

Section VII

WATER DISTRIBUTION SYSTEM

CONSTRUCTION PROCEDURES

This section covers construction procedures normally required for work within the District. It does not cover any special construction procedures which may be encountered for abnormal conditions.

Special construction procedures are to be presented to the District by the Developer's Design Engineer.

A. SHIPPING OF PVC PIPE

1. Protect pipe from exhaust fumes during shipping.

B. HANDLING OF MATERIALS

1. Handle pipe so as to ensure delivery to the trench in sound, undamaged condition:
 - a. Carry pipe into position - do not drag.
 - b. Use pinch bars or tongs for aligning or turning the pipe only on the bare end of the pipe.
 - c. Use care not to injure pipe linings.
2. Thoroughly clean interior of pipe and accessories before lowering pipe into trench. Keep clean during layout operations by plugging or other approved method.
3. Before installation, inspect each piece of pipe and each fitting for defects:
 - a. Replace material found to be defective before or after laying with sound material meeting the specified requirements.
4. Rubber gaskets: Store in a cool dark place until just prior to time of installation.

C. PIPE CUTTING

1. Cut pipe neatly and without damage to the pipe.
2. Unless otherwise recommended by the pipe manufacturer, cut pipe with mechanical cutter only.
 - a. Use wheel cutters when practicable.
 - b. Cut plastic pipe square and remove all burrs.

D. LOCATING

1. Where possible, locate water line at least ten (10) feet away, horizontally, from sewer pipes.
2. Should ten (10) foot separation not be practical, then the water main may be located closer provided:
 - a. It is laid in a separate trench.
 - b. It is laid in the same trench with the main water located at one side on a bench of undisturbed earth.
 - c. In either of the above cases, crown elevation of the sewer shall be at least 18" below invert elevation of water line.
3. Where water lines cross over sewers, maintain 18" minimum clearance between crown of sewer and invert of water lines.
4. Where water lines cross under sewers, each line shall be ductile iron.
 - a. A full length of water line shall be located over the sewer so that joints will be equal distance from the sewer.
5. No water pipe shall pass through or come in contact with any part of a sewer manhole.
6. Service lines:

- a. Provide a separate service to each subdivision lot.
 - b. Install service lines from the distribution main to the property lines at each lot, or at each location indicated or directed by the Engineer.
 - c. Locate service line on new lots 5' from one front corner property pin.
 - 1) The sewer service is to be installed 5' from the other front property pin.
7. Force Mains: There shall be at least a 10 foot horizontal separation between water mains and sanitary sewer force mains. There shall be an 18 inch vertical separation at crossing as required in R.61-58.4(D)(12)(a) and (b).
8. Drain-fields and Spray-fields: Potable water lines shall not be laid less than 25 feet horizontally from any portion of a waste-water tile-field or spray-field, or shall be otherwise protected by an acceptable method approved by the Department.

E. ALIGNMENT OF PIPE

1. Pipe lines intended to be straight shall be so laid.
2. Where vertical or horizontal alignment requires deflection from straight lines or grade, do not exceed maximum deflection recommended by the pipe manufacturer.
3. If alignment requires deflection exceeding recommended limits, furnish special blends to provide angular deflections within the allowable limits.

F. PLACING AND LAYING

1. General:
 - a. Lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other equipment approved by the manufacturer.
 - b. Do not dump or drop any of the materials into the trench.
 - c. Except where necessary in making connections to other lines, lay pipe with the bells facing in the direction of laying.

- d. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.
 - e. Take up and relay pipe that has the grade or joint disturbed after laying.
 - f. Do not lay pipe in water, or when trench conditions are unsuitable for the work; keep water out of the trench until jointing is completed.
 - g. Securely close open ends of pipe, fittings, and valves when work is not in process.
 - h. Replace pipe where any part of coating or lining is damaged.
 - i. Bell pipe using manufacturer's approved leverage bar.
 - 1) Do not use machinery to bell pipe.
 - 2) Home line is to be clearly visible when pipe is joined.
2. Installation of water mains and appurtenances shall be conducted in accordance with Section C of the AWWA Standards and/or manufacturer's recommended installation procedures.
3. Bedding:
- a. A continuous and uniform bedding shall be provided in the trench for all buried pipe.
 - b. Back-fill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe.
 - c. Stones, other than crushed bedding, shall not come in contact with the pipe and shall not be within 6 inches of the pipe.
4. Ductile iron pipe:
- a. Mechanical and push on joints, install in accordance with ANSI/AWWA C600.
 - b. Gaskets: Handle, lubricate where necessary and install in strict accordance with manufacturer's recommendations.
5. Plastic pipe:

- a. Clean gasket, bell or coupling interior, especially groove area.
 - b. Lubricate gasket as recommended by manufacturer.
 - c. Align spigot to bell, insert spigot into bell until it contacts gasket uniformly.
 - d. Push pipe "home" until reference mark is at proper location.
6. Restrained joints:
- a. Install in accordance with manufacturer's instructions.
 - b. Tighten set screws to the manufacturer's rated torque using a torque wrench.
 - 1) If twist-off nuts are provided, tighten screws until nut breaks loose.
7. Underwater crossings:
- a. Underwater crossings: A minimum of 2 feet of cover shall be provided over the pipe. When crossing water courses that are greater than 15 feet in width, the following shall be provided:
 - 1) The pipe material and joints shall be designed appropriately.
 - 2) Valves shall be located so the section can be isolated for testing or repair; the valves (on both sides of crossing) shall be easily accessible and not subject to flooding and installed in a manhole or vault.
 - 3) A blow-off shall be provided on the side opposite the supply service sized in accordance with Section R.61-58.4.(D)(7). Direct away from streams, over ground.
 - 4) Use DIP with ball type joints.
 - 5) Make $\frac{3}{4}$ " permanent taps on each side of the valve on the source side.
8. Above-water crossings:

- a. Use ductile iron pipe.
 - b. Adequately support and anchor the pipe, protect from damage and freezing and be accessible for repair.
 - c. Hardware, straps, etc. to be stainless steel.
9. All tees, bends, plugs and hydrants on lines 2.5 inches in diameter and larger shall be provided with reaction blocking, tie rods, or other approved method of restraint.

G. SERVICE LINES

1. Locate service lateral within five (5) feet from property corner on opposite corner of sewer lateral.
2. Install flexible service lines in one continuous piece from main to curb stop.
3. Depth of the service connection shall be no less than the top of the main connection to and shall be 12" deep at the curb stop.
4. Do not exceed an angle of 45° to the horizontal on the top.
5. Connections to ductile iron mains:
 - a. Drill and tap pipe barrel and install corporation stop therein.
6. Connections to PVC mains, 4" and larger:
 - a. Provide factory tapped coupling sleeve in new mains, located within 3½' of designated service location.
 - b. Use approved tapping saddle on existing mains.
7. Connections to mains, 3" and smaller.
 - a. Provide tees and tapped couplings in new mains.
 - b. Use approved tapping saddle on existing mains.
8. Provide corporation stops on all mains.

9. Terminate each service line with curb stop and cap.
 - a. Mark with a steel rod flush with the ground and blue PVC stake surrounding the rod installed to 16" above grade.

H. METALLIC DETECTION TAPE

1. Provide on all buried PVC and polyethylene pipe.
2. Locate 12" below the ground surface in the pipe trench.

I. COPPER TRACER WIRE

1. Provide on all buried PVC and polyethylene pipe.
2. Tracer wire shall be taped to the top of the water main.
3. Terminate tracer wire at each valve and meter and make provisions to allow for connection of testing apparatus without interfering with the proper operation of valves and meters.

J. SETTING VALVES AND VALVE BOXES

1. Center valve boxes on the valves, setting plumb.
2. Tamp earth fill around each valve box to a distance of 4' on all sides, or to the undisturbed trench face if less than 4'.
3. Install shaft extensions plumb without any binding.
4. Fully open and close each valve to assure that all parts are in working condition.

K. VALVE BOX PROTECTION RING

1. Place valve box protection ring around top of valve box as detailed.
 - a. Install ring level with top 1" above finished grade.
 - b. Top of ring to be level with or no more than 1" above the top of the valve box.

L. INSTALLATION OF HYDRANTS

1. General:
 - a. Inspect carefully, insuring that all foreign material is removed from the barrel.
 - b. Rotate Grade Lok fitting so hydrant is plumb and at the elevation detailed.
 - c. Install stone drainage bed and thrust blocking.
 - d. Fully open and close each hydrant to assure that all parts are in working condition.
 - e. Install blue hydrant reflector on centerline of paved roadway marking the perpendicular location of hydrant with reference to the road centerline.
 - f. Color of fire hydrant is to be "Old Yeller" to match the District's standards.
 - g. Install with breakaway flange at a minimum of 2" above finished grade.
 - h. Hydrants shall be covered by a black bag prior to system acceptance to insure they will not be mistaken by Fire Department officials as active hydrants.

M. BLOW-OFF HYDRANT

1. Set below grade in a cast iron meter box.
2. Hydrant should be serviceable from above grade with no digging.

N. THRUST BLOCKS

1. Provide thrust blocks, on plugs, caps, tees, hydrants and bends deflecting 1 1/4" or more either vertically or horizontally, and on water lines 2.5" in diameter or larger.

2. Thrust blocking is not required where restrained joints are provided unless shown on the details.
3. Provide concrete thrust blocking with a compressive strength of 3000 psi in 28 days.
4. Size of the blocking as detailed. For soil bearing capacities less than 2000 psf or water pressures greater than 150 psi, design for specific soil and water pressure conditions.
5. Locate thrust blocking between solid ground and the fitting to be anchored.
6. Provide 8 mil polyethylene film between the thrust block and fitting.
7. Place the base and thrust bearing sides of thrust blocking directly against undisturbed earth.
8. Sides of thrust blocking not subject to thrust may be placed against forms.
9. Place thrust blocking so the fitting joints will be accessible for repair.

O. CONNECTION OF WATER MAINS

1. Any physical connection of untested water mains with existing water mains is prohibited, except when a District approved and inspected backflow prevention device has been installed.
 - a. Water for filling or flushing new water mains will be obtained through a temporary jumper connection to the existing water main.
 - b. The District will provide the backflow prevention device and water meter required to make the temporary connection.
 - c. Physically disconnect the temporary jumper connection from the existing system after sufficient water for hydrostatic testing, disinfection and flushing are obtained.
 - d. A hydrant meter may also be used for construction water supply. The District will supply the meter and backflow prevention device for this connection.

P. HYDROSTATIC TESTING

1. General:
 - a. Conduct tests on each line or valved section of line.
 - 1) Tapping sleeves are to be tested at 150 psi for a minimum of 15 minutes prior to making tap. No leakage is allowed.
 - b. Clean and flush line of dirt and foreign material. The Contractor shall be responsible for the cost of the water used for flushing if it is obtained from District sources. In lieu of metering, the Contractor may pay an amount equal to normal District rates using ten (10) times the volume of the entire new water system.
 - c. Do not perform hydrostatic tests until at least five days after installation of concrete thrust blocking.
 - d. Test pressures shall be 150 psi based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.
 - e. Tests are to be conducted in the presence of a representative of the District.
2. Pressure tests:
 - a. After the pipe is laid, the joints completed, fire hydrants permanently installed and the trench backfilled, subject the newly laid pipe and valved sections to a hydrostatic pressure of 150 psi.
 - b. Open and close each valve within the section being tested several times during the test period.
 - c. Replace cracked pipe, defective pipe, and cracked or defective joints, fittings and valves with new material and repeat the test until results are satisfactory.
3. Leakage test:
 - a. Conduct leakage test after the pressure test has been satisfactorily completed.

- b. Duration of each leakage test: at least two hours.
- c. Pressure and leakage tests must be conducted in accordance with AWWA Standards C600. The pressure must be at least 1.5 times the maximum working pressure and the duration of this test must be at least two (2) hours. (R.61-58.4.D.(11)(e)). The formulas to be used for calculating the allowable leakage per hour shall be:

Ductile Iron:

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

L = allowable leakage (gals./hr.)

S = length of the pipeline tested (feet)

D = diameter of pipe (inches)

P = average test pressure (psig)

PVC:

$$L = [ND(P)^{1/2}], 7,400$$

L = allowable leakage (gals./hr.)

N = # of joints in pipeline being tested

D = diameter of pipe (inches)

P = average test pressure (psig)

- 1) All visible leaks shall be repaired regardless of the amount of leakage.
- 2) Should any test of pipe disclose leakage greater than that specified above, locate and repair the defective joint or joints until the leakage is within the specified allowance.

Q. DISINFECTION

1. General:

- a. Upon completion of testing, disinfect all water lines to meet requirements of the South Carolina Department of Health and Environmental Control.
- b. Newly laid valves or other appurtenances shall be operated several times while line is filled with chlorinating agent.
- c. Should initial treatment fail to meet results specified, repeat procedures until satisfactory results are obtained.

2. Procedure:

- a. Flush line to extent possible with available pressure and outlets, prior to disinfection.
 - 1) Hydrant openings required to produce proper flushing velocity at 40 psi are:

Pipe Size (Inches)	Hydrant Openings
4 through 12	one 2½"
14 through 18	two 2½"
20	one 4½"

- b. Apply chlorine as liquid chlorine and chlorine compound such as calcium hypochlorite with known chlorine content.
 - c. Apply through corporation cock in top of main, at beginning of section being sterilized.
 - d. Use proper feeder and flow regulator to introduce chlorinating agent.
 - e. Application rate shall be not less than 50 ppm.
 - f. Retain chlorinated water in main not less than 24 hours.
 - g. At end of retention period, at least 10 ppm of chlorine shall remain in the water at the extreme end of section.
 - h. Dechlorinate and flush line thoroughly.
3. Acceptance:
- a. Provide two separate samples for each sample location, taken at 24-hour intervals, free of coliform bacteria.
 - 1) Contractor to take first and second samples, deliver to South Carolina Department of Health and Environmental Control (SCDHEC) approved laboratory for testing.
 - 2) The first and second sample results shall include the free chlorine residual at the time the samples were collected.
 - 3) Notify SCDHEC to take a third sample.
 - b. At a minimum, sample locations shall be as required by SCDHEC and the following:
 - 1) The tie-in location of new and existing water lines.
 - 2) The end of all dead end lines.
 - 3) At intervals of no more than 1,200 feet for all new lines longer than 1,200 feet in length.

- c. All sample locations are to be given an identifying label and a corresponding identification label is to be included on the record drawings indicating each sample location.
- d. Prior to sampling, the chlorine residual must be reduced to normal system residual levels or be non-detectable in those systems not chlorinating.
- e. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported.
- f. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated.

R. DECHLORINATION OF CHLORINATED DISINFECTION WATER

- 1. Dechlorinate the chlorinated water used for disinfected water lines to meet requirements of the South Carolina Department of Health and Environmental Control.

S. NOTICE OF CONSTRUCTION ACTIVITY

- 1. Immediately prior to the beginning of construction the "Notice of Construction Activity" form as included in the appendix is to be completed and mailed to the District Representative with a copy mailed to the District's Engineering Representative.

T. CROSS CONNECTION CONTROL (Backflow Prevention Devices):

- 1. There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contamination materials may be discharged or drawn into the system.
- 2. No by-passes shall be allowed, unless the bypass is also equipped with an equal, approved back-flow prevention device.
- 3. High hazard category cross connections shall require an air gap separation or an approved reduced pressure backflow preventer.
- 4. Reduced pressure principal backflow prevention assemblies shall not be installed in any area location subject to possible flooding. This includes pits

or vaults which are not provided with a gravity drain to the ground's surface that is capable of exceeding the discharge rate of the relief valve. Generally, if installed in a pit, the drain line shall be 2 times the size of the line entering the backflow prevention device. The drain cannot empty into any type of ditch, storm drain, or sewer, which could flood water back into the pit.

5. All piping up to the inlet of the backflow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on the inlet side of the device.
6. Fire line sprinkler systems and dedicated fire lines, except those in the high hazard category shall be protected by an approved double check valve assembly.