.1 Final Certification: Upon completion of the project and before final acceptance, the Contractor shall deliver to the Owner a statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in complete accordance with the contract plans and specifications and the manufacturer's prescribed procedures and techniques.
- 3.5.2 Connections: Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. Standard methods are available for making connections to various types of pipe, either under pressure or in the dewatered condition. Where made under pressure, these connections shall be installed as approved by the Commission.
- 3.5.3 Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

3.6 Setting of Fire Hydrants, Valves and Valve Boxes:

- 3.6.1 Fire hydrants shall be located and installed as shown. Each hydrant shall be connected to the main with a 6-inch ductile iron branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the roadway and with the center of the lowest outlet not less than 18 inches above the finished surrounding grade, and the operating nut not more than 48 inches above the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished gradeline immediately after installation to obtain beneficial use of the hydrant as soon as practicable. The hydrant shall be set upon a slab of concrete not less than 4 inches thick and 15 inches square. Not less than 7 cubic feet of free draining broken stone or gravel shall be placed around and beneath the waste opening of dry barrel hydrants to ensure drainage.
- 3.6.2 Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown.

Where feasible, valves shall be located outside the area of roads and streets. Earthfill shall be carefully tamped around each valve box to a distance of 4 feet on all sides of the box, or the undisturbed trench face if less than 4 feet.

- 3.6.3 Valves and hydrants after delivery shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and the hydrant or valve shall be fully opened and fully closed to ensure that all parts are in working condition.
- 3.6.4 Check valves shall be installed in valve pits as shown.
- 3.7 Thrust Block: Plugs, caps, tees and bends deflecting 22-1/2 degrees or more, either vertically or horizontally, on water lines 2-1/2 inches in diameter or larger, and fire hydrants shall be provided with thrust blocking, or metal tie rods and clamps or lugs, as directed. Valves shall be securely anchored or shall be provided with thrust blocking to prevent movement. Thrust blocking shall be concrete of a mix not leaner than 1 cement: 2-1/2 sand: 5 gravel, and having a compressive strength of not less than 2,500 psi after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps shall be protected by galvanizing or by coating with bituminous paint.
- 3.8 Stream-Crossing: Stream crossing construction shall be as detailed on the plans. In addition, all crossing shall have a minimum cover of two feet and DI pipe. For crossings greater than 15 feet, isolation valves at each end and a blow-off on the side opposite to the supply service shall be provided. It is a SCDHEC requirement that for above-water crossings the pipe shall be adequately supported and anchored, protected from damage and freezing, accessible for repair or replacement. Blow-off shall be directed away from streams, over ground.
- 3.9 Hydrostatic Tests: Where any section of a water line is provided with concrete thrust blocking for fitting or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking unless otherwise approved. The method proposed for disposal of waste water from hydrostatic tests and disinfection shall be submitted to the Commission for approval prior to performing hydrostatic tests.
 - 3.9.1 Pressure Test: After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench backfilled, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 2 hours to a hydrostatic pressure test of 150 psi. Each valve shall be opened and closed several times during the test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings hydrants and valves, discovered in consequence of this pressure test shall be removed and replaced with

sound material, and the test shall be repeated until the test results are satisfactory.

- 3.9.2 **Leakage Test:** Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours. During the test the water line shall be subjected to 150 psi pressure, no less than 1.25 times the working pressure at the highest point along the test section or at least 1.5 times the working pressure at the point of testing, whichever greater. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. Water shall be added as needed during the test procedure to maintain a pressure no less than 5 psi from the initial test pressure. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = 0.000135ND(P^{0.5}) \text{ for PVC pipe, and}$$

$$L = SD(P^{0.5})/133,200 \text{ for DI pipe}$$

L equals the allowable leakage in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe in inches; S is the length of the pipeline tested in feet; and P is the average test pressure during the leakage test, in psi gauge. Should any test of pipe disclose leakage greater than that specified in the foregoing formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Owner.

- 3.9.3 **Time for Making Test:** Except for joint material setting or where concrete reaction backing necessitates a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after completion of backfill.
- 3.9.4 **Concurrent Hydrostatic Tests:** Pressure test and leakage test may be conducted concurrently if approved by the Owner. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be satisfactory as specified. All replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Owner.
- 3.10 **DISINFECTION:** Before acceptance of a potable water line for operation, each unit of completed water line shall be disinfected as prescribed by AWWA C651.
- 3.10.1 **General Requirements:** After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. In no case will the agent be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all nonspore-forming bacteria. All valves on the lines being disinfected shall be opened and closed several times during the contact period. The line

shall then be flushed with clean water until the free residual chlorine is reduced to the water system's residual (between 1.5 and 0.5 ppm). During the flushing period, each fire hydrant on the line shall be opened and closed several times. The Contractor will take samples of water in proper sterilized containers for bacterial examination and record the residual chlorine for the sample. The disinfection shall be repeated until tests indicate the absence of total coliform bacteria for 2 consecutive tests taken at least 24 hours apart. If the membrane filter method of coliform analysis is used, non-coliform growth must also be reported. The line will not be accepted until satisfactory bacteriological results have been obtained. Test shall be performed by a SCDHEC approved lab. No test results older than 14 days will be accepted.

- 3.10.2 Sample Locations: There will be a minimum of two sample locations for all projects, but must include all dead end lines and must be representative of the water in the newly constructed water mains. The Commission will require a test for every 1200 feet of line installed or fraction thereof. At sample points during flushing of lines, a sign stating "**NON-POTABLE WATER, DO NOT DRINK**" must be posted.
- 3.11. CLEANUP: Upon completion of the installation of the water lines and appurtenances, all debris and surplus materials resulting from the work shall be removed.

END OF SECTION