

WATER DISTRIBUTION

1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.5.2.1M (1981; R 1995) Metric Round Head Short Square Neck Bolts

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME/ANSI B16.1 (1989) Cast Iron Pipe Flanges and Flanged Fittings

ASME/ANSI B18.2.2 (1987; R 1993) Square and Hex Nuts (Inch Series)

ANSI/ASME B18.5.2.2M (1982; R 1993) Metric Round Head Square Neck Bolts

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47M (1990) Ferritic Malleable Iron Castings (Metric)

ASTM A 47 (1990) Ferritic Malleable Iron Castings

ASTM A 48M (1994) Gray Iron Castings (Metric)

ASTM A 48 (1994; Rev. A) Gray Iron Castings

ASTM A 53 (1995) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM A 307 (1994) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

ASTM A 536 (1984; R 1993) Ductile Iron Castings

ASTM A 563M (1993) Carbon and Alloy Steel Nuts (Metric)

ASTM A 563 (1994) Carbon and Alloy Steel Nuts

ASTM A 746 (1994) Ductile Iron Gravity Sewer Pipe

ASTM B 32 (1995; Rev. A) Solder Metal

ASTM B 42 (1993) Seamless Copper Pipe, Standard Sizes

ASTM B 61 (1993) Steam or Valve Bronze Castings

ASTM B 62 (1993) Composition Bronze or Ounce Metal Castings

ASTM B 88M (1995) Seamless Copper Water Tube (Metric)

ASTM C 94 (1994) Ready-Mixed Concrete

ASTM C 150 (1995) Portland Cement

ASTM D 1785	(1994) Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2235	(1993; Rev. A) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2241	(1994) Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2466	(1994; Rev. A) Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(1993) Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2774	(1994) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1993) Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3139	(1995) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F 402	(1993) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(1995) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105/A21.5	(1993) Polyethylene Encasement for Ductile - Iron Pipe Systems
AWWA C110/A21.10	(1993) Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (75 mm Through 1200 mm), for Water and Other Liquids
AWWA C111/A21.11	(1990; Erratum 1991) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(1994) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
ANSI/AWWA C151/A21.51	(1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C153/A21.53	(1994) Ductile-Iron Compact Fittings, 3 in. Through 24 in. (76 mm Through 610 mm) and 54 in. Through 64 in. (1,000 mm Through 1,600 mm), for Water Service
AWWA C502	(1994) Dry-Barrel Fire Hydrants
AWWA C503	(1988) Wet-Barrel Fire Hydrants

AWWA C508	(1993) Swing-Check Valves for Waterworks Service, 2 in. (50 mm) Through 24 in. (600 mm) NPS
AWWA C509	(1994) Resilient-Seated Gate Valves for Water and Sewerage Systems
AWWA C600	(1993) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C605	Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA C606	(1987) Grooved and Shouldered Joints
AWWA C651	(1992) Disinfecting Water Mains
AWWA C800	(1989) Underground Service Line Valves and Fittings
AWWA C900	(1989; Addendum 1992) Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution
AWWA M23	(1980) PVC Pipe - Design and Installation

FEDERAL SPECIFICATIONS (FS)

FS WW-P-460	(Rev. D) Pipe Fittings; Brass or Bronze (Threaded) Classes 125 and 250 Pound
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
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UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	(1988) Installation of Polyvinyl Chloride (PVC) Pressure Pipe
UBPPA UNI-B-8	(1986) Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe

UNDERWRITERS LABORATORIES INC. (UL)

UL 246	(1993; R 1994, Bul. 1994) Hydrants for Fire-Protection Service
UL 262	(1994) Gate Valves for Fire-Protection Service
UL 312	(1993; R 1994) Check Valves for Fire-Protection Service
UL 789	(1993; R 1994) Indicator Posts for Fire-Protection Service

1.2 DESIGN REQUIREMENTS

1.2.1 Water Distribution Mains

Provide water distribution mains to the alignment indicated on the plan drawings. New water mains shall be 6-inch diameter Polyvinyl Chloride (PVC), standard dimension ratio (SDR) 21. Provide water main accessories, res. Seat wedge valves as specified and where indicated.

1.2.2 Water Service Lines

Provide water service lines to the alignment indicated on the plan drawings. New service lines shall be 1-inch diameter polyethylene tubing and shall extend from the water distribution main through the meter setter and tail piece as shown on the detail sheet. Provide water service line appurtenances as specified.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.3.1 SD-02 Manufacturer's Catalog Data

- Water distribution main piping, fittings, joints, valves, valve boxes and couplings
- Water service line piping and appurtenances (saddles, corporation stops, compression fittings, meter setters, meter boxes, etc.)
- Hydrants

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for mechanical joints. Include information concerning gaskets with submittal for joints and couplings.

1.3.2 SD-06 Instructions

- Installation procedures for water piping

1.3.3 SD-13 Certificates

- Water distribution main piping, fittings, joints, valves, and coupling
- Water service line piping, fittings, joints, valves, and coupling
- Shop-applied lining and coating
- Fire hydrants

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and hydrants free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry, do not drag, pipe to the trench. Store plastic piping, jointing materials and rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

2 PRODUCTS

2.1 WATER DISTRIBUTION MAIN MATERIALS

2.1.1 Piping Materials

2.1.1.1 Polyvinyl Chloride (PVC) Pipe

- A. Pipe: Polyvinyl Chloride (PVC) pipe as called for on the plans or in the schedule bid items shall be plainly marked with the following information: manufacturer's name, size, material (PVC) type and grade or compound, NSF Seal, pressure rating and reference to appropriate product standards. PVC

Pipe shall conform to the following standards:

- AWWA C900
- Material: Virgin PVC resin ASTM D1784
- Standard Dimension Ratio: SDR 18
- Pressure Rating: 200 psi @ 2.0 factor of safety
- Sustained Pressure Requirement: 420 psi for 1,000 hrs.,
- ASTM D1598, ASTM D2241
- Quick Burst Pressure: 630 psi for 60 sec., ASTM D1599

- B. Joints and Jointing Material: Joints for pipe shall be push-on joints, ASTM D 3139. Joints between pipe and metal fittings, valves, and other accessories shall be mechanical joints, ASTM D 3139 and AWWA C111/A21.11. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe, ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories, AWWA C111/A21.11, respectively, for push-on joints and mechanical joints.

2.1.1.2 Ductile-Iron Pipe

- A. Pipe and Fittings: Pipe, except flanged pipe, ANSI/AWWA C151/A21.51, Pressure Class 350 Flanged pipe, AWWA C115/A21.15. Fittings shall have pressure rating equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining, AWWA C104/A21.4, standard thickness.
- B. Joints and Jointing Material:
- *Joints*: Joints for pipe and fittings shall be push-on joints unless otherwise indicated. Provide mechanical joints where indicated. Joints made with sleeve-type mechanical coupling may be used in lieu of push-on joint, subject to the limitations specified in paragraph entitled "Sleeve-Type Mechanical Couplings."
 - *Push-On Joints*: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly, AWWA C111/A21.11.
 - *Mechanical Joints*: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets, AWWA C111/A21.11.

- *Flanged Joints*: Bolts, nuts, and gaskets for flanged connections as recommended in the Appendix to AWWA C115/A21.15. Flange for set screwed flanges shall be of ductile iron, ASTM A 536, Grade 65-45-12, and conform to the applicable requirements of ASME/ANSI B16.1, Class 250. Setscrews for set screwed flanges shall be 190,000-psi tensile strength, heat treated and zinc-coated steel. Gasket for set screwed flanges, in accordance with applicable requirements for mechanical-joint gaskets specified in AWWA C111/A21.11. Design of set screwed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made.
- *Restrained Joints*: Restrained joints for pipe and fittings shall be designed for a working pressure of 350 psi for 4” - 24” DIP pipe. Restrained joints shall be capable of being deflected a minimum of 4 degrees after assembly for 14” - 24” pipe. Restrained joints for pipe and fittings shall be U.S. Pipe TR Flex, Griffin SNAP-LOK or an approved equal. Mega Lugs are also approved for use on DIP; Mega Flange is approved for use on DIP. Restrained joints for PVC pipe shall be incorporated into the design of the follower gland. The restraint mechanism shall consist of a plurality of individually actuated gripping surfaces to maximize restraint capability. Glands shall be manufactured of ductile iron conforming to ASTM A536-80. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized joint bell. Twist off nuts, sized the same as tee-head bolts, shall be used to insure proper actuating of restraining devices. The restraining glands shall have a pressure rating equal to that of the pipe on which it is used. The restraining glands shall have been tested to ASTM F1674-96, be UL listed and FM approved. When mechanical thrust restraints are used, concrete thrust blocking shall be deleted from the installation or bell restrain system.

2.1.1.3 **Ductile Iron Fittings**

Ductile iron fittings shall conform with ANSI A 21.10 (AWWA C-110), latest revision with the exception of the manufacturer’s design dimensions and thickness. Fittings shall have a working pressure rating of 350 psi for fittings, 12 inch and under and 250 psi for fittings over 12 inches.

Ductile iron shall conform to ASTM A-536, latest revision, Grade 70-50-05.

- *Thickness Design*: Nominal thickness of the fittings shall be equal to Class 51 ductile iron pipe as specified in ANSI A 21.51 (AWWA C-151).
- *Lining*: Fittings shall have a cement mortar lining and seal coating conforming with ASNI A 21.4 (AWWA C-104), latest revision.
- *Exterior Coating*: Fittings shall have an outside coating of bituminous material in accordance with the manufacturer’s specifications. The final coat shall be continuous and smooth being neither brittle when subjected to low temperatures nor sticky when exposed to hot sun. The coating shall be strongly adherent to the pipe at all temperatures.

- *Joints*: Fittings shall have mechanical or flanged joints as specified herein.
 - (1) Mechanical Joint: ANSI Specification A 21.11 (AWWA C-111), latest revision, for three-inch pipe and larger. Bolted mechanical joint fittings shall be used with ductile iron pipe, PVC pipe, for all hydrant tees, and where specifically called for on the plans or in the Schedule of Bid Items.
 - (2) Push-on Joints: Single gasket push-on type joints shall conform with ANSI A 21.11 (AWWA C-111), latest revision. Push-on joint fittings may be used on PVC pipe or where mechanical joints are not specifically called for on the plans or specified above.
 - (3) Flanged Joint: Flanged fittings shall be constructed of ductile iron with flanges drilled and faced per ANSI B f16.1 for both 125 Lb. working pressure.
 - (4) Restrained Joints: Restrained joints for pipe and fittings shall be designed for a working pressure of 350 psi for 4” through 24” DIP pipe. Restrained joints shall be capable of being deflected a minimum of 4 degrees after assembly for 6” through 12” pipe and a minimum of 3 degrees after assembly for 14” through 24” pipe. Restrained joints for pipe and fittings shall be U.S. Pipe TR Flex, Griffin SNAP-LOK or an approved equal. Mega Lugs are also approved for use on DIP; Mega Flange is approved for use on DIP. Restrained joints for PVC pipe shall be incorporated into the design of the follower gland. The restraint mechanism shall consist of a plurality of individually actuated gripping surfaces to maximize restraint capability. Glands shall be manufactured of ductile iron conforming to ASTM A536-80. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell. Twist off nuts, sized the same as tee-head bolts, shall be used to insure proper actuating of restraining devices. The restraining glands shall have a pressure rating equal to that of the pipe on which it is used. The restraining glands shall have been tested to ASTM F1674-96, be UL listed and FM approved. When mechanical thrust restraints are used, concrete thrust blocking shall be deleted from the installation or bell restrain systems.

2.1.2 **Valves, Hydrants, and Other Water Main Accessories**

2.1.2.1 **Gate Valves on Buried Piping**

Shall be resilient seat wedge valves. AWWA C509, unless otherwise specified. Valves conforming to AWWA C509 shall be non-rising stem type with mechanical-joint ends, designed for a hydraulic working pressure of 200 psi. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have O-ring stem seals, except for those valves for which gearing is specified, in which case use conventional packing in place of o-ring seal. Stuffing boxes shall be bolted and constructed to permit easy removal of parts for repair. Valves shall be of one manufacturer.

2.1.2.2 **Gate Valves in Valve Pit(s) and Aboveground Location**

Shall be resilient seated wedge valves. AWWA C509, unless otherwise specified. Valves conforming to AWWA C509 shall be non-rising stem type with flanged ends, designed for a hydraulic working pressure of 200 psi. Valves shall be of one manufacturer.

2.1.2.3 **Check Valves**

Swing-check type, AWWA C508 or UL 312. Valves conforming to: (1) AWWA C508 shall have iron or steel body and cover and flanged ends, and (2) UL 312 shall have cast iron or steel body and cover, flanged ends, and designed for a working pressure of 175 psi. Materials for UL 312 valves shall conform to the reference standards specified in AWWA C508. Valves shall have clear port opening. Valves shall be weight-loaded where indicated. Valves shall be of one manufacturer.

2.1.2.4 **Fire Hydrants**

Paint hydrants with factory at least one coat of factory applied primer and two coats of factory applied Rust-Oleum forest green body and gloss white paint bonnets and outlet caps.

- *Dry-Barrel Type Fire Hydrants:* Dry-barrel type hydrants, AWWA C502 or UL 246, "Base Valve" design, shall have 6-inch inlet, 5 ¼-inch valve opening, one 4 ½-inch Storz pumper connection, and two 2 ½-inch hose connections. Inlet shall have mechanical-joint end only. End shall conform to the applicable requirements as specified for the joint. Size and shape of operating nut, cap nuts, and national standardized threads on hose and pumper connections shall be as specified in AWWA C502 pentagonal. Hydrants shall have breakable features as mentioned in AWWA C503. The traffic type hydrant shall have special couplings joining upper and lower sections of hydrant barrel and upper and lower sections of hydrant stem and shall be designed to have the special couplings break from a force not less than that which would be imposed by a moving vehicle; hydrant shall operate properly under normal conditions.

2.1.2.5 **Indicator Posts**

Provide for gate valves where indicated.

2.1.2.6 **Valve Boxes**

Provide a valve box for each gate valve on buried piping. Valve boxes shall be of cast iron of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 ¼-inches. Cast-iron box shall have a heavy coat of bituminous paint.

2.2 **WATER SERVICE LINE MATERIALS**

2.2.1 **Polyethylene Pipe for Service Laterals**

Provide polyethylene pipe conforming with all applicable requirements in the latest revisions of the following standards:

AWWA C-901:
Standard for Polyethylene pressure pipe 1/2” through 3” for water

ASTM D-1248:
Standard for polyethylene molding and extrusion materials.

ASTM D-2239:
Standard for polyethylene plastic pipe (sdr-9, CTS)

The following data shall be clearly marked on all service lateral piping:

- Nominal size
- Operating Pressure @73.5 degrees F.
- Type of Pipe, i.e. “water service pipe”
- Material designation code, “PE-3406”
- Manufacturer’s brand name
- National Sanitation Foundation logo (indicating approval for portable water and compliance with ASTM specifications)
- ASTM Specification –“ASTM D-2239”
- Plant location code

Pipe and fittings shall be supplied from the same manufacturer.

2.2.2 Water Service Line Appurtenances

2.2.2.1 Tapping Saddles

Tapping saddles shall provide full support around the circumference of the pipe with a designed in safeguard against over-tightening to prevent deforming the pipe. All parts of the saddle shall be constructed of corrosive resistant bronze including bolts and nuts required to assemble. Only saddles designed specifically for the type water main pipe used shall be allowed. Threads shall be AWWA standard cc tapered. Tapping saddles shall be manufactured by Ford, Mueller.

2.2.2.2 Corporation Stops

Corporation stops shall be of bronze construction and a minimum 1-inch (inlet and outlet). Inlet threads shall be AWWA Standard Taper cc. Outlets will be IP threads with a brass compression-fitting adapter for the appropriate water service pipe size. Corporation stops shall be Ford, Mueller. 1-inch ball valves shall be required.

2.2.2.3 Compression Fittings

Compression fittings shall be “Ford, Pack Joint”, “Mueller”. A stainless-steel insert will be required with any fitting that compresses the outside of the pipe to hold the pipe in place.

2.2.2.4 Meter Boxes

Meter boxes shall be supplied with each service connection. Boxes may be constructed of cast-iron, non-corrosive high-density polyethylene or PVC.

- A. *Cast-Iron Boxes*: Cast iron meter boxes shall be made in two pieces, i.e. box and cover. The box shall be a minimum of 12” deep by 17” long by 10” wide. Cast iron boxes shall be manufactured by Dewey Brothers, Ford Meter Box Company, Opelika Foundry Company or equal.
- B. *Plastic Boxes*: Plastic meter boxes shall be high-density polyethylene material, used in the boxes shall meet or exceed the following physical properties:
- Flexural modulus, psi - 90,000
 - Compression strength 10% deflection psi - 1,100
 - Heat distortion, 66 psi - 170 degrees
 - Specific gravity – 0.6
 - Hardness, Shore D-58
 - Impact strength, 1016, falling dirt - 160 in-lb.
 - Total load at center of top - 2,800 + lbs.

Boxes shall not be less than 12-inch deep, by 17-inch long by 10-inch wide. The box cover shall be of all cast iron construction.

2.2.2.5 **Teflon Tape**

Teflon tape shall be used on all threaded connections to reduce the possibility of leaking joints.

2.2.2.6 **Check Valves**

The Contractor shall supply with each service a double check valve as described herein required on all meter setters incorporated into the setter.

All check valves supplied under these specifications shall be manufactured by “Ford” or an approved equal.

3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to all pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

3.1.1.1 Location of Water Lines

Terminate the work covered by this section at the edge of the existing NCDOT or street right-of-way, unless otherwise indicated. Do not lay water lines in the same trench with gas lines, fuel lines or electric wiring.

A. *Water Piping Installation Parallel with Sewer Piping*

- (1) *Normal Conditions*: Lay water piping at least 10 feet horizontally from a sewer or sewer manhole whenever possible. Measure the distance edge-to-edge.
- (2) *Unusual Conditions*: When local conditions prevent a horizontal separation of 10 feet, the water piping may be laid closer to a sewer or sewer manhole provided that:
 - The bottom (invert) of the water piping shall be at least 18-inches above the top (crown) of the sewer piping.
 - Where this vertical separation cannot be obtained, Sewer piping passing over or under water piping shall be constructed of AWWA-approved ductile iron water piping, pressure tested in place without leakage prior to backfilling.
 - The sewer manhole shall be of watertight construction and tested in place.

B. *Installation of Water Piping Crossing*

- (1) *Normal Conditions*: Water piping crossing above sewer piping shall be laid to provide a separation of at least 18-inches between the bottom of the water piping and the top of the sewer piping.
- (2) *Unusual Conditions*: When local conditions prevent a vertical separation described above, use the following construction:
 - When it is not practical to pass water over sewer, water piping passing under sewer piping shall have a minimum vertical separation of at least 18-inches between the bottom of the sewer piping and the top of the water piping, and a minimum of 18-feet of ductile iron water piping shall be centered at the point of the crossing, so that joints shall be equidistant and as far as possible from the sewer piping.

- Sewer piping passing over or under water piping shall be constructed of AWWA-approved water piping, such as C900 PVC or DIP, and pressure tested in place without leakage prior to backfilling. The AWWA approved water piping shall be a minimum of 18-feet and centered on the point of crossing.
- Sewer Piping or Sewer Manholes: No water piping shall pass through or come in contact with any part of a sewer manhole.
- When local conditions prevent a vertical separation of 18-inches as described above, justification of the deviation must be outlined in accordance with Rule .0906 (f) sent to and approved by the State of North Carolina Public Water Supply Section. If less than 18” vertical separation is approved by the State, then adequate structural support shall be provided for sewer piping that passes over water piping, in order to prevent excessive deflection of joints and keep the pipe from settling on and breaking the water piping.

3.1.1.2 **Earthwork**

Perform earthwork operations in accordance with Section 02302, “Excavation, Backfilling and Compacting for Utilities.”

3.1.1.3 **Pipe Laying and Jointing**

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not, under any circumstances, drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace, by one of the proper lengths, any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each workday, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Depth of cover over top of pipe shall not be less than 3 feet.

3.1.1.4 **Connections to Existing Water Lines**

Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line. Make connections to existing lines under pressure as indicated.

3.1.2 Special Requirements for Installation of Water Mains

3.1.2.1 Installation of Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

- A. Jointing: Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11. Make flanged joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; Use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions. Use set screwed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe and assemble in accordance with the recommendations of the set screwed flange manufacturer. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer.
- B. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one-part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.2.2 Installation of PVC Plastic Water Main Pipe

Installation of PVC Plastic Water Main Pipe and Associated Fittings: Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines"; with the requirements of AWWA 605 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

- A. *Jointing*: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of AWWA 605 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of AWWA 605 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of AWWA 605 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.
- B. *Pipe Anchorage*: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Thrust blocks shall be in accordance with the requirements of AWWA M23 for reaction or thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one-part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.2.3 **Installation of Valves and Hydrants**

- A. *Installation of Valves*: Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509. Install gate valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation. Make and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings. All valves shall be rodded to fittings.
- B. *Installation of Hydrants*: Install hydrants in accordance with AWWA C600 for hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Install hydrants with 4 1/2-inch connections facing the adjacent paved surface. All hydrants shall be rodded to fittings; Hydrant legs shall be DIP.

3.1.3 Installation of Water Service Piping

3.1.3.1 Service Line Connections to Water Mains

Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.

3.1.4 Disinfection

Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Bacteriological samples shall be collected by the Town of Southern Pines Construction Inspector and the bacteriological samples following water main disinfection shall be analyzed by a state approved lab, per Rule .1001. Disinfection of systems supplying non-potable water is not required.

The environment to which the chlorinated water is to be discharged shall be inspected. If there is any question that the chlorinated discharge will cause damage to the environment, then a reducing agent shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. (See AWWA C-651 Appendix B for neutralizing chemicals). Where necessary, Federal, State and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water. This effort shall be coordinated fully by the Contractor.

Blow off shall be performed to minimize erosion. Erosion caused by blowing off water shall be repaired by the Contractor.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Town of Southern Pines Construction Inspector will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work have been constructed in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete. Water for testing and sterilization will be provided by the Town of Southern Pines.

3.2.2 Testing Procedure

Test water mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test ductile-iron water mains in accordance with the

requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other method. Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at plastic pipe joints.

3.2.3 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 150 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

4 MEASUREMENT AND PAYMENT

4.1 GENERAL REQUIREMENTS

Payment for work in this section shall be at the Contractor's unit prices for estimated quantities of water main, fittings, valves, hydrant assemblies, service laterals and other appurtenances called for herein and on the plan drawings. Payment shall be full compensation for furnishing, hauling and placing all materials, demolition and/or abandonment of existing structures, testing, painting, and all other incidentals necessary to complete the work.

4.2 MEASUREMENT AND PAYMENT

4.2.1 Relocated Water Distribution Main

Measurement of installed water distribution main shall begin at the end of the pipe and proceed through to the end of the installed line complete in place and accepted. The measured quantity shall be paid for at the Contractor's unit prices for the actual linear footage of water distribution installed with respect to particular material, joint type and class of pipe as furnished in the Schedule of Bid Items.

4.2.2 Valves

All valves, including valves boxes set to finished grade shall be measured according to unit, complete in place and accepted. Payment shall be made at the Contractor's unit prices with respect to valves size and type as furnished in the Schedule of Bid Items.

4.2.3 Water Main Fittings

Water main fittings and couplings shall be measured according to unit complete in place and accepted. Concrete for thrust blocking shall be considered incidental to placement and included in the unit cost of the fitting. Payment shall be made at the Contractor's unit price with respect to pounds of mechanical joint fittings as furnished in the Schedule of Bid Items.

4.2.4 Hydrants

Hydrant assemblies shall be measured by unit, complete in place and accepted. A hydrant unit shall consist of: (1) Hydrant (depth of bury as specified herein); (2) varying length D.I.P. hydrant leg; (3) 2-3/4" threaded tie rods from tee to valve and from valve to hydrant. Payment shall be at the Contractor's unit price for hydrant assemblies as furnished in the Schedule of Bid Items.

4.2.5 Blow-off Assemblies

Blow-off assemblies shall be measured by unit, complete in place and accepted. A blow-off unit shall consist of: (1) gate valve; (2) varying length cast iron or galvanized pipe and fittings; (3) valve boxes; as indicated in the detail drawing. Payment shall be at the Contractor's unit price for blow-off assemblies as furnished in the Schedule of Bid Items.

4.2.6 Service Laterals

Service lateral piping shall be measured according to unit complete, in-place and accepted. A service lateral unit shall consist of tapping saddle, corporation stop, required length of service pipe, meter setter, meter box and 5' of type K 3/4" copper tubing. Payment shall be at the Contractor's unit price for service laterals with respect to diameter as furnished in the Schedule of Bid Items.

WATER MAIN CONSTRUCTION

SPECIAL PROVISIONS

01. **PIPE:** All pipe shall be SDR 21, PVC or ductile iron thickness Class 50 as shown on the plans and the Schedule of Bid Items, unless otherwise specified.
02. **PIPE JOINTS:** All pipe joints shall be slip joint gasket type. No solvent weld will be permitted on any size pipe.
03. **DUCTILE IRON FITTINGS:** Fittings and specials for this project shall be mechanical joint conforming to ANSI A21.10 (AWWA C-110) and ANSI A21.11 (AWWA C-111) latest revision. No push-on fittings will be allowed.
04. **HYDRANTS AND VALVES:** Adjustment of fire hydrant fittings and valves shown at intersections shall be made by the contractor in the field subject to the desire of the Engineer without any increase or decrease in price. Hydrants shall have bronze to bronze seats as required by the Town of Southern Pines, North Carolina.
05. **VALVE BOX ADJUSTMENTS WITHIN PAVING LIMITS:** The Contractor shall make final grade adjustments to all valve boxes prior to paving of the streets within the project limits. Adjustments to final grade are not extra work and should be considered an incidental part of the pipe construction.
06. **TESTING AND STERILIZATION:** Pressure testing shall begin after all main water lines are installed. Sections to be tested shall be between valves not to exceed 2,000 feet per test. Pressure test will be for 2 hours. All lines shall be tested at 50 psi over static or 150 psi, whichever is greater. Allowable leakage shall not exceed 10 gallons/diameter inch/mile/24 hours. The Town of Southern Pines must be notified to witness the pressure testing. Water for testing and blow-off may be obtained from the existing water main.

Sterilization shall be accomplished by filling the pipe with chloride solution of sufficient strength such that after 24 hours contact time, there will be 50 mg/l residual chlorine.

Sections to be sterilized shall not exceed 2,000 feet under any circumstances. The pipe shall be flushed and refilled and a bacteriological sample will be taken by the Town of Southern Pines 72 hours after the pipe is flushed and refilled.
07. **SERVICES:** The Contractor shall install services through the box, not including the meter. All service lines, taps, tapping saddles and corporation stops shall be 1-inch diameter.

The following materials shall be used for the services:

1. Ford brass Saddles for PVC Pipe Style S70.
Body and Strap – 85-5-5-5 brass per ASTM C-62 and AWWA C-800.
Bolt – Slotted hex head 18-8 stainless steel.
Outlet tapped CC threads.
For ductile iron pipe use Ford F202 or Smith Blair 313 Double Strap Saddles.

2. Ford Corporation Stops – Type FB 1000 G.
Pack Joint Outlet X AWWA taper (CC) thread inlet.
3. 1-inch CTS Polyethylene Service Line 200 psi rating with stainless steel inserts at all fittings.
4. ¾-inch Type K Copper tubing tail piece, minimum 5'- 0" long.
08. **SAFETY REQUIREMENTS:** All Contractor personnel on the job site will be required to wear hard hats, safety glasses, safety vests, and hard sole shoes. No tennis shoes will be allowed.
09. **CONCRETE:** The Contractor will be required to supply batch tickets for concrete where the bid item is paid for on a cubic yard basis such as concrete for blocking. Concrete for storm sewer separation as detailed shall not be paid directly but will be considered under the bid item for concrete blocking.
10. **GRAVEL:** The Contractor will be required to supply certified weigh master tickets for gravel where the bid item is paid for on a per ton basis such as gravel driveway repair.
11. **SUBMITTALS:** Approval for all shop drawings and submittals will be obtained before the Contractor is allowed to begin work. Three (3) sets of submittals shall be delivered to the Town of Southern Pines Construction Inspector for review and approval.
12. **CONTRACTOR SUPERINTENDENT:** The Contractor shall submit a letter giving the names and home and work phone numbers of both the on-site superintendent and the company point of contact. The superintendent shall be on site while any work is being done.
13. **FIRE HYDRANTS:** The Contractor will be required to wrap and seal plastic bags around each new fire hydrant set on the project. It will be removed when the hydrants are placed in service.
14. **TIE-INS:** The Contractor will be required to coordinate all tie-ins with the Town of Southern Pines Construction Inspector so that he may be present when they occur. No water mains will be cut off without consent of the Southern Pines Inspector.
15. **TESTING:** The Town of Southern Pines Representative will be present at all pressure tests. Sterilization and taking of bacteria samples will be coordinated with the Town of Southern Pines Inspector.
16. **COMPACTION OF TRENCHES:** All trenches will be compacted by mechanical means. All stone placed in trenches for road cuts will be compacted by mechanical means.
17. **PAVEMENT CUTS:** All pavement cuts will be accomplished by using a saw, motorgrading cutting wheel, or jack hammer.
18. **ISOLATION OF EXISTING WATER MAINS:** The Contractor will coordinate the isolation of all necessary existing water mains with the Town of Southern Pines Water Department.

19. **EXISTING LINE LOCATION:** The Contractor will be required to pay for any repair work resulting from disturbing existing water mains that have been properly located by the Town of Southern Pines.
20. **SEDIMENTATION AND EROSION CONTROL:** The Contractor is instructed to control sedimentation runoff with methods approved by the Engineer during the course of construction of this project. The Contractor is reminded that all work shall meet all applicable requirements of the rules and regulations of Erosion and Sedimentation Control as published by the Department of Natural Resources and Community Development, North Carolina Sedimentation Control Commission.
21. **SHOP DRAWINGS:** Shop drawings shall be submitted for all metal casings including manhole rings and covers, valve boxes and catch basin frames and grates. Manufacturer's certifications shall be submitted to the Town of Southern Pines Inspector certifying that all pipe meets the project specifications. Concrete mix designs, the detail specifications and bituminous concrete plant mix designs of the detail specifications shall be submitted to the Engineer for approval. None of the above listed materials shall be used on the projects unless the necessary approval for that particular material has been given by the Engineer. The Contractor shall submit (3) three sets of all shop drawings, certificates and mix designs required within this contract. Shop drawings shall be approved prior to the start of any work on the project.
22. **AS-BUILT DRAWINGS AND SPECIFICATIONS AT THE JOB SITE:** The Contractor shall maintain, in readable condition at the job site, one complete set of working drawings and specifications for his work, including shop drawings. Such drawings and specifications shall be available for use by the Owner or his representative at all times. This set shall be marked, or notes acceptable to the Engineer provided, in order to reflect as-built conditions; changes indicating such conditions shall be kept current at all times. Upon completion of the project, this complete set of drawings and specifications or notes, showing as-built conditions, shall be returned to the Owner or his representative.
23. **PAY REQUEST:** All pay requests shall be submitted to the Town of Southern Pines Construction Inspector by the 20th of the month to receive payment by the 30th.
24. **VIDEO TAPING:** The Contractor is required to video tape all areas to be disturbed prior to start of work. The completed tape shall be given to the Town of Southern Pines Inspector and become property of the Town.
25. **TRACING WIRE:** A solid bare #12 copper wire shall be used as a tracing wire on all water lines. The wire shall be attached to each valve and run along the top of all water lines. A pigtail wire shall extend up through valve boxes to ground level for attaching pipe locating equipment.