

# TOWN OF PITTSBORO

## STANDARD SPECIFICATIONS

### SECTION 3

#### WATER DISTRIBUTION CONSTRUCTION

01. **MATERIALS:** All materials used in water distribution system construction shall conform to applicable industry standards including American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), Ductile Iron Pipe Research Association (DIPRA), American Association of State Highway and Transportation Officials (AASHTO), and American National Standards Institute (ANSI) and the requirements of the Town of Pittsboro.
- A. Ductile Iron Pipe: Ductile iron pipe 6-inch and larger shall be in accordance with AWWA C150 and C151; cement-mortar lining and seal coat in accordance with AWWA C104. Joints shall be in accordance with AWWA C111 and include rubber compression gasket. All ductile iron pipe shall be marked "Ductile" and bear the name of the manufacturer.
1. Pipe Joints:
- i. Slip-Type: AWWA C111 rubber gaskets and lubricant.
  - ii. Mechanical Joints: AWWA C111 ductile-iron or gray-iron glands, high-strength steel bolts and nuts, and rubber gaskets.
  - iii. Restrained Joints: Joint restraint mechanisms shall be AWWA C111 and consistent with the pipe manufacturers recommendation and intent.
  - iv. Flanged Pipe: Flanged pipe shall be used only in above-ground applications. All flanged pipe shall be of ductile iron with ductile iron flanges per AWWA C115/ANSI A21.15, and shall be rated for a working pressure of 250 psi. Flanges shall be standard ANSI B16.1, Class 125.
- B. Steel Encasement Pipe: Steel pipe for encasing pipe beneath roads or railroads shall be high strength spiral welded or seamless grade "B" steel with minimum yield strength of 35,000 psi. The inside diameter of the casing pipe shall be at least 6 inches greater than the largest outside diameter of the carrier pipe at the bell, allowing for at least 3 inches of annular space around the circumference of the carrier pipe.

Minimum casing pipe thickness shall be as follows, except where NCDOT or railroad specifications supercede, and in such cases, those shall be considered the minimum requirements.

<u>Casing Pipe Diameter</u>	<u>Minimum Wall Thickness (Roadways)</u>	<u>Minimum Wall Thickness (Railways)</u>
10"	0.188	0.188
12"	0.188	0.251
16"	0.250	0.312
18"	0.250	0.313
20"	0.250	0.375
24"	0.250	0.407
30"	0.312	0.469
36"	0.375	--

Carrier pipe within casing shall be ductile iron pipe supported by spiders at both the bell and spigot of each joint of pipe.

- C. Pipe Fittings: Pipe fittings shall conform to AWWA C153 for compact fittings. Fittings shall be mechanical joint in accordance with AWWA C111. Fittings shall be ductile iron with a minimum working pressure rating of 250 psi.

Fittings shall be cement mortar lined and seal coated in accordance with AWWA C104. Fittings shall have an outside coating of bituminous material that is maintained through storage, handling and installation. Fittings shall not be installed without a complete and thorough bituminous coat.

At the discretion of the Town of Pittsboro, Meg-a-lug retainer glands may be accepted in certain instances when joint restraint is required.

- D. Gate Valves: Gate valves shall be resilient wedge type in accordance with AWWA C509 with full interior and exterior fusion bonded epoxy coating in accordance with AWWA C550. Resilient wedge coating shall be in accordance with ASTM D2000. Gate valves shall be mechanical joint per AWWA C111. Gate valve bodies shall be ductile iron with O-ring stem seals above and below the thrust collar and O-rings between the stuffing box, bonnet and body. Gate valves shall be open-left, non-rising stem with a 2-inch operating nut. Valves shall have 200 psi minimum working pressure and 500 psi hydrostatic test pressure.

This specification shall also apply for tapping valves except that tapping valves shall include a tapping ring and flanged connection to the tapping sleeve/saddle.

There shall be required at each water main tee three (3) gate valves, one on each branch.

- E. Butterfly Valves: Valves 16-inch and larger shall be butterfly valves. Butterfly valves shall be Class 150B in accordance with AWWA C504. Butterfly valves shall have 90 degrees rotation from full open to full shut. Butterfly valves shall have adjustable mechanical stops, bronze or stainless steel seating rings and

Buna-N or Buna-S valve seats. Valve stuffing box and bearing hub shall be integrally cast with the valve body. The shaft shall be stainless steel and the shaft bearings shall be heavy duty bronze. Shaft bearings shall be self-lubricating with fully adjustable thrust bearings. Butterfly valve operators shall be worm gear type in a waterproof gear box, open left, with a 2-inch square operating nut.

Butterfly valves shall be shipped to the site fully assembled. Butterfly valves selected for use shall be obtained from manufacturers that fully warrant the satisfactory performance of the assembled valve and operator.

Butterfly valves shall be installed in a precast concrete manhole with cast iron frame and cover with "WATER" cast in the cover. Manholes and manhole construction shall meet the standards set forth in the Sanitary Sewer Standard Specification. The manhole shall be sealed and watertight and grading shall promote drainage away from the manhole and prevent flooding of the manhole. The manhole shall be adequately sized to accommodate the valve assembly and permit room for maintenance and repairs.

- F. Tapping Sleeves and Valves: Tapping sleeves shall be ductile iron, 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve shall have mechanical-joint ends with rubber gaskets or sealing rings in sleeve body. Ductile iron sleeves shall bear an exterior protective bituminous coating.

Stainless steel fully-gasketed sleeves will also be accepted. When stainless steel sleeves are used, all metal parts including bolts and flange shall be stainless steel.

Tapping sleeves used shall be appropriate to the size and material of pipe being tapped and possess a flange appropriate for the tapping machine and tapping valve to be employed. Flanges shall be Class 125 (pressure rating 250 psi) in accordance with AWWA C115.

- G. Valve Boxes: Valve boxes shall be of close-grained gray cast iron and adjustable. The word "Water" shall be cast in the lid. Valve boxes shall be cast domestically, bearing the manufacturer's name and "USA" in the casting. Valve boxes shall be painted with a protective bituminous coat before being shipped from the factory.
- H. Fire Hydrants: Fire hydrants shall be Mueller Centurion in accordance with AWWA C502. Fire hydrants shall be provided with two 2.5-inch nozzles and one 4.5-inch nozzle and caps with chains for each nozzle. Fire hydrants shall have 5.25-inch main valve opening, compression type, designed to close with line pressure. Fire hydrants shall have sealed lubrication chambers with O-ring seals to protect operating threads from the waterway and anti-friction rings for ease of operation. Hydrant-to-base flange seating shall be bronze to bronze. Fire hydrants shall bear a breakaway traffic flange between the upper and lower

hydrant barrel. Operating nuts shall be bronze, 1.5-inch pentagonal, counterclockwise opening.

In distribution mains, fire hydrants shall be spaced such that all structures fall within a 500-foot radius of at least one fire hydrant.

In transmission mains, fire hydrants shall be placed a minimum of every 2000 feet along the length of the transmission piping. Fire hydrants on transmission piping shall be placed at the high points on the route to allow for air release.

- I. Air Release Valves: Air release valves shall be Crispin or an approved equal, manufactured in accordance with AWWA C512. Air release valves shall provide automatic escape of entrained air while the water main is in service. Air release valves shall be suitable for minimum operating pressure of 150 psi or the designed operating pressure of the water system, whichever is greater.

Air release valves shall be properly sized using manufacturer's guidelines; that is, water main size, flowrate, pipe grade and the required air release rate shall be considered in sizing of each air release valve.

Air release valve inlets shall be NPT screwed or ANSI Class 125 flanged. Valve bodies shall be cast iron; floats and trim shall be stainless steel with Buna-N seats. The ARV outlet orifice shall be finished with a breather pipe one foot tall with a downward-turned elbow to prevent trash from entering the outlet orifice.

Air release valves shall be installed at the high points along the transmission mains. Air release valves shall not be installed in distribution piping.

Air release valves shall be installed in a manhole and shall include valving to allow for removal/repair of the air release valve. Connection to the main shall include a tapping saddle. Piping used for air release valve installation shall be SCH 40 brass, threaded NPT.

- J. Blow-off Assemblies: Blow-off assemblies shall be installed at the terminus of dead-end sections of water mains. Blow-off assemblies shall be constructed from a restrained, mechanical joint plug tapped 2-inch NPT. A gate valve of equivalent size to the water main shall be installed immediately upstream of the mechanical cap. A 2-inch gate valve shall be installed near the blow-off assembly to operating the blow-off.

Piping downstream of the mechanical cap shall be 2-inch SCH 40 brass pipe threaded NPT, or an approved equal piping. PVC pipe shall not be allowed in blow-off assembly construction.

Valves, bends and fittings shall be properly and thoroughly restrained with concrete blocking and rodding as needed. The blow-off spout shall be tapped 2-

inch NPT and a 2-inch cap shall be provided. A 2-inch threaded union with an ample section of brass piping with a 90-degree elbow at one end shall be provided to the Town of Pittsboro to connect to the blow-off assembly to divert water when in operation.

- K. Water Service Appurtenances: Water services shall be ¾-inch minimum. Pipe for water services ¾-inch through 2-inch shall be type “K” soft copper. Fittings shall be copper-compatible brass.

added Dec. 28, 2007 All service connections 2-inch diameter and smaller shall incorporate a corporation stop as a shut off valve at the water main. On 2-inch diameter services, in addition to the corporation stop at the water main, a threaded end gate valve in accordance with Specification Section 01.D. shall be installed a curb stop. Valve shall be fitted with a valve box extended to grade.

Tapping/service saddles shall be selected for compatibility with the host pipe. Saddles for PVC pipe shall possess ample width for distribution of clamping pressure and shall be of hinge-less design with two (2) fastening nuts on each side of the saddle body (Ford S70 or approved equal). Service connections to PVC pipe shall be made with tapping saddles.

Saddles for ductile iron pipe shall be of the double strap, hinge-less design, possessing two (2) fastening nuts on each side of the saddle body (Ford 202B or approved equal).

Saddle construction shall be of 85-5-5-5 brass conforming to AWWA C800. Saddle bosses shall have AWWA standard tapered threads compatible with the corporation cock used and incorporating a Buna-N rubber gasket.

Corporation stops shall be all brass 85-5-5-5 construction conforming to AWWA C800; unions shall be three piece copper to copper. Threads shall be AWWA standard taper. Outlets shall be IP threads with a brass compression fitting. Corporation stops shall be compatible with the tapping saddle. Corporation stops for direct taps may be used on ductile iron pipe per the table in the Execution and Installation section.

Copper meter setters shall be used; meter yokes or “straight piping” shall not be allowed. Meter setters for all line sizes shall be minimum 7” in height and shall provide 6” clearance from the bottom of the meter box and 6” clearance below the meter box lid. Meter setters shall accommodate Neptune radio read type meters.

Meter setters (Ford 70 Series or an approved equal) shall have an angle valve on the inlet end and a check valve on the outlet end. Angle valve and check valve shall be of same manufacturer as meter setter, assembled and supplied as one unit. Angle valve shall be all bronze, ball valve type with lock wings. Check valves shall have a dual check assembly.

All parts and materials used in water services shall be of one manufacturer and possess compatible connectors and threads and be of materials compatible with all other water service parts and materials.

Meter boxes shall include a solid cast iron lid (without flip-to-read hatch) manufactured for Radio-Read applications (2-inch hole in lid for radio antennae). Plastic or cast iron meter boxes shall be supplied of sufficient size to allow for 6 inches clear space both above and below the meter. Generally, this requires an 18-inch deep box.

- L. Meters: Meters shall be Neptune radio read type, possessing radio read output consistent with that used by the Town of Pittsboro at the time of installation. The Town of Pittsboro supplies and installs Neptune, radio read type meters up to  $\frac{3}{4}$ -inch. Meters larger than  $\frac{3}{4}$ -inch shall be provided by the Owner.

Meters  $\frac{3}{4}$ -inch through  $1\frac{1}{2}$ -inch shall be displacement type and shall conform to AWWA C700. The main case shall be of bronze or lead-free copper alloy construction with frost protection features. The measuring chamber shall be of bronze, copper alloy or synthetic polymer construction. Registers shall be magnetic drive, direct reading in U.S. gallons. Meters shall be of the nutating disc, positive displacement type.

Meters provided and installed shall possess a minimum one-year manufacturer warranty. Supplier/manufacturer shall repair or replace any meter parts that become defective under normal wearing conditions within one year of the date of installation of the meter without charge to the Town of Pittsboro.

- M. Larger Meters: Service meters 2-inch and larger shall be Neptune radio read conforming to AWWA C702. Meters shall be compound type with operating ranges adequate for metering the expected high and low flows at the service. Meters shall include turbine type and disc type magnetically driven registers.

Meters shall be installed in a precast concrete meter vault, adequately sized for the meter and all appurtenances, that is, minimum 12-inch clearance between vault walls and all working parts of the meter and appurtenances, including 12-inch clearance for all flange bolts. The meter assembly shall include gate valves upstream and downstream of the meter and a valved bypass line to allow the meter to be isolated/removed for calibration and repairs. The meter vault shall be constructed so that flooding of the vault will not occur.

Manufacturer's recommendations for screens, backflow prevention, etc. shall be included. The full assembly shall be supported from the vault floor at least 12 inches by concrete pedestals or pillars beneath the spool pieces. The vault shall include an aluminum access hatch, such as by Halliday Products, sized adequately for removal of the meter. The access hatch shall possess an integral

extruded aluminum channel frame incorporating a continuous concrete anchor and a 1-1/2 inch drainage coupling.

Where the vault lies within road right-of-way or may otherwise be purposely or inadvertently driven upon, a traffic-rated vault lid and door shall be provided.

- N. Tracer Wire: Tracer wire shall be installed on all water mains (taped to the pipe crown). Tracer wire shall be installed as outlined in the "Installation and Execution" specification. Tracer wire shall be minimum 18 gauge copper wire, plastic coated. During installation, electrical continuity shall be maintained between valves. If a wire is cut or otherwise requires splicing, the ends of the wire shall be bared, twisted together and connected with an electrical "twist cap".
- O. Locator Tape: Locator tape shall be installed above all water mains. Locator tape shall bear the words: "Warning – Water Main Below". Locator tape shall be installed as outlined in the "Installation and Execution" section.

02. **INSTALLATION AND EXECUTION:** The Owner or Contractor shall provide all materials, labor, tools, equipment and incidentals required for excavation, installation, backfilling and testing of water mains and associated appurtenances shown on approved plans.

- A. Pipe Installation: Water main piping shall be installed in accordance with AWWA C600. Pipe shall be installed on reasonably consistent grade and straight alignments, and all joints shall be properly fitted. All pipe and appurtenances shall be placed in trenches with suitable equipment to prevent damage to materials. Pipe and appurtenances shall not be dropped into the trench. Damaged or defective materials shall be permanently marked and removed from the project.

All foreign matter or dirt shall be removed from pipe and fittings. Pipe interior shall be clean. Pipe that cannot be swabbed clean shall not be used. Materials with evidence of oil, tar or grease shall be permanently marked and removed from the project. Chlorine powder or tablets shall not be placed in pipe during installation.

Pipe jointing shall be accomplished according to manufacturer requirements. Bell and spigot shall be cleaned and lubricated before jointing. Pipe installation shall progress with bell ends facing the laying direction. Manufacturer's maximum allowable joint deflection shall not be exceeded.

Pipe cutting for inserting valves, fittings or closure pieces shall be square, neat and properly chamfered according to manufacturer requirements.

Before backfilling, tracer wire shall be taped onto the crown of the pipe. During installation, electrical continuity shall be maintained between valves. If a wire is cut or otherwise requires splicing, the ends of the wire shall be bared, twisted together and connected with an electrical "twist cap".

While backfilling the water main trench, locator tape shall be placed immediately over the water main, approximately 12 inches below ground surface. Locator tape shall bear the words: "Warning – Water Main Below".

- B. Relation of Water Mains to Other Piping: Lateral separation from sanitary sewer shall be minimum 10 feet, outside to outside. If this separation cannot be obtained, then the water and sewer mains shall be installed in separate trenches with the bottom of the water main at least 18 inches above the top of the sewer main.

When a water main must cross over a sewer main, the bottom of the water main shall be at least 18 inches above the top of the sewer main. If this separation cannot be obtained while maintaining the required cover, both the water and sewer mains shall be ductile iron pipe, with joints equivalent to water main

standards, for 10 feet on each side of the point of crossing. A joint of water main pipe shall be centered at the point of crossing.

When a water main must cross under a sewer main, both the water and sewer mains shall be ductile iron pipe, with joints equivalent to water main standards, for 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing. Vertical separation between the top of the water main and the bottom of the sewer main shall be minimum 12 inches.

When a water main crosses over or under a storm sewer, vertical separation between the pipes shall be minimum 18 inches unless both pipes are ductile iron or encased in concrete for 10 feet either side of the crossing.

- C. Setting Valves and Valve Boxes: Valves shall be set at locations shown in approved plans. Valve to pipe connections shall be mechanical joint. A cast iron valve box shall be installed, accurately centered over the valve operating nut. Valve boxes shall be installed to the project finished grade. When not in pavement, the valve box shall be protected with a precast concrete donut. The donut shall be dug into the ground approximately two inches so the donut is level, fully flush with the ground and even with the top of the valve box. Valve boxes in paved sections shall be finished flush with final grade and shall be supported at the top with a poured concrete collar at least 2-1/2 feet in diameter.
- D. Setting Fittings: Fittings shall be installed in the locations shown in approved plans. Fittings shall be mechanical or restrained joint and shall be properly and tightly installed per manufacturer's requirements. Slip joint fittings shall not be allowed. Adequate thrust restraint shall be employed as shown in plans and as described in these specifications.
- E. Setting Fire Hydrants: Fire hydrants shall be set where shown on approved plans. Pipe for hydrant leg shall be ductile iron regardless of pipe material used on the main. The hydrants shall be set upon a bed of compacted crushed stone at least 36 inches square by 12 inches deep. When backfilling, washed stone or pea gravel shall be placed around the hydrant and above the drain holes so that the hydrant will properly drain when not in use. The hydrant and hydrant leg gate valve shall be securely anchored to the main line using an approved tie rod assembly. A concrete thrust block shall be placed behind the hydrant tee and hydrant assembly. A 6-inch gate valve shall be installed on the hydrant leg within 10 feet of the hydrant.

Fire hydrants shall be set such that the hydrant base is flush with the project final grade.

- F. Reaction Blocking: All water main fittings shall be installed with thrust restraint. Reaction blocking shall be transit-mixed concrete of minimum 2500 psi 28-day

compressive strength placed in adequate quantities for the size and shape of fitting being installed. Reaction blocking shall be formed and poured such that mechanical joint bolts remain accessible. The blocking shall be backed by firm solid earth. Where manufactured joint restraint is used, concrete blocking shall be used only as recommended by the joint restraint manufacturer.

- G. Service Connections: Service connections on PVC pipe shall be made using tapping saddles. Direct taps are allowed on ductile iron pipe per the table below. Taps shall be made at a 45-degree angle from vertical on the same side of the pipe as the service. Service line shall be Type K copper tubing, buried a minimum of 2 feet. Pipe bends shall be smooth, not crimped. Crimped pipe shall be rejected.

<u>Water Main Size</u>	<u>Max. Allowable Tap</u>
8" DIP and larger	2"
6" DIP	1-1/2"

Connections larger than 2-inch shall be made using a tapping sleeve and valve.

Service connections are not allowed on water mains larger than 12-inch except with the permission of the Town of Pittsboro.

Meter boxes shall be set flush with finished grade with a 3-inch minimum depth of washed stone in the base of the meter box. If grade changes are made during the project, meter boxes shall be adjusted to final grade.

Meter setters and meter shall be centered in the meter box with the meter setter plumb and the meter face facing straight up. The meter setter shall be installed such that the meter face is 6 inches below the meter box lid.

- H. Water Main Flushing and Pigging: Prior to pressure testing, disinfecting and placing any water main into service, the water mains shall be pigged and flushed with adequate velocity to flush sediment from the lines as follows:

Pigging: Contractor shall pig all new water mains with a 5 LB/CF polyurethane "pig". The Contractor shall be responsible for all aspects of the pigging process including, but not limited to, the launcher and receiver, water management aspects such as pits or piping, extrication of lodged pigs, excavation and repair of cited deficiencies, etc. The pigging shall not create deleterious results such as erosion, sedimentation in streets or sewer/stormwater piping, discharge to sewers, etc.

Flushing: After pigging, all mains shall be flushed with adequate velocity to remove remaining sediment. A line velocity of at least 5 feet per second must

be reached to obtain adequate scour for cleaning. Discharge shall be to a suitable point that will not result in flooding, erosion or flow into the sanitary sewer system.

- I. Pressure Testing Water Mains: Following installing, pressure testing shall be performed on all pipe, valves, hydrants, and fittings. Pressure tests shall be conducted on line segments from shut valve to shut valve in segments not exceeding 1,000 linear feet except as directed or approved by the Town of Pittsboro. Longer test sections may be allowed on transmission mains where valve spacing is greater.

The Contractor shall provide a suitable pump and an accurate pressure gauge. Hydrostatic pressure and leakage testing shall conform to ANSI/AWWA C600 for ductile iron pipe and ANSI/AWWA C605 for PVC pipe.

Pressure tests shall be conducted at 150 psi or 1.5 times the maximum operating pressure, whichever is greater. Test duration shall be 2 hours minimum. The acceptable leakage rate shall be as follows.

$$Q = \frac{L * D * \sqrt{P}}{133,200}$$

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

Acceptance of water mains shall be based on allowable leakage, as described above. The Contractor shall, at his own expense, locate and make repairs as necessary until the leakage is within the specified allowance. All visible leaks shall be fixed regardless of measured leakage.

Pressure tests will not be considered acceptable and will not be approved without a representative of the Town of Pittsboro present. 48-hour notice shall be given to the Town prior to pressure testing.

The Contractor shall pre-test all water mains before requesting pressure test observation from the Town of Pittsboro. No pressure tests will be observed without the Contractor's first pre-testing the water mains.

Excessive site visits will not be tolerated. In the event that more than two site visits are required for a segment of water main to pass pressure testing, the Town of Pittsboro shall bill the Owner for the additional visits at a rate of \$75 per hour.

- J. Disinfecting Water Mains and Other Appurtenances: Disinfection of new potable water supply system components shall be in accordance with the North Carolina Department of Environment, and Natural Resources, Rules Governing Public Water Systems, NCAC Title 15A, Subchapter 18C Section .1003 and the requirements of AWWA C651.

Water mains shall not be placed in service until all final submittals are provided and the Town of Pittsboro has approved the project for service. It is the responsibility of the Owner/Contractor to coordinate water main disinfection with the submittal of close-out materials.

All water mains shall be pigged and thoroughly flushed prior to disinfecting.

Disinfection shall be performed by pumping a solution of HTH and water (potable water obtained from the metered connection) into the new water mains (and services) so that a chlorine residual concentration of at least 50 milligrams per liter (50 ppm) remains in the lines. The chlorine solution shall be pumped in at a constant rate so that a uniform distribution is produced in the lines. Valves and hydrants shall be adequately exercised to aid in uniformly distributing the chlorine solution.

The chlorine solution shall remain in the lines for a minimum of 24 hours and a maximum of 48 hours at which time the residual concentration shall be no less than 10 ppm. Residual chlorine levels shall be demonstrated to be at least 10 ppm or the Town shall require the lines to be rechlorinated before bacteriological testing is conducted.

At the end of the contact period and prior to bacteriological testing, the chlorine solution shall be thoroughly flushed from the water mains to no more than the normal chlorine residual in the distribution system. Flushing shall occur at hydrants and/or service connections and discharge shall be to a suitable point that will not result in flooding, erosion or flow into the sanitary sewer system

Extreme care shall be taken to insure that high-concentration chlorine solution does not enter existing water mains.

- K. Bacteriological Sampling: After water mains have been disinfected and flushed, the Owner/Contractor shall collect samples for turbidity and bacteriological analysis for each section of pipe tested. At least one sample shall be collected for every 1000 feet of water main. Sample collection shall be performed under the supervision of the Town of Pittsboro or a certified laboratory and shall follow proper chain of custody procedures. Samples shall be collected at locations determined by the Town of Pittsboro. Samples shall be analyzed by a certified laboratory meeting the certification requirements of NCDENR.

If a bacteriological test fails, the line segment may be retested once. If the second test fails, the line shall be reflashed, rechlorinated and retested as outlined above.

Certified laboratory reports shall be submitted to the Town of Pittsboro. Final project approval will not be given without submittal of certified laboratory reports.

# TOWN OF PITTSBORO STANDARD SPECIFICATIONS

## SECTION 3

### PUBLIC WATER DISTRIBUTION CONSTRUCTION

01. **MATERIALS:** All materials used in water distribution system construction shall conform to applicable industry standards including American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), Ductile Iron Pipe Research Association (DIPRA), American Association of State Highway and Transportation Officials (AASHTO), and American National Standards Institute (ANSI) and the requirements of the Town of Pittsboro and North Carolina Department of Environmental Quality (DEQ) for certifications and permits.

A. **Ductile Iron Pipe:** Ductile iron pipe 6-inch and larger shall be in accordance with AWWA C150 and C151; cement-mortar lining and seal coat in accordance with AWWA C104. Joints shall be in accordance with AWWA C111 and include rubber compression gasket. All ductile iron pipe shall be marked "Ductile" and bear the name of the manufacturer.

1. **Pipe Joints:**

- i. **Slip-Type:** AWWA C111 rubber gaskets and lubricant.
- ii. **Mechanical Joints:** AWWA C111 ductile-iron or gray-iron glands, high-strength steel bolts and nuts, and rubber gaskets.
- iii. **Restrained Joints:** Joint restraint mechanisms shall be AWWA C111 and consistent with the pipe manufacturers' recommendation and intent.
- iv. **Flanged Pipe:** Flanged pipe shall be used only in above-ground applications. All flanged pipe shall be of ductile iron with ductile iron flanges per AWWA C115/ANSI A21.15, and shall be rated for a working pressure of 250 psi. Flanges shall be standard ANSI B16.1, Class 125.

B. **Steel Encasement Pipe:** Steel pipe for encasing pipe beneath roads or railroads shall be high strength spiral welded or seamless grade "B" steel with minimum yield strength of 35,000 psi. The inside diameter of the casing pipe shall be at least 6 inches greater than the largest outside diameter of the carrier pipe at the bell, allowing for at least 3 inches of annular space around the circumference of the carrier pipe.

Minimum casing pipe thickness shall be as follows, except where NCDOT or railroad specifications supercede, and in such cases, those shall be considered the minimum requirements.

<u>Casing Pipe Diameter</u>	<u>Minimum Wall Thickness (Roadways)</u>	<u>Minimum Wall Thickness (Railways)</u>
10"	0.188	0.188
12"	0.188	0.251
16"	0.250	0.312
18"	0.250	0.313
20"	0.250	0.375
24"	0.250	0.407
30"	0.312	0.469
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Carrier pipe within casing shall be ductile iron pipe supported by spiders at both the bell and spigot of each joint of pipe.

- C. Pipe Fittings: Pipe fittings shall conform to AWWA C153 for compact fittings. Fittings shall be mechanical joint in accordance with AWWA C111. Fittings shall be ductile iron with a minimum working pressure rating of 250 psi.

Fittings shall be cement mortar lined and seal coated in accordance with AWWA C104. Fittings shall have an outside coating of bituminous material that is maintained through storage, handling and installation. Fittings shall not be installed without a complete and thorough bituminous coat.

At the discretion of the Town of Pittsboro, Meg-a-lug retainer glands may be accepted in certain instances when joint restraint is required.

- D. Gate Valves: Gate valves shall be resilient wedge type in accordance with AWWA C509 with full interior and exterior fusion bonded epoxy coating in accordance with AWWA C550. Resilient wedge coating shall be in accordance with ASTM D2000. Gate valves shall be mechanical joint per AWWA C111. Gate valve bodies shall be ductile iron with O-ring stem seals above and below the thrust collar and O-rings between the stuffing box, bonnet and body. Gate valves shall be open-left, non-rising stem with a 2-inch operating nut. Valves shall have 200 psi minimum working pressure and 500 psi hydrostatic test pressure.

This specification shall also apply for tapping valves except that tapping valves shall include a tapping ring and flanged connection to the tapping sleeve/saddle.

There shall be required at each water main tee three (3) gate valves, one on each branch.

- E. Butterfly Valves: Valves 16-inch and larger shall be butterfly valves. Butterfly valves shall be Class 150B in accordance with AWWA C504. Butterfly valves shall have 90 degrees rotation from full open to full shut. Butterfly valves shall

have adjustable mechanical stops, bronze or stainless steel seating rings and Buna-N or Buna-S valve seats. Valve stuffing box and bearing hub shall be integrally cast with the valve body. The shaft shall be stainless steel and the shaft bearings shall be heavy duty bronze. Shaft bearings shall be self-lubricating with fully adjustable thrust bearings. Butterfly valve operators shall be worm gear type in a waterproof gear box, open left, with a 2-inch square operating nut.

Butterfly valves shall be shipped to the site fully assembled. Butterfly valves selected for use shall be obtained from manufacturers that fully warrant the satisfactory performance of the assembled valve and operator.

Butterfly valves shall be installed in a precast concrete manhole with cast iron frame and cover with "WATER" cast in the cover. Manholes and manhole construction shall meet the standards set forth in the Sanitary Sewer Standard Specification. The manhole shall be sealed and watertight and grading shall promote drainage away from the manhole and prevent flooding of the manhole. The manhole shall be adequately sized to accommodate the valve assembly and permit room for maintenance and repairs.

- F. Tapping Sleeves and Valves: Tapping sleeves shall be ductile iron, 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve shall have mechanical-joint ends with rubber gaskets or sealing rings in sleeve body. Ductile iron sleeves shall bear an exterior protective bituminous coating.

Stainless steel fully-gasketed sleeves will also be accepted. When stainless steel sleeves are used, all metal parts including bolts and flange shall be stainless steel.

Tapping sleeves used shall be appropriate to the size and material of pipe being tapped and possess a flange appropriate for the tapping machine and tapping valve to be employed. Flanges shall be Class 125 (pressure rating 250 psi) in accordance with AWWA C115. Shall be tested hydrostatically tested up to 200-psi for thirty (30) minutes before a tap is made. Tapping sleeves shall NOT be air tested.

- G. Valve Boxes: Valve boxes shall be of close-grained gray cast iron and adjustable. The word "Water" shall be cast in the lid. Valve boxes shall be cast domestically, bearing the manufacturer's name and "USA" in the casting. Valve boxes shall be painted with a protective bituminous coat before being shipped from the factory.

- H. Fire Hydrants: Fire hydrants shall be Mueller Centurion in accordance with AWWA C502. Fire hydrants shall be provided with two 2.5-inch nozzles and one 4.5-inch nozzle and caps with chains for each nozzle. Fire hydrants shall have 5.25-inch main valve opening, compression type, designed to close with line pressure. Fire hydrants shall have sealed lubrication chambers with O-ring seals to protect operating threads from the waterway and anti-friction rings for ease of

operation. Hydrant-to-base flange seating shall be bronze to bronze. Fire hydrants shall bear a breakaway traffic flange between the upper and lower hydrant barrel. Operating nuts shall be bronze, 1.5-inch pentagonal, counterclockwise opening.

In distribution mains, fire hydrants shall be spaced such that all structures fall within a 500-foot radius of at least one fire hydrant.

In transmission mains, fire hydrants shall be placed a minimum of every 2000 feet along the length of the transmission piping. Fire hydrants on transmission piping shall be placed at the high points on the route to allow for air release.

- I. Air Release Valves: Air release valves shall be shall be Crispin or an approved equal, manufactured in accordance with AWWA C512. Air release valves shall provide automatic escape of entrained air while the water main is in service. Air release valves shall be suitable for minimum operating pressure of 150 psi or the designed operating pressure of the water system, whichever is greater.

Air release valves shall be properly sized using manufacturer's guidelines; that is, water main size, flowrate, pipe grade and the required air release rate shall be considered in sizing of each air release valve.

Air release valve inlets shall be NPT screwed or ANSI Class 125 flanged. Valve bodies shall be cast iron; floats and trim shall be stainless steel with Buna-N seats. The ARV outlet orifice shall be finished with a breather pipe one foot tall with a downward-turned elbow to prevent trash from entering the outlet orifice.

Air release valves shall be installed at the high points along the transmission mains. Air release valves shall not be installed in distribution piping.

Air release valves shall be installed in a manhole and shall include valving to allow for removal/repair of the air release valve. Connection to the main shall include a tapping saddle. Piping used for air release valve installation shall be SCH 40 brass, threaded NPT.

- J. Blow-off Assemblies: Blow-off assemblies shall be installed at the terminus of dead-end sections of water mains. Blow-off assemblies shall be constructed from a restrained, mechanical joint plug tapped 2-inch NPT. A gate valve of equivalent size to the water main shall be installed immediately upstream of the mechanical cap. A 2-inch gate valve shall be installed near the blow-off assembly to operating the blow-off.

Piping downstream of the mechanical cap shall be 2-inch SCH 40 brass pipe threaded NPT, or an approved equal piping. PVC pipe shall not be allowed in blow-off assembly construction.

Valves, bends and fittings shall be properly and thoroughly restrained with concrete blocking and rodding as needed. The blow-off spout shall be tapped 2-inch NPT and a 2-inch cap shall be provided. A 2-inch threaded union with an ample section of brass piping with a 90-degree elbow at one end shall be provided to the Town of Pittsboro to connect to the blow-off assembly to divert water when in operation.

- K. Water Service Appurtenances: Water services shall be ¾-inch minimum. Pipe for water services ¾-inch through 2-inch shall be type "K" soft copper. Fittings shall be copper-compatible brass.

All service connections 2-inch diameter and smaller shall incorporate a corporation stop as a shut off valve at the water main.

On 2-inch diameter services, in addition to the corporation stop at the water main, a threaded end gate valve in accordance with Specification Section 01.D. shall be installed a curb stop. Valve shall be fitted with a valve box extended to grade.

Tapping/service saddles shall be selected for compatibility with the host pipe. Saddles for PVC pipe shall possess ample width for distribution of clamping pressure and shall be of hinge-less design with two (2) fastening nuts on each side of the saddle body (Ford S70 or approved equal). Service connections to PVC pipe shall be made with tapping saddles.

Saddles for ductile iron pipe shall be of the double strap, hinge-less design, possessing two (2) fastening nuts on each side of the saddle body (Ford 202B or approved equal).

Saddle construction shall be of 85-5-5-5 brass conforming to AWWA C800. Saddle bosses shall have AWWA standard tapered threads compatible with the corporation cock used and incorporating a Buna-N rubber gasket.

Corporation stops shall be all brass 85-5-5-5 construction conforming to AWWA C800; unions shall be three piece copper to copper. Threads shall be AWWA standard taper. Outlets shall be IP threads with a brass compression fitting. Corporation stops shall be compatible with the tapping saddle. Corporation stops for direct taps may be used on ductile iron pipe per the table in the Execution and Installation section.

Copper meter setters shall be used; meter yokes or "straight piping" shall not be allowed. Meter setters for all line sizes shall be minimum 7" in height and shall provide 6" clearance from the bottom of the meter box and 6" clearance below the meter box lid. Meter setters shall accommodate Neptune radio read type meters.

Meter setters (Ford 70 Series or an approved equal) shall have an angle valve on the inlet end and a check valve on the outlet end. Angle valve and check valve

shall be of same manufacturer as meter setter, assembled and supplied as one unit. Angle valve shall be all bronze, ball valve type with lock wings. Check valves shall have a dual check assembly.

All parts and materials used in water services shall be of one manufacturer and possess compatible connectors and threads and be of materials compatible with all other water service parts and materials.

Meter boxes shall include a solid cast iron lid (without flip-to-read hatch) manufactured for Radio-Read applications (2-inch hole in lid for radio antennae). Plastic or cast iron meter boxes shall be supplied of sufficient size to allow for 6 inches clear space both above and below the meter. Generally, this requires an 18-inch deep box.

- L. Meters: Meters shall be Neptune radio read type, possessing radio read output consistent with that used by the Town of Pittsboro at the time of installation. The Town of Pittsboro supplies and installs Neptune, radio read type meters up to  $\frac{3}{4}$ -inch. Meters larger than  $\frac{3}{4}$ -inch shall be provided by the Owner.

Meters  $\frac{3}{4}$ -inch through  $1\frac{1}{2}$ -inch shall be displacement type and shall conform to AWWA C700. The main case shall be of bronze or lead-free copper alloy construction with frost protection features. The measuring chamber shall be of bronze, copper alloy or synthetic polymer construction. Registers shall be magnetic drive, direct reading in U.S. gallons. Meters shall be of the nutating disc, positive displacement type.

Meters provided and installed shall possess a minimum one-year manufacturer warranty. Supplier/manufacturer shall repair or replace any meter parts that become defective under normal wearing conditions within one year of the date of installation of the meter without charge to the Town of Pittsboro.

- M. Larger Meters: Service meters 2-inch and larger shall be Neptune radio read conforming to AWWA C702. Meters shall be compound type with operating ranges adequate for metering the expected high and low flows at the service. Meters shall include turbine type and disc type magnetically driven registers.

Meters shall be installed in a precast concrete meter vault, adequately sized for the meter and all appurtenances, that is, minimum 12-inch clearance between vault walls and all working parts of the meter and appurtenances, including 12-inch clearance for all flange bolts. The meter assembly shall include gate valves upstream and downstream of the meter and a valved bypass line to allow the meter to be isolated/removed for calibration and repairs. The meter vault shall be constructed so that flooding of the vault will not occur.

Manufacturer's recommendations for screens, backflow prevention, etc. shall be included. The full assembly shall be supported from the vault floor at least 12

inches by concrete pedestals or pillars beneath the spool pieces. The vault shall include an aluminum access hatch, such as by Halliday Products, sized adequately for removal of the meter. The access hatch shall possess an integral extruded aluminum channel frame incorporating a continuous concrete anchor and a 1-1/2 inch drainage coupling.

Where the vault lies within road right-of-way or may otherwise be purposely or inadvertently driven upon, a traffic-rated vault lid and door shall be provided.

- N. Tracer Wire: Tracer wire shall be installed on all water mains, and services (taped to the pipe crown). Tracer wire shall be installed as outlined in the standard detail Tracer wire shall be minimum 18 gauge copper wire, plastic coated. During installation, electrical continuity shall be maintained between valves. If a wire is cut or otherwise requires splicing, the ends of the wire shall be bared, twisted together and connected with an electrical "twist cap".
- O. Locator Tape: Locator tape shall be installed twenty (24") inches above all water mains. Locator tape shall bear the words: "Warning – Water Main Below". Locator tape shall be installed as outlined in the standard detail section.
- P. Polyethylene Wrap shall be used on all buried ductile iron pipe, fittings, gate valves and other appurtenances that are subject to corrosion either in the soil, or surrounding condition. Shall either be painted Pantone 522 purple and/or wrapped with a Columbia blue polyethylene membrane conforming to ANSI A21.5, or installed in accordance with AWWA C105. The polyethylene sheets shall be 10 mils thick, minimum.

The Town of Pittsboro shall determine on a case by case if polyethylene wrap is required. Soil corrosion is a geologic hazard that affects buried metals and concrete that is in direct contact with soil or bedrock. Soil corrosion is a complex phenomenon, with a multitude of variables involved. Pitting corrosion and stress-corrosion cracking (SCC) are a result of soil corrosion, which leads to underground oil and gas transmission pipeline failures. The corrosivity of soils can be estimated by measuring soil resistivity. Sandy soils are high on the resistivity scale and therefore considered the least corrosive. Clay soils, especially those contaminated with saline water are on the opposite end of the spectrum. Factors that influence soil corrosion are:

- Porosity (aeration)
- Electrical conductivity or resistivity
- Dissolved salts, including depolarizers or inhibitors
- Moisture
- pH

Each of these variables may affect the anodic and cathodic polarization characteristics of a metal in soil. The most corrosive soils have high content of:

- Moisture
- Electrical conductivity
- Acidity
- Dissolved salts

In cases where metallic steel and ductile iron pipelines or encasement pipes are planned for installation in close proximity to any potential sources of stray current or aggressive soils, a field analysis consisting of stray current evaluation and soil testing shall be conducted by an experienced technician, as certified by the National Association of Corrosion Engineers, (NACE), to determine the potential for external corrosion at no additional cost to the Town of Pittsboro. In cases where stray current conditions and/or aggressive soils are prevalent, a corrosion specialist certified by the NACE or other applicable certification board shall be consulted regarding the design of pipeline protection measures.

At a minimum, all stray current protection systems should include bonded joints and sacrificial anodes with a 50-year or longer design life and test facilities in lieu of polyethylene encasement, unless otherwise approved by the Town of Pittsboro. The cathodic protection element of the pipeline design package shall be sealed by Professional Engineer licensed in the State of NC.

Full impressed current cathodic protection shall only be utilized when extreme corrosion potential has been proven and/or as otherwise directed by the Town of Pittsboro Engineering Department and the certified corrosion engineer of record.

**02. INSTALLATION AND EXECUTION:** The Owner or Contractor shall provide all materials, labor, tools, equipment and incidentals required for excavation, installation, backfilling and testing of water mains and associated appurtenances shown on approved plans.

- A. Pipe Installation: Water main piping shall be installed in accordance with AWWA C600. Pipe shall be installed on reasonably consistent grade and straight alignments, and all joints shall be properly fitted. All pipe and appurtenances shall be placed in trenches with suitable equipment to prevent damage to materials. Pipe and appurtenances shall not be dropped into the trench. Damaged or defective materials shall be permanently marked and removed from the project.

All foreign matter or dirt shall be removed from pipe and fittings. Pipe interior shall be clean. Pipe that cannot be swabbed clean shall not be used. Materials with evidence of oil, tar or grease shall be permanently marked and removed from the project. Chlorine powder or tablets shall not be placed in pipe during installation.

Pipe jointing shall be accomplished according to manufacturer requirements. Bell and spigot shall be cleaned and lubricated before jointing. Pipe installation shall progress with bell ends facing the laying direction. Manufacturer's maximum allowable joint deflection shall not be exceeded.

Pipe cutting for inserting valves, fittings or closure pieces shall be square, neat and properly chamfered according to manufacturer requirements.

Before bedding, and backfilling, tracer wire shall be taped onto the crown of the pipe. During installation, electrical continuity shall be maintained between valves. If a wire is cut or otherwise requires splicing, the ends of the wire shall be bared, twisted together and connected with an electrical "twist cap".

While backfilling the water main trench, locator tape shall be placed immediately over the water main, approximately twenty (24") inches below ground surface. Locator tape shall bear the words: "Warning – Water Main Below".

- B. Relation of Water Mains to Other Piping: Lateral separation from sanitary sewer shall be minimum 10 feet, outside to outside. If this separation cannot be obtained, then the water and sewer mains shall be installed in separate trenches with the bottom of the water main at least 18 inches above the top of the sewer main.

When a water main must cross over a sewer main, the bottom of the water main shall be at least 18 inches above the top of the sewer main. If this separation cannot be obtained while maintaining the required cover, both the water and sewer mains shall be ductile iron pipe, with joints equivalent to water main standards, for 10 feet on each side of the point of crossing. A joint of water main pipe shall be centered at the point of crossing.

When a water main must cross under a sewer main, both the water and sewer mains shall be ductile iron pipe, with joints equivalent to water main standards, for 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing. Vertical separation between the top of the water main and the bottom of the sewer main shall be minimum 12 inches.

When a water main crosses over or under a storm sewer, vertical separation between the pipes shall be minimum 18 inches unless both pipes are ductile iron or encased in concrete for 10 feet either side of the crossing.

- C. Setting Valves and Valve Boxes: Valves shall be set at locations shown in approved plans. Valve to pipe connections shall be mechanical joint. A cast iron valve box shall be installed, accurately centered over the valve operating nut. Valve boxes shall be installed to the project finished grade. When not in

pavement, the valve box shall be protected with a precast concrete donut. The donut shall be dug into the ground approximately two inches so the donut is level, fully flush with the ground and even with the top of the valve box. Valve boxes in paved sections shall be finished flush with final grade and shall be supported at the top with a poured concrete collar at least 2-1/2 feet in diameter.

D. Setting Fittings: Fittings shall be installed in the locations shown in approved plans. Fittings shall be mechanical or restrained joint and shall be properly and tightly installed per manufacturer's requirements. Slip joint fittings shall not be allowed. Adequate thrust restraint shall be employed as shown in plans and as described in these specifications.

E. Setting Fire Hydrants: Fire hydrants shall be set where shown on approved plans. Pipe for hydrant leg shall be ductile iron regardless of pipe material used on the main. The hydrants shall be set upon a bed of compacted crushed stone at least 36 inches square by 12 inches deep. When backfilling, washed stone or pea gravel shall be placed around the hydrant and above the drain holes so that the hydrant will properly drain when not in use. The hydrant and hydrant leg gate valve shall be securely restrained to the main line using an approved MJ fitting assembly. A concrete thrust block shall be placed behind the hydrant tee and hydrant assembly. No bells allowed in section of piping between valve, and hydrant, or shall be restrained. The hydrant assembly shall include restrained with MJ fitting at the tee, gate valve and the hydrant assemble. A 6-inch gate valve shall be installed on the hydrant leg within 10 feet of the hydrant, and restrained with a thrust block.

Fire hydrants shall be set such that the hydrant base is flush with the project final grade.

F. Reaction Blocking: All water main fittings shall be installed with thrust restraint. Reaction blocking shall be transit-mixed concrete of minimum 2500 psi 28-day compressive strength placed in adequate quantities for the size and shape of fitting being installed. Reaction blocking shall be formed and poured such that mechanical joint bolts remain accessible. The blocking shall be backed by firm solid earth. Where manufactured joint restraint is used, concrete blocking shall be used only as recommended by the joint restraint manufacturer.

G. Service Connections: Service connections on PVC pipe shall be made using tapping saddles. Direct taps are NOT allowed on ductile iron pipe Taps shall be made at a 45-degree angle from vertical on the same side of the pipe as the service. Service line shall be Type K copper tubing, buried a minimum of 2 feet. Pipe bends shall be smooth, not crimped. Crimped pipe shall be rejected.

Connections larger than 2-inch shall be made using a tapping sleeve and valve.

Service connections are not allowed on water mains larger than 12-inch except with the permission of the Town of Pittsboro.

Meter boxes shall be set flush with finished grade with a 3-inch minimum depth of washed stone in the base of the meter box. If grade changes are made during the project, meter boxes shall be adjusted to final grade.

Meter setters and meter shall be centered in the meter box with the meter setter plumb and the meter face facing straight up. The meter setter shall be installed such that the meter face is 6 inches below the meter box lid.

- H. Water Main Flushing: Please refer to Town Pittsboro Specification 2, paragraph's 3, and 5.

Prior to pressure testing, disinfecting and placing any water main into service, the water mains shall be flushed with adequate velocity to flush sediment from the lines as follows:

Flushing: All mains shall be flushed with adequate velocity to remove remaining sediment. A line velocity of at least 5 feet per second must be reached to obtain adequate scour for cleaning. Discharge shall be to a suitable point that will not result in flooding, erosion or flow into the sanitary sewer system. The Town of Pittsboro reserves the right to have contractor employee a "pig" after three (3) failed bacteriological samples.

- I. Pressure Testing Water Mains: Hydrostatic Testing: **Town inspections staff must be present for all pressure tests.** Pressure testing may be made before or after backfilling, but backfilling must be completed before allowance testing. If the pipe is center-loaded, a visual inspection for leaks may be made along the pipe line while the test section is under test pressure, and all visible leaks repaired. However, if mechanical compaction is to be used in the backfilling operations as spelled out in AWWA C-600, the tests shall not be made until the backfilling is completed and compacted. Backfill and compaction for the full distance encompassed by restrained/welded joints shall be completed prior to testing. All connections, blow offs, hydrants and valves shall be tested with the main as far as is practicable. Hydrostatic testing shall not begin until the pipe has been filled with water for at least 24 hours to allow for air venting.

Pressure Testing: Unless otherwise noted in the contract documents, the minimum prescribed test pressure shall be at least 200 psi for lines smaller than 16 inches and 150 psi for lines 16 inches or larger, not to exceed 5 psi over the minimum prescribed test pressure, as measured at the lowest end of the section under test. The duration of each pressure test shall be at least 2 hours, during which time the test section shall not drop below the minimum prescribed test pressure. If the pressure in the pipe test section has not stabilized by the end of the testing period, a hydrostatic retest will be required. Each section of a new line

between sectionalizing valves or between the last sectionalizing valve and the end of the project shall be tested separately as required in AWWA C-600, and/or as modified in these specifications, except that any such section less than 500 feet in length may be tested with the adjacent section, if both sections of line have the same pipe class rating. No section greater than 1/2 mile in total pipe length shall be tested without special written permission of the Engineer.

Testing Allowance/Makeup Water: Makeup water volume shall be determined after the pressure test has been satisfactorily completed and all backfilling and compaction has been completed to top of trench. Testing allowance shall be defined as the maximum quantity of makeup water necessary to be supplied into the pipe line section under test to restore the ending test pressure to the beginning test pressure, after the pipe line has been filled with water and all air expelled. The Contractor shall furnish the necessary apparatus and assistance to conduct the test.

The duration of each makeup water test shall be at least 2 hours. To pass the allowance testing, the quantity of makeup water from the pipe line shall not exceed the makeup water quantity allowed by the following formula, from AWWA C-600:

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

M = testing Allowance (makeup water), in gallons per hour.

S = length of pipe tested, in feet

D = nominal diameter of pipe, in inches.

P = test pressure of the pipe being tested, per 610.15 (A)

Should the test on any section of the pipe line require more makeup water than allowed by the above formula, the Contractor shall locate and repair the defective pipe, fittings, or joint until the makeup water volume is within the specified allowance. All repairs and retests, if required, shall be made at the Contractor's expense. Connections to the existing pipelines or existing valves shall not be made until after that section of new construction has satisfactorily passed the hydrostatic tests.

Ductile iron pipe used in conjunction with ACP will be tested to the ACP standards, unless otherwise directed by the Engineer of Record.

High pressure systems of all ductile iron pipe will be tested in accordance with AWWA C-600, Section 4.1. Pressure tests will not be considered acceptable and will not be approved without a representative of the Town of Pittsboro present. 48-hour notice shall be given to the Town inspector prior to pressure testing.

The Contractor shall pre-test all water mains before requesting pressure test observation from the Town of Pittsboro with a minimum 48 hour notification. No pressure tests will be observed without the Contractor's first pre-testing the water mains.

Excessive site visits will not be tolerated. In the event that more than two site visits are required for a segment of water main to pass pressure testing, the Town of Pittsboro shall bill the Owner for the additional visits at a rate of \$105 per hour.

- J. Disinfecting Water Mains and Other Appurtenances: Disinfection of new potable water supply system components shall be in accordance with the North Carolina Department of Environment, and Natural Resources, Rules Governing Public Water Systems, NCAC Title 15A, Subchapter 18C Section .1003 and the requirements of AWWA C651. Town of Pittsboro staff must be present at the time of disinfection of public water mains.

Water mains shall not be placed in service until all final submittals are provided and the Town of Pittsboro has approved the project for service. It is the responsibility of the Owner/Contractor to coordinate water main disinfection with the submittal of close-out materials.

All water mains shall be thoroughly flushed prior to disinfecting. The Town of Pittsboro reserves the right to require "pigging" of lines if necessary.

Disinfection shall be performed by pumping a solution of HTH and water (potable water obtained from the metered connection) into the new water mains (and services) so that a chlorine residual concentration of at least 50 milligrams per liter (50 ppm) remains in the lines. The chlorine solution shall be pumped in at a constant rate so that a uniform distribution is produced in the lines. Valves and hydrants shall be adequately exercised to aid in uniformly distributing the chlorine solution.

The chlorine solution shall remain in the lines for a minimum of 24 hours and a maximum of 48 hours at which time the residual concentration shall be no less than 10 ppm. Residual chlorine levels shall be demonstrated to be at least 10 ppm or the Town shall require the lines to be re-chlorinated before bacteriological testing is conducted.

At the end of the contact period and prior to bacteriological testing, the chlorine solution shall be thoroughly flushed from the water mains to no more than the normal chlorine residual in the distribution system. Flushing shall occur at hydrants and/or service connections and discharge shall be to a suitable point that will not result in flooding, erosion or flow into the sanitary sewer system

Extreme care shall be taken to insure that high-concentration chlorine solution does not enter existing water mains.

- K. Bacteriological Sampling: After water mains have been disinfected and flushed, the Owner/Contractor shall collect samples for turbidity and bacteriological analysis for each section of pipe tested. At least one sample shall be collected for every 1000 feet of water main. Sample collection shall be performed under the supervision of the Town of Pittsboro or a certified laboratory and shall follow proper chain of custody procedures. Samples shall be collected at locations determined by the Town of Pittsboro. Samples shall be analyzed by a certified laboratory meeting the certification requirements of NCDEQ.

If a bacteriological test fails, the line segment may be retested once. If the second test fails, the line shall be re-flushed, re-chlorinated and retested as outlined above.

Certified laboratory reports shall be submitted to the Town of Pittsboro. Final project approval will not be given without submittal of certified laboratory reports.