



Public Works Department - Office of Environmental Services

**ENVIRONMENTAL ENGINEERING DIVISION**

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Gentlemen:

Attached is the latest revision to the Office of Environmental Services' Minimum Design and Construction Standards for facilities which will be operated and maintained by this office. This supersedes the February 2001 edition and revisions thereto.

These standards are intended as a guide for design and construction work associated with water and sewer utility development within this office's service area and are not intended to supersede the requirements of any regulatory agencies.

Any questions or suggestions you may have concerning these specifications should be directed to:

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Sincerely,

Alan Garcia, P.E., Director  
Environmental Engineering Division

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Attachment

This document approved by the Broward County Office of Environmental Services Technical Standards Committee.

Signed Steven W. Uhrick Date 1-2-04  
Steven W. Uhrick, P.E.

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**GENERAL NOTES FOR ENTIRE MINIMUM STANDARDS**

1. All materials shall be new and unused.
2. All permits shall be issued prior to construction.
3. For the purpose of standardization, materials shall meet AWWA/ANSI Standards.

## **WATER MAINS**

### **1. Materials**

#### **1.01 Pipe**

- A. All pipe, pipe fittings and specials intended for conveying or transmitting service of treated water shall be designed for a minimum working pressure of 150 PSI and shall be in conformance with ANSI/NSF Standard 61 – Drinking Water System Components – Health Effects.
- B. Ductile Iron Pipe shall conform to ANSI/AWWA Standard C151/A21.51 latest revision - Ductile Iron Pipe Centrifugally Cast in Metal Molds. Pressure Class 350 shall be used for 4-inch through 24-inch diameters and Pressure Class 250 shall be used for 30-inch through 64-inch diameters. Class 53 pipe shall be used on flanged applications.
- C. Ductile Iron Pipe shall be cement lined and seal coated in accordance with ANSI/AWWA Standard C104/A21.4, latest revision. The pipe shall be adapted for use with Class 350 fittings through 24-inches and for Class 250 fittings in sizes 30-inches and over.
- D. Reinforced concrete water pipe, limited in size to 36-inches and over shall be of the steel cylinder type, pre-stressed type II cement and shall conform to AWWA Standard C301 latest revision, unless otherwise directed by the County.
- E. Pipe smaller than 6-inches in diameter shall not be used unless approved by BCOES.

#### **1.02 Fittings**

- A. Ductile iron fittings shall conform to ANSI/AWWA Standard C110 A21.10 latest revision or ANSI/AWWA Standard C153 A21.53 latest revision, with the joints meeting the requirements of AWWA C111 latest revision. Fittings 4-inches and larger shall be cement lined and seal coated in accordance with ANSI/AWWA Standard C104 A21.4 latest revision.
- B. Fittings for prestressed concrete pressure pipe shall conform to AWWA Standard C301 or latest revision.

### 1.03 Joints

- A. Joints for bell and spigot ductile iron pipe and fittings shall conform to ANSI/AWWA Standard C111/A21.11 latest revision. Mechanical joint or push-on joint shall be the rubber gasket compression-type. Special fittings and restrained joints shall be considered for specific installation subject to the approval of the County. Joints for flanged ductile iron pipe and fittings shall conform to ANSI/AWWA Standard C110/A21.10 latest revision.
- B. Joints for reinforced concrete pipe shall be of rubber gasket compression type conforming to AWWA Standard C301 latest revision.

### 1.04 Butterfly Valves - 16" and Larger

- A. Butterfly valves shall be designed and manufactured in accordance with ANSI/AWWA Standard C504 latest revision for Rubber Seated Valves Class 150 B. The operating mechanism shall be designed so that the valve disc is held rigid when in any position. The valve shall be fitted with a 360 degree 18-8 stainless steel seat offset from the shaft and mechanically retained in the body or on the disc of the valve. Mechanical retention shall not be affected by the mating flange.
- B. The valve disc or valve body shall be cast iron or ductile iron. The valve disc or valve body shall be fitted with a resilient seat of synthetic rubber retained with an 18 - 8 stainless steel clamp ring and stainless bolting. The resilient seat shall be designed with a cross section providing 360 degree mechanical retention against pulling out from between the retaining ring and disc. Retaining ring cap screws shall pass through the rubber seat.
- C. The valve disc shall be rigidly attached to the shafts with keys to absolutely eliminate relative motion between the disc and shafting. The shaft keys shall be made of heat treated 410 or 416 stainless steel to prevent brinelling of the shaft keys in service. The keys shall be held in position with 18-8 stainless nuts.
- D. Valve shafts shall be made from 18 - 8 stainless and shall be offset from the disc and body seats so that the shafting does not intersect the disc or body seats. Valve shafts 3" and smaller shall be one piece through shafts with factory set thruster to center the disc in the seat. Valve shafts larger than 3" shall be stub shafts, each rigidly keyed to the disc and provided with an adjustable thruster to move the disc and shaft assembly positively in either direction to center the disc in the seat of the valve. Shaft seal shall be designed for the use of standard split V type packing for standard O ring seals or for a pull down packing. Valve operators for valves 24" and smaller shall be traveling nut or worm gear type fully field adjustable stops so the operator does not have to be disassembled for valve seat adjustment. Valves larger than 24" shall be equipped with worm gear type operators per

ANSI/AWWA Standard C504 latest revision.

- E. Valves shall open left or counter clockwise. The operating mechanism shall be for buried service with a 2-inch square operating nut.

**1.05 Resilient Seat Gate (or Wedge) Valves 4" and larger**

- A. Resilient Seat Gate Valves shall comply with AWWA Standard C-509 latest revision and shall have the following design standards.
- B. All Resilient Seat Valves are to be iron body, resilient seat type non-rising stem, opening left (counter clockwise). Valves shall be furnished with O ring packing (two O rings). The operating mechanism shall be for buried service with a 2-inch square operating nut.
- C. Valve disc shall be contoured to assure uniform seating.
- D. Valves shall be coated with a two-part thermosetting epoxy coating or fusion bonded epoxy coating on inside of the valve body and on the valve disc. The type of end connection shall be determined by the type of pipe used.
- E. Resilient Seat Valves shall have a minimum working pressure of 200 P.S.I. and be tested at 400 P.S.I. minimum between disc seat ring and body seating surface. Seat ring seals shall be replaceable and made from internally reinforced molded natural rubber (ASTM D2000). Seat ring shall be attached to disc with stainless steel screws.
- F. The valves shall be designed and tested to open at 150 P.S.I pressure differential.
- G. No leakage will be allowed/permitted.

**1.06 Check Valves**

- A. Check valves, sizes 6-inch and 8-inch, shall be the flexible, rubber coated disc type that provide an unrestricted flow area.
- B. All check valves are to be manufactured from either cast iron meeting ASTM A126 or from ductile iron meeting ASTM A536.
- C. The rubber encapsulated disc shall be readily accessible for repair or replacement without removal of the valve from the pipeline. The disc shall be manufactured from ductile iron with a stainless steel shaft and nylon reinforcement or from steel with steel and nylon reinforcement.
- D. The seating surface shall be rubber to metal. The valves shall have a working pressure of 200 psi, or greater. The end flanges shall be in accordance with ANSI/AWWA C110/A21.10 or ANSI B16.1, Class 125. The

interior of the valve shall be coated with an epoxy suitable for potable water.

### 1.07 Valve Boxes

- A. Valve boxes shall be cast iron extension, adjustable screw type with not less than 5" diameter shaft and with covers marked WATER. The stem of a buried valve shall be within 12" of finished grade unless otherwise specified by the County. All lids shall be locking type. Valve boxes shall be located in right of way (r/w) and/or located in utility easements. The type of valve shall be stamped on a permanent tag located next to the valve box in the pavement or in the concrete collar.

### 1.08 Tapping Sleeves and Valves

- A. Stainless Steel tapping sleeves shall have a stainless steel body with flat faced stainless steel flange, recessed for a tapping valve, in accordance with MSS-SP60.  
Gaskets shall be neoprene O ring type with a gasket restraint incorporated into the sleeve. A test plug shall be provided on the outlet throat.
- B. Ductile iron tapping sleeves shall be of the mechanical joint type having a flat faced ductile iron flange, recessed for a tapping valve. All end and side gaskets shall be totally confined. The throat section of tapping sleeves through 12" size shall conform to MSS-SP60. Test plug shall be provided on the outlet throat.
- C. Minimum Tap Sizes for Water Mains

6" thru 16"	6" Tap
18" thru 30"	12" Tap
36" and larger	20" Tap
- D. Tapping valves 6" and larger shall comply with AWWA Standards C-500 or C-509 latest revisions and shall have the following design standards plus the valve port shall be free and full to allow clutter passage without interference.
- E. All valves are to be iron body, bronze mounted, double disc or resilient wedge, nonrising stem, parallel seat type, opening left (counter clockwise). Non geared valves shall be furnished with O ring packing (two O rings). The operating mechanism shall be for buried service with a 2 inch square operating nut.
- F. The disc mechanism for the double disc gate valve shall be designed so that the seating pressure is applied equally at four separate contact points near the outer edge of each disc or in the case of fully revolving disc valves, this shall be accomplished by two flat rectangular contact strips producing an equivalent effect, the upper contact strip shall be faced with stainless steel.

- G. Valves 16" and larger shall be furnished with bevel gears and by-pass valves. Bevel geared valves shall have roller, tracks and scrapers.
- H. Tapping valves 6" - 12" shall have a minimum working pressure of 200 P.S.I. and be tested at 400 P.S.I. minimum. Valves 14" - 48" shall have a minimum working pressure of 150 P.S.I. and be tested at 300 P.S.I. minimum.
- I. Wet taps shall only be permitted where approved by BCOES.
- J. Size on size wet taps on ACP will not be permitted.

### **1.09 Fire Hydrants**

- A. All fire hydrants shall comply with AWWA Standard C502 latest revision and the following design standards.
- B. The minimum line size supplying the fire hydrant shall be 6-inch diameter.
- C. Fire hydrants shall be of the compression type, opening against the pressure and closing with the line pressure with a 5-1/4" minimum valve opening. The hydrant shall be equipped with 2-2 1/2" hose and 1-4 1/2" steamer nozzles to meet the American National Standard hose thread.
- D. Hydrants shall be furnished with a sealed oil or grease reservoir located in the bonnet so that all threaded and bearing surfaces are automatically lubricated when the hydrant is operated. The hydrant will be designed for disassembly by use of a short disassembly wrench or the hydrant shoe having integral cast tieback lugs on the main valve to permit the main valve assembly and valve seat to be removed without digging earth or disassembling the hydrant barrel.
- E. Hydrants shall be furnished with a breakable feature that will break cleanly upon impact. This shall consist of a two part breakable safety flange with a breakable stem coupling. The upper and lower barrels shall be fluted and ribbed above and below the safety flange or have an extra strength lower barrel.
- F. The hydrant internal valve shall be 5-1/4" minimum. The pentagonal operating nuts and the cap nuts shall be 1 1/2" point to flat. Drain valve outlets shall be plugged or omitted. The hydrants shall open counter-clockwise and the direction of opening shall be cast on top. The bury length measured from the bottom of the connecting pipe to the ground line at the hydrant, shall be 3 feet 6 inches bury. (Minimum)
- G. The hydrant shall be equipped with a 6" mechanical joint base inlet unless otherwise specified by the Engineer.
- H. Fire hydrant spacing and flow requirements shall conform to the latest requirements of the Broward County Fire Marshal, or the requirements of

any local fire department having jurisdiction.

- I. Fire hydrants shall be painted yellow with a reflective type paint and glass beads all in accordance with N.F.P.A. #291 or per the latest requirements of the Broward County Fire Marshal, or the requirements of any local fire department having jurisdiction.
- J. Raised reflective pavement markers in blue shall be used to identify the fire hydrant locations. Each marker is to be placed in the center line of the roadway lane closest to the hydrant.
- K. Chains are to be removed.

#### **1.10 Combination Air Release/Air & Vacuum Valve**

- A. Combination Air Valves shall be of the single housing style that combines the operating features of both an Air/Vacuum and Air Release Valve.
- B. The Air/Vacuum portion shall automatically exhaust large quantities of air during the filling of the pipeline and automatically allows air to re-enter the pipeline when the internal pressure of the pipeline approaches a negative value due to column separation, draining of the pipeline, power outage, pipeline break, etc.
- C. The Air Release portion shall automatically release small pockets of air from the pipeline while the pipeline is in operation and under pressure.
- D. The Combination Air Valve shall have 2" NPT inlet and outlet connections and a 3/32" diameter orifice for a minimum working pressure of 150 PSI. The sizing of the valve may be varied based upon an analysis of the application.
- E. The materials of construction shall be: Body, Cover and Baffle of Cast Iron; Float and all other trim shall be of Stainless Steel with the exception of the seat and adjustable Orifice Button.

END OF SECTION 1

## **2. WATER SERVICES**

### **MATERIALS**

- 2.01 TUBING
- 2.02 CASING PIPE
- 2.03 JOINTS
- 2.04 METER VALVES
- 2.05 CURB STOPS
- 2.06 CORPORATION STOPS
- 2.07 CHECK VALVES
- 2.08 SERVICE SADDLE
- 2.09 WATER METERS
- 2.10 PRIVATE FIRE PROTECTION
- 2.11 OTHER BACKFLOW PREVENTERS
- 2.12 METER BOXES

## **WATER SERVICES MATERIALS**

### **2.01 Tubing**

#### **2.01.1 Polyethylene Tubing**

- A. The polyethylene compound from which the tubing is made shall be an ethylene-hexane copolymer and shall comply with the applicable requirements as specified in ASTM D3350 providing for inner and outer layers of UV protection for 5 years in direct sunlight and shall be manufactured from PE3408 high density polyethylene resin.

Polyethylene shall comply with the following:

- B. Tubing shall have a working pressure of 200 PSI at 73.4 degrees F and be in conformance with ANSI/NSF Standard 61.
- C. All tubing furnished under these specifications shall conform to the following standards:  
  
AWWA C-901, ASTM D2239, ASTM D2737, ASTM D3350, ASTM D1248, ASTM F1248, ASTM D1693, ASTM D2837 and ASTM D3140.
- D. Tubing dimensions and tolerances shall conform to the following requirements:  
  
1. Polyethylene tubing surfaces shall be mirror smooth, and shall be free from bumps and irregularities. Materials must be completely homogenous and uniform in appearance.
- E. Tubing dimensions and tolerances shall correspond with the values listed in AWWA C901 with a standard dimension ratio (SDR) of 9.
- F. Tubing shall be fully labeled at intervals of not more than 5 feet with brand name and manufacturer, the nominal size, PE 3408, the word TUBING and SDR9, PC 200, AWWA C901-88, and the seal, or mark, of the testing agency.

#### **2.01.2 Copper Tubing**

Copper tubing shall be type K and shall conform to AWWA Standard C800 Section A.2, ASTM Specification B 88 and ANSI/NSF Standard 61.

**General Note:** Polybutylene tubing is not acceptable.

### **2.02 Casing Pipe**

- A. Casing pipe for water services shall be black iron or galvanized steel and shall conform to ANSI/AWWA C800 Section A.6 and ASTM Standard A120.
- B. Casing ends shall be sanded smooth and sealed using urethane foam (expandable foam, which is subject to approval by the County).

### **2.03 Joints**

- A. Joints for polyethylene or copper tubing shall be of the compression type utilizing a totally confined grip seal and coupling nut. Stainless steel tube stiffener insert shall also be used for tubing services.
- B. Other type joints may be considered for specific installations upon submission of specifications and approved by the Engineer.

### **2.04 Meter Valves**

- A. Meter valves shall be of bronze construction in accordance with ASTM Standard B62 latest revision, and conform to ANSI/NSF Standard 61.
- B. Meter valves shall be closed bottom design and resilient O ring sealed against external leakage at the top. Shut-off shall be affected by a resilient pressure actuated seal so positioned in the plug as to completely enclose the flow way in the closed position. The inlet side of all meter valves shall have a compression type fitting as specified in Section 2.05C. Meter valves for meter sizes 1 1/2" and under shall be equipped with a meter coupling nut on the outlet sides.
- C. Meter valves for 1 1/2" and 2" meters shall have flanged connections on the outlet sides. Meter valves over 2" will be considered on individual basis for the particular installation involved.
- D. Meter valves 2" or less shall be ball type.

### **2.05 Curb Stops**

- A. Curb Stops shall be of the Ball Valve type and be in compliance with ANSI/NSF Standard 61. These valves shall be made from cast bronze. The ball shall be Teflon coated brass and shall be held in position by and seal off against seats of Buna N rubber that are held securely in place with epoxy adhesive.

Valves shall be water-tight against flow in either direction. The waterways shall be no smaller than the nominal size of the valve and shall be smooth, with no abrupt changes in size to create resistance to flow. The stem that turns the ball shall exert no other force on it except to open or close the ball and shall be held securely in place by means of a bronze ring. The minimum

diameter of the stem at the point of attachment to the valve body shall be as follows:

Valve Size	Minimum Diameter
3/4"	11/16"
1"	11/16"
1-1/4"	7/8"
1-1/2"	7/8"
2"	1"

- B. The seal around the stem shall consist of two O rings. Each valve shall have a substantial T-head for the operation of opening and closing with a 90 degree turn of a standard slotted wrench. The stops or lugs for controlling the motion of the T-head shall be enclosed and properly positioned to line up the waterways through the ball with the water passage through the valve body.
- C. The end connections shall be Pack Joint (compression type) connections for copper, plastic, or iron pipe. The valve shall be available in sizes 3/4" through 2". The valve shall turn easily. See the Materials Review List (latest revision) for acceptable models/manufacturers.

**2.06 Corporation Stops**

- A. Corporation stops shall be manufactured of brass alloy in accordance with ASTM Specification B62 latest revision. These corporation stops shall be of the ball valve type and shall conform to ANSI/NSF Standard 61.
- B. Inlet thread shall be AWWA taper thread in all sizes in accordance with AWWA Standard C800 latest revision. Outlet connections shall have a compression type fitting.

**2.07 Check Valves**

- A. Water service single check valves shall be of brass construction in accordance with ASTM Standard B62, latest revision, and conform to ANSI/NSF 61.
- B. Single check valves shall have a spring and poppet assembly with an access cap that can be removed for inspection and replacement of internal working parts without removing the check valve from the service line.
- C. The check valve shall be available in 1-inch and 2-inch sizes.
- D. The working pressure of the valve shall be 175 psi or greater.
- E. Head loss in the 1-inch check valve shall be no greater than 3.7 psi at 20

gpm; head loss in the 2-inch check valve shall not exceed 1.0 psi at 50 gpm.

## **2.08 Service Saddles**

- A. Service saddles shall be ductile iron ASTM A536, have double stainless steel straps which tighten to conform to the curvature of the pipe and sealing the O ring gasket confined in a retaining groove, for a pressure tight seal on the main. Fusion bonded plastic coating shall be applied to the ductile iron body.

## **2.09 Water Meters**

- A. After installation an affidavit of Compliance and a Certificate of Testing for accuracy, including certified calibration for each meter larger than 2-inches shall be supplied. Test shall be witnessed by BCOES inspector. All meters installed shall have factory seals, and a manufacturer's serial number die stamped or molded upon the register lid. All wetted parts must conform to ANSI/NSF Standard 61.

Test ports shall be provided upstream and downstream of meters 2" and larger.

- B. Displacement meters shall be 2" and smaller and will be evaluated on an individual basis taking into account operating and performance characteristics along with general quality of manufacture, machining and workmanship.
- C. Turbine Meters shall be 1 1/2" and larger and shall be provided with a strainer upstream of the meter. All meters furnished shall be manufactured in the Continental United States and shall conform to ANSI/AWWA Standard C701 latest revision.

Maincases for all sizes shall be cast bronze, when available. Size, model and direction of flow shall be cast, in raised characters, on both sides of the maincases.

The measuring chamber shall be of unitized construction (i.e. complete with measuring element, calibration device and register in one assembly). The measuring chamber shall be capable of operating within above listed accuracy limits without recalibration when transferred from one maincase to another of similar size. The measuring element shall be mounted on a horizontal stationary shaft with sleeve bearing and be essentially weightless in water.

The register shall be permanently hermetically sealed; all registers of similar size and registration shall have a standard ratio gear reduction to permit interchangeability. The measuring chamber shall be removable from the maincase. Sweep hand reading and odometer wheel details will conform to American Water Works Standard C-701, latest revision.

The register must be of the straight reading type and have a test dial. It shall read in US gallons and be capable of direct visual reading both at the meter and by remote reading external to the meter. All reduction gearing shall be contained in a permanently hermetically sealed, tamper-proof enclosure made of a corrosion resistant material. The register is to be secured to the upper maincase by means of an internal locking device so that the register cannot be removed by the utility customer.

Register output data format for automatic meter reading shall be 7-bit ASCII (American Standard Code for Information Interchange) digital, plus an even parity bit. The first character is ASCII R followed by a 4-digit meter reading (most significant digit first), followed by an 8-digit meter ID number. Data is to be positive true. The register's ASCII digital output is to be capable of interfacing directly to an automatic meter reading transponder to transmit data via cable TV, telephone or power lines to a central location.

The drive magnet shall be located in the measuring element, and the follower magnet shall be located inside the permanently hermetically sealed register. An intermediate magnetically active material shall be required to distribute the magnetic flux uniformly to the follower magnet, thereby improving the service life of the register's rotating component.

All meters shall be supplied with strainers. The 6", 8" and 10" size meters shall have external strainers as part of the meter package. Strainers shall have cover plate for inspection and removal of debris from the bronze screen without disturbing the pipeline.

- D. Displacement type water meters shall conform in all respects to ANSI/AWWA Standard C700 latest revision and the following options provided under this standard. Meters main casing shall be all bronze, split case type magnetically driven with rotating discs or oscillating pistons. Registers shall be straight reading hermetically sealed, and read in U.S. gallons. The register housing may be either bronze or suitable synthetic polymer materials. All other EXTERNAL parts of the meter shall be bronze including, but not limited to, the maincase and bottom and/or top. Displacement meters (1-inches and smaller) are to be furnished without coupling nuts; 1 1/2-inch and 2-inch meters are to be furnished with flanged ends.
- E. Guarantees for materials and workmanship of all meters for a period of not less than one (1) year from date of delivery. A minimum ten-year factory warranty shall be provided to cover all defects in the register.
- F. Nuts and bolts for all meters shall be stainless steel.

## **2.10 Private Fire Protection**

- A. The Backflow Preventer used for fire protection is designed for two purposes:
  - 1. To detect leakage or unauthorized use of water from fire or automatic sprinkler systems.
  - 2. To protect the potable water system from contamination by the fire system.
- B. The mainline assembly consists of a double check valve assembly. Type 1 Private Fire Protection also includes a bypass which consists of a double check valve assembly, shut-off valves, taps into the main upstream and downstream of the mainline assembly, and a meter (owned by Broward County) with a sealed register. Type 2 Private Fire Protection includes a fire service assembly installed in-line and upstream of the double check valve assembly.
- C. Both types of Private Fire Protection must meet the requirements of Underwriter's Laboratories and Factory Mutual, as well as State, Broward County, Municipal and NFPA Standards and Codes.
- D. Backflow prevention double check valve shall be designed and manufactured in accordance with AWWA Standard C506 latest revision, shall be in compliance with paragraph C. (above) and shall be tested at the time of installation by a certified testing technician prior to acceptance by Broward County.

## **2.11 Other Backflow Preventers**

Other backflow prevention devices required by the applicable governing authorities are to be in accordance with those authorities' requirements, and are not addressed by these standards. Testing of these devices shall be done at the time of installation by a certified testing technician prior to acceptance by Broward County.

## **2.12 Meter Boxes**

- 1. All reinforced meter boxes lids and covers shall meet the requirements for incidental Traffic H-10 loading as established by AASHTO and be a product acceptable to the County. The boxes shall be made with high density polyethylene of one piece molded construction. The tops (or lids) shall be made with ductile iron. Mid-States Plastics model numbers MSBCF1118-12, MSBCF1416-12 and MSBCF1730-12, or approved equal, are acceptable.

**END OF SECTION 2**



**3. GRAVITY SEWERS**

**MATERIALS**

3.01 PIPE

3.02 FITTINGS

3.03 JOINTS

3.04 MANHOLES

## **GRAVITY SEWERS**

### **MATERIALS**

#### **3.01 Pipe**

- A. All ductile iron pipe, fittings, and specials conveying or transmitting raw sewage shall be designed for a minimum working pressure of 150 P.S.I. See the requirements for SEWAGE FORCE MAINS, Section 5.01.
- B. Ductile Iron Pipe and fittings shall be lined inside with Protecto 401 lining system. The lining shall be fused in place, a minimum of 40 mils in thickness, shall tightly adhere to the pipe wall and shall extend from the spigot end to the gasket seat in the bell socket. The inside surface of the pipe shall be thoroughly ground and cleaned of oil, dirt and foreign matter prior to applying the liner.
- C. PVC non-pressure pipe shall conform to ASTM D3034 latest revision (SDR 26). Ultra violet degradation or sun bleached pipe will be cause for rejection.
- D. Transition couplings shall be used to join ductile iron pipe to PVC pipe.

#### **3.02 Fittings**

- A. PVC fittings (SDR 26) for non-pressure PVC pipe shall be of monolithic construction and of the type specified by the manufacturer of the pipe being used. No solvent welds will be permitted, unless required by the County.
- B. Ductile Iron fittings shall conform to the requirements of SEWAGE FORCE MAINS, Section 5.02.

#### **3.03 Joints**

- A. Joints for bell and spigot ductile iron pipe and fittings shall conform to ANSI/AWWA Standard C111/A21.11 latest revision. Mechanical joint or push-on joint shall be the rubber gasket compression-type. Special fittings and joints shall be considered for specific installations subject to the approval of the County.
- B. Joints for P.V.C. non-pressure pipe and fittings shall be bell and spigot push-on rubber gasket type only. No solvent weld or threaded joints will be permitted.
- C. The jointing of the pipe on the job shall be done in strict accordance with the pipe manufacturer's instructions and shall be done entirely in the trench unless otherwise directed by the County.

### 3.04 Maintenance Access Structures (MAS)

- A. Precast reinforced concrete MAS shall conform to the requirements of ASTM C478 latest revision, and the following modifications thereto:
1. Minimum wall thickness shall be eight inches (8").
  2. Minimum inside diameter of base sections shall be forty eight inches (48").
  3. The precast reinforced base shall be a minimum of eight inches (8") thick and be cast monolithically with the bottom section's walls.
  4. Lifting holes through the structures shall be permitted; however, holes shall be plugged with cement or other methods approved by County.
  5. Minimum height of base sections shall be three feet (3') from the outside bottom of the base slab.
  6. MAS sections shall be joined with a preformed plastic joint sealing compound consisting of either bituminous or butyl rubber base, conforming to Federal Specification SS-S-210A, Type I. Two strips of the preformed compound shall be uniformly compressed between the positioned sections so as to form water tight joints. Any material squeezed out on the inside shall be cut off.
    - a. After the sections are assembled, the remaining space in the joint shall be pointed up and filled with a water proof cement mortar and finished so as to make a smooth, continuous surface inside and outside the wall sections.
  7. Deep structures (7 feet or deeper) may substitute an eight inch (8") precast reinforced concrete slab on the top in lieu of the cone section. Slabs shall have a twenty four inch (24") diameter access hole centered in the slab. Slabs, if used, shall terminate at such elevations as will permit laying up a minimum of three (3) concrete adjustment rings (4 inches minimum/12 inches maximum in height) under the MAS frame.
  8. Precast MAS cones, if used, shall terminate at such elevations as will permit laying up a minimum of three (3) concrete adjustment rings (4 inches minimum/12 inches maximum in height) under the MAS frame.
    - a. Two strips of preformed plastic sealing compound shall be used on each sealing surface. Any material squeezed out on the inside shall be cut off.

- b. The sealing compound shall be in rope form, supplied with a two-piece cover to prevent adhesion until use. The material shall be a minimum of 7/8 inch by 1-3/8 inches, or equivalent to 1-1/4 inches round.
9. Where shown on the drawings, the contractor shall place openings for future extensions. The openings shall be closed with a plug as specified by the County.
10. Service laterals will not be permitted to enter directly into the structures. Laterals are connected only to sewer mains.
11. The invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Steep slopes outside the invert channels shall be avoided. Changes in the size and grade shall be made gradually and evenly. Changes in the direction of the sewer or entering branch shall be a smooth curve with as long a radius as practical.
12. Outside drop connections will be required when the vertical distance between pipe inverts entering the structure exceeds two feet (2'). Drop connections, where required, shall be cast monolithically with the MAS elements. Pipe work for inside drop connections will not be permitted.
13. Steps or ladders will be omitted unless specifically requested by the County.
14. Two coats of protective material, Kopper's 300M or equal, shall be applied to the entire inside and outside surfaces of the structure at the job site. This material shall be applied in accordance with the manufacturer's specifications. The coats shall have contrasting colors so as to be easily verified.
15. Sewers shall be grouted in place using a waterproof, expanding grout, acceptable to the County. All openings and joints shall be sealed watertight.
16. The cover and frame shall be cast of close ground grey iron, or ductile iron, conforming to ASTM A48 latest revision, and shall be of uniform quality, free of blow holes, porosity, cracks and other obvious visual defects. The combined weight of a cast iron frame and cover shall not be less than 530 pounds, and the cover shall weigh a minimum of 160 pounds. The seating surfaces between frames and covers shall be machined to fit true and shall be water tight. No plugging or filling will be allowed. Casting patterns for the cover shall bear the County Logo and shall have the words sanitary sewer cast in all covers. Castings shall be

cleaned. Pick type lifting holes will be cast into lids, but shall not go clear through the lid.

- a. Iron adjustment rings are not allowed on new construction.
  - b. Set frame to proper elevation and to cross section slope. Set in a bed of waterproof mortar and the preformed plastic sealing compound strips. Bring mortar up over frame.
  - c. Recheck elevation due to possible plastic compound sealant compression.
17. When a structure is in a low lying area or when, in the opinion of the County, an unusual condition exists, a sealed locking type lid may be installed as directed by the County.
  18. All concrete used in MAS construction shall use Type II cement.
  19. MAS adapter couplings approved by the County are required on all pipe connections to the structures.

**END OF SECTION 3**



**4. GRAVITY SEWER LATERALS**

**MATERIALS**

- 4.01 PIPE
- 4.02 FITTINGS
- 4.03 JOINTS
- 4.04 CLEANOUTS

## **GRAVITY SEWER LATERALS**

### **MATERIALS**

#### **4.01 Pipe**

- A. PVC non-pressure pipe shall conform to ASTM D3034 latest revision (SDR 26). Ultra violet degradation or sun bleached pipe shall be cause for rejection.

#### **4.02 Fittings**

See the requirements for GRAVITY SEWERS, Section 3.02.

#### **4.03 Joints**

See the requirements for GRAVITY SEWERS, Section 3.03.

#### **4.04 Clean-Outs**

PVC clean-outs shall have male threaded access plugs with raised 2-inch square operating nuts and shall be constructed in accordance with the standard details.

**END OF SECTION 4**

**5. SEWAGE FORCE MAINS**

**MATERIALS**

- 5.01 PIPE
- 5.02 FITTINGS
- 5.03 JOINTS
- 5.04 PLUG VALVE
- 5.05 VALVE BOXES
- 5.06 TAPPING SLEEVES AND VALVES
- 5.07 SEWAGE COMBINATION AIR VALVES

## **SEWAGE FORCE MAINS**

### **1) Materials**

#### **5.01 Pipe**

- A. All ductile iron pipe, fittings, and specials conveying or transmitting raw sewage shall be designed for a minimum working pressure of 150 PSI.
- B. Ductile Iron Pipe and fittings shall conform to ANSI/AWWA Standard C151/A21.51 latest revision – Ductile Iron Pipe Centrifugally Cast in Metal Molds. Pressure Class 350 shall be used for 4-inch through 24-inch diameters and Pressure Class 250 shall be used for 30-inch through 64-inch diameters. Class 53 pipe shall be used on flanged applications.
- C. Ductile iron pipe shall be lined inside with Protecto 401 lining system. See the requirements for GRAVITY SEWERS, Section 3.01, paragraph B. The pipe shall be adapted for use with Class 350 fittings through 24-inches and for Class 250 fittings in sizes 30-inches and over.
- D. Pipe smaller than 6-inches in diameter shall not be used unless approved by BCOES.

#### **5.02 Fittings**

- A. Ductile iron fittings shall conform to ANSI/AWWA Standard C110 A21.10 latest revision or ANSI/AWWA Standard C153 A21.53 latest revision, with joints meeting the requirements of AWWA C111 latest revision. Fittings 4" and larger shall be coated with Protecto 401 lining system (see paragraph 5.01 C., above).

#### **5.03 Joints**

See the requirements for WATER MAINS, Section 1.03, paragraph A.

#### **5.04 Plug Valve**

- A. Plug valves shall be of the non-lubricated, eccentric type with resilient faced plugs, port areas for valves 20 inches and smaller shall be at least 80% of full pipe area. Port area of valves 24 inches and larger shall be at least 70% of full pipe area. The body shall be of semi-steel (ASTM A-126 C1.B) and shall have bolted bonnet which gives access to the interval serviceable ports of the valve. Seats shall be welded overlay of high nickel content or a stainless steel plate locked in the body cavity. If a plate is used, it shall be replaceable through the bonnet access. Bearings shall be permanently lubricated of stainless steel, bronze or Teflon lined, fiber glass backed duralon. Bearing areas shall be isolated from the flow with grit seals.

Valves shall have packing bonnets where the shaft protrudes from the valve and the packing shall be self-adjusting chevron type which can be replaced without removing the bonnet. All nuts, bolts, springs and washers shall be stainless steel.

- B. Valves shall be designed for a minimum working pressure of 150 P.S.I. The valve and actuator shall be capable of satisfactory operation in either direction of flow against pressure drops up to and including 100 P.S.I. (for plug valves over 12 inches in diameter). Valves shall be bubble tight in both directions at 100 psi differential.

Plug valves over 12" in diameter shall have worm gear operators. The operating mechanism shall be for buried service with a 2 inch square operating nut.

- C. Plug valves are to be installed with the seat pointed towards the upstream flow, when specified.
- D. Valves 16" and larger shall be manufactured by Dezurik, or approved equal.
- E. Plug valves are the only type of isolation valves acceptable for this application.

#### **5.05 Valve Boxes**

- A. See the requirements for WATER MAINS, Section 1.06.
- B. The valve box covers shall be marked SEWER.

#### **5.06 Tapping Sleeves and Valves**

- A. See the requirements for WATER MAINS, Section 1.07.
- B. The tapping valve will be left in the open position with no valve box. A plug valve will be required at this location.

#### **5.07 Sewage Combination Air Valves**

- A. Sewage Combination air valves shall consist of one sewage air release valve and one sewage air and vacuum valve. The valves shall be piped into a compact assembly.
- B. Sewage air release valves shall be of the type that automatically releases air, gas or vapor under pressure during system operation. The valve shall have a 2 inch N.P.T. inlet with a 1/2 inch N.P.T. outlet and a 3/16 inch venting orifice for a minimum working pressure of 150 P.S.I. The valve shall be constructed with a cast iron body and cover, stainless steel trim and float, with an adjustable resilient orifice button to insure positive seating.
- C. Sewage air and vacuum valves shall be of the type that automatically exhaust large quantities of air during the filling of a system and allows air to re-enter during

draining or when a vacuum occurs. The valve shall have a 2-inch N.P.T. inlet with a 1-inch N.P.T. outlet for a minimum working pressure of 150 P.S.I. The valve shall be constructed with a cast iron body and cover, stainless steel trim and float with a Buna-N seat for positive seating.

- D. See the Materials Review List, latest revision, for acceptable models/manufacturers.
- E. See the Standard Detail Drawings for additional information.

**END OF SECTION 5**

**6. PUMP STATIONS AND LIFT STATIONS**

**GENERAL NOTES**

6.01 ELECTRICAL

6.02 OPERATION

6.03 STANDARD DETAIL DRAWINGS

## **PUMP STATIONS AND LIFT STATIONS**

### **SCOPE**

The work included under this specification consists of a guide for the design of lift stations and pump stations to be owned and operated by the Office of Environmental Services (OES). A lift station will be comprised of eight (8) major elements:

1. Wet well and submersible pumps
2. Check valves, plug valves and emergency pump out
3. Control panel
4. Parking area
5. Pipe line
6. Concrete pad/slab
7. Fence
8. 2" water service with a 2" water meter

These specifications apply to normal domestic sewage where the sewage temperature will not exceed 115 degrees Fahrenheit.

### **General Note:**

For additional information see the OES standard lift station detail drawings.

### **6.01 Check Valves**

Check valves shall be the flapper type and contain no levers. The flapper shall be made of a durable, reinforced man-made compound, capable of handling sewage fluids under pressure, as manufactured by Val-Matic, or approved equal.

### **6.02 Electrical**

All equipment and materials shall be permanently grounded in accordance with the requirements of the National Electrical Code and the Florida Building Code. All cable and wire for feeders and branch wiring shall be copper type "THRW". The contractor shall furnish all labor, materials, equipment, facilities, transportation and services required for furnishing, delivery and installation of the electrical work as indicated on OES standard lift station detail drawings.

### **6.03 Operation**

- A. The operation of the lift station will be based on a point control with an emergency back-up system. In ascending order the four points are:
  - a. low water cut off point
  - b. lead pump start point
  - c. lag pump start point

d. high water alarm point

The lead pump is energized when the sewage level reaches the “lead pump start point”. The lead pump operates continuously until the water level is lowered to the “low water cut off point”. The lag pump is energized if the lead pump is incapable of handling the flow of sewage, allowing the water level to reach the “lag pump start point.” The lag pump then operates in unison with the lead pump until the water level is lowered to the “low water cut off point”. At this time both pumps are de-energized. An automatic circuit will alternate the lead pump, lag pump, sequence on every pump down cycle. An alarm bell and light (with weather-proof alarm bell on-off switch located inside of the control box) will be activated if the water level reaches the “high water alarm point”. The alarm bell and light will be de-energized when the water level falls below the “high water alarm point”. A high water indicator light, located inside the control box, is activated if the water reaches the “high water alarm point”. This indicator light shall stay on after the water level falls below the “high water alarm point” and must be de-energized manually.

- B. An emergency back up system shall be provided, as shown on the OES standard lift station detail drawings. The emergency system shall operate the pumps if the four point system above fails.

**6.03 Standard Detail Drawings**

The standard lift station detail drawings are a part of these standards. These drawings contain the latest information on the OES lift station requirements.

**END OF SECTION 6**



## **7. INSTALLATION**

- 7.01 INSTALLATION OF NEW WATER MAIN
- 7.02 INSTALLATION OF NEW WATER SERVICE
- 7.03 INSTALLATION OF NEW GRAVITY SEWERS, FORCE MAINS AND PUMP/LIFT STATIONS
- 7.04 INSTALLATION ADDITIONAL REQUIREMENTS
- 7.05 PIPE BORING AND JACKING

### **7.01 Installation of New Water Mains**

- A. The installation of all new water mains shall be done in accordance with the requirements of AWWA Standard C600, "Recommended Standards for Water Works," the Department of Health, the Office of Environmental Services, the Engineering Division and the manufacturer's specifications/requirements.
- B. See Installation Additional Requirements - Section 7.04.
- C. Pipe Deflection - When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane or where long radius curves are permitted, the amount of deflection shall not exceed 75% maximum deflection recommended by manufacturer.
- D. The minimum cover for ductile iron pipe is 30 inches.

### **7.02 Installation of New Water Services**

- A. The installation of all new water services shall be done in accordance with the latest revision of AWWA Standard C600, C901 and C902 plus the additional requirements of the Department of Health, the Office of Environmental Services and the Engineering Division.
- B. Laying
  - 1. The bedding material used for service line installations shall consist of selected backfill material containing sand, no stone or rocks larger than 1" in diameter, and no drainfield lime rock larger than 3/4" in diameter.
  - 2. When the service line is laid in the prepared trench, special care shall be taken to insure that minimum radius is maintained on plastic and copper service lines and that undue pressure is not exerted on the service line by rocks or other material protruding through the bedding material.
  - 3. The interior of the service line shall be thoroughly cleaned of all foreign matter before being lowered into the trench. Compression joints and couplings shall be assembled in strict accordance with the manufacturer's recommendations. Particular care should be taken to keep foreign materials from interfering with proper joint assembly. The mating surfaces of the compression joint should be wiped clean. The tubing should then be inserted into the compression fitting and made tight according to the manufacturer's recommendations.
  - 4. The maximum deflection of any service line shall not exceed 75% maximum deflection recommended by the tubing manufacturer. The service line shall terminate in an approved meter box or vault located within the public right-of-way or easement, adjacent to the property served.

5. The minimum depth of cover over the service line at street crossings and other paved areas shall be 24" unless otherwise directed by the Engineer. On installations within unpaved areas where no street crossing is necessary, the minimum depth of cover shall be 18" unless special problems are encountered.
6. See Installation Additional Requirements - Section 7.04.

### **7.03 Installation of New Gravity Sewers, Force Mains and Pump/Lift Stations**

- A. The installation of all new gravity sewers shall be done in accordance with the requirements of the "Recommended Standards for Waste Water Facilities (latest revision), DPEP, the Office of Environmental Services and the Engineering Division.
- B. See Installation Additional Requirements under Section 7.04.
- C. Pipe deflection is allowed for force mains only. See Section 7.01.
- D. The minimum cover for ductile iron pipe is 30 inches. The minimum cover for PVC pipe is 36 inches.

### **7.04 Installation Additional Requirements**

The installation of all new mains and services shall be in accordance with the requirements of the Office of Environmental Services, and as stated herein.

- A. Clearing
  1. The Contractor shall perform all clearing necessary for the proper installation of all lines, and appurtenances in the locations shown on the drawings. Plantings, shrubbery, trees, utility poles or structures subject to damage resulting from the excavation shall be transplanted, relocated, braced, shored, or otherwise protected and preserved unless otherwise directed by the Engineer.
- B. Excavation
  1. The Contractor shall perform all excavation of every description and of whatever substances encountered, to the dimensions and depth shown on the drawings or as directed. All excavations shall be made by open cut. All existing utilities such as pipes, poles, and structures shall be carefully supported and protected from injury, and in case of damage, they shall be restored at no cost to Broward County.
  2. Work shall be properly sheeted and braced where necessary. Where wood sheeting, or certain designs of steel sheeting are used, the sheeting shall be cut off at a level two feet above the top of the installed pipe and that portion below that level shall be left in place. If interlocking steel sheeting, of a

design approved by the Engineer is used, it may be removed providing removal can be accomplished without disturbing the bedding or alignment of the pipe. Any damage to the pipe bedding, pipe, or alignment of the constructed main caused by removal of sheeting shall be cause for rejection of the affected portion of the work.

3. Pipe trenches shall be excavated to a width, within the limits of the top of the pipe and the trench bottom so as to provide a clearance on each side of the pipe barrel, measured to the face of the excavation, or sheeting if used, of not less than eight inches (8") nor more than twelve inches (12") except for pipe over eighteen (18") inches in nominal size, this maximum twelve (12") inches clearance may be increased to eighteen (18") inches. All pipe trenches shall be excavated to a level six inches (6") below the outside bottom of the proposed pipe barrel unless otherwise directed by the Engineer. Properly sloped or shored per OSHA \* requirements and job site conditions, and Trench Safety Act \*\*
4. Excavation for appurtenances shall be sufficient to provide a clearance between their outer surfaces and the face of the excavation, or sheeting if used, of not less than twelve inches (12"). Materials removed from the trenches shall be stored and disposed of in such a manner that they will not interfere unduly with traffic on public streets and sidewalks, and they shall not be placed on private property. In congested areas, such materials as cannot be stored adjacent to the trench or used immediately as backfill, if acceptable, shall be removed to convenient places of storage.
5. All excess material suitable for use as backfill shall be hauled to and used in areas where not enough suitable material is available from the excavation.
6. Suitable material in excess of backfill requirements and material unsuitable for backfill shall become the property of the Contractor and shall be removed from the work and disposed of by the Contractor at his expense.
7. All unsuitable material shall become the property of the Contractor and shall be removed from the work and disposed of by the Contractor at his expense.
8. Unsuitable material shall not be mixed with or allowed to contaminate suitable backfill material.

\* Federal Register Part II, Department of Labor, OSHA 29CFR 1910; Permit required, confined spaces for General Industry, Final Rule.

\*\* Trench Safety Act, House Bill 3183 Law of Oct. 1, 1990.

C. Dewatering

1. When practical, it is a requirement of these specifications that excavation shall be free from water before pipe or structures are installed. When not practical, work shall be done as specified by the Engineer.
2. The Contractor shall provide all necessary pumps, under-drains, well point systems, and other means for removing water from trenches and other parts of the work. The Contractor shall continue dewatering operations until the backfill has progressed to a sufficient depth over the pipe to prevent flotation or movement of the pipe in the trench.
3. Water from the trenches and excavation shall be disposed of in such a manner as will not cause injury to public health, to public or private property, to the work completed or in progress, to the surface of the streets, or waterways or cause any interference with the use of the same by the public. When applicable, the Contractor shall use erosion control measures specified by permits.

D. Trench Stabilization

1. No claims for extras, or additional payment will be considered for cost incurred in the stabilization of trench bottoms which are rendered soft or unsuitable as a result of construction methods, such as improper or inadequate sheeting, dewatering or other causes. In no event shall pipe be installed when such conditions exist and the Contractor shall correct such conditions so as to provide proper bedding or foundations for the proposed installation.

E. Laying

1. A minimum two foot horizontal distance shall be maintained between new water main installations and any other utilities.
2. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.
3. The interior of the pipes shall be thoroughly cleaned of all foreign matter before being lowered into the trench. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe. Lines shall be laid straight, and depth of cover shall be maintained uniform with respect to finish grade whether grading is completed or proposed at time of pipe installation. Where a grade or slope is shown on the drawings, batter boards with string line or a laser beam paralleling design grade shall be used by the Contractor to assure conformance to the required

grade. No abrupt changes in direction or grade will be allowed. Any pipe found defective shall be immediately removed and replaced with sound pipe. Restrained joints shall be used for all bends, tees, plugs, and other fittings. The joints of all piping shall be made absolutely tight. The particular joint used shall be approved by the County prior to installation.

4. Mechanical joints shall be made up using annealed high strength cast iron bolts and rubber gaskets having either plain or duck tip as recommended by the manufacturer. All types of mechanical joint pipes shall be laid and jointed in full conformance with manufacturer's recommendations, which shall be submitted to the Engineer for review and approval before work is begun. Torque wrenches set as specified in AWWA Standard C111 latest revision, shall be used; or spanner type wrenches may be used with the permission of the County.
5. Push-on joints shall be made in strict, complete compliance with the manufacturer's recommendations. Lubricant, if required shall be an inert, nontoxic, water-soluble compound incapable of harboring, supporting, or culturing bacterial life. Manufacturer's recommendations shall be submitted to the County for review and approval before work is begun.

F. Backfill

1. Backfilling of utility trenches will not be allowed until the work has been inspected by the Engineer and he indicates that backfilling may proceed. Any work which is covered up or concealed without the knowledge and consent of the Engineer may be required to be uncovered or exposed at no cost to Broward County.
2. Backfill material shall be non-cohesive and non-plastic, free of all debris, lumps, clods, wood, broken paving or any organic or unstable material. Backfill material placed within one foot (1.0') of the lines shall not contain any stones or rocks larger than two inches (2") in diameter and no stones or rocks larger than six inches (6") in diameter will be permitted in any backfill.
3. If a sufficient quantity of suitable backfill material is not available from the trench excavation, or other trench excavations within the site of the work, the Engineer shall order the Contractor to provide additional material suitable for this purpose. The additional material shall be installed as specified herein.
4. Selected backfill material containing no stone or rocks larger than two inches (2") shall be placed in six inch (6") layers and thoroughly tamped to a depth of twelve inches over the top of the pipe. Particular attention and care shall be exercised in obtaining thorough support for the branch of all service connection fittings. Care shall be taken to preserve the alignment and gradient of the installed pipe.
5. After selected backfill has been placed to a depth of twelve inches (12") over

the pipe, backfilling shall proceed to a depth of thirty inches (30") over the pipe by placing the backfill material in six inch (6") layers and thoroughly compacting with mechanical vibrations. Backfill in this portion of the work shall be compacted to 100 percent of maximum density of the material as hereinafter defined.

6. After the backfill has been placed to a level thirty inches (30") over the pipe, the remainder of the backfill shall be placed in layers, not to exceed nine inches (9") and compacted with mechanical vibrators, or other suitable equipment, i.e., flooding to obtain a density of the backfilled material of not less than 100 percent of its maximum density as hereinafter defined.
7. An alternate method of backfilling shall be used when laying pipe underwater or when otherwise directed by the Engineer. The alternate method of backfilling shall differ from the previously mentioned specification only in that the backfill material used around the pipe and to a level one foot (1.0) above the top of the pipe barrel shall be small diameter pea rock. Drain field lime rock not larger than 3/4" in diameter is not acceptable.
8. Under certain circumstances flowable fill may be either desirable to use or is required by regulatory agencies. When used for backfilling purposes, the flowable fill shall meet the State of Florida, Department of Transportation specifications and requirements.

G. Restoring Surfaces

1. The top surfaces of the backfill shall be restored to the original or planned conditions or better. Trenches shall be carefully examined upon the completion of backfilling and surface irregularities that are dangerous or obstructive to traffic are to be removed. Paved sections shall conform in grade with adjacent areas and shall be of at least equal quality. Design mixes for flexible pavements shall be subject to approval by the Broward County Engineering Department but shall adhere to Department of Transportation State of Florida rules and regulations and standards and/or other government agencies. All damaged or undermined areas of existing pavement, not previously removed, shall be removed and restored to original condition or in the specified manner.
2. Equipment or traffic shall not travel over loose rock fragments, or other hard material, lying on sections of pavement which are not to be removed. For traffic control and safety barricades may be required. Removal, replacement and restoration of areas of pavement shall be as indicated on the drawings and the standard details.

**7.05 Pipe Boring and Jacking**

- A. The Contractor shall perform the pipe boring and jacking in accordance with

the requirements specified herein.

- B. Boring and Jacking materials shall be in accordance with the latest requirements of the State of Florida Department of Transportation and be in accordance with, but not limited to, the following:

- Material: Welded Steel Pipe, ASTM A139, Grade B.
- Size & Thickness: Varies and 0.500 inches.
- Coatings: Two (2) coats inside and out, Koppers Bitumastic No. 50 or equal, applied in strict accordance with manufacturer's instructions.
- Pipe Ends: Beveled for field welding.
- Material Certificate: Affidavit of Compliance certifying pipe complies with ASTM A139, Grade B.
- Blocking: Stainless steel casing spacers with polymer runners spaced in accordance with the manufacturer's requirements
- Casing Pipe Ends: Masonry bulkheads as shown on the plans, or other sealing systems on new installations, subject to County's approval.

- D. Boring and Jacking installation work shall be installed in accordance with standard practice and the requirements of the Florida Department of Transportation. The work shall be in accordance with and not limited to the following:

- Contractor's Equipment: Shall be compatible with subsoil conditions encountered. The Engineer may order the contractor to change his boring equipment if he considers it so non-compatible, and if, in his opinion, the change is necessary to safeguard the public and to protect public or private property.
- Soil Stabilization: Unstable soil shall be stabilized ahead and around casing pipe by chemical grout injection and/or other acceptable methods.
- Jacking: Installation of the casing pipe shall be a continuous operation until completed. It shall be done from one end of the crossing to the other without horizontal deflection or settlement of ground, surface

facilities or structures.

- Boring: Excavated materials shall be removed as jacking proceeds without causing voids behind casing pipe.
- Grade Control: Casing lead pipe grade shall be checked at least every four feet or whenever directed. A jack shall be used at the head end to control grade as required.
- Alignment Control: Alignment shall be controlled by guide rails set in the jacking pit.
- Casing Pipe: Lengths shall be circumferentially welded in conformance with AWWA C206. After welding, the joint area inside and out shall be cleaned and given 2 coats of Koppers Bitumastic No. 50 or equal.
- Carrier Pipe: The carrier pipe shall be jacked or cable-pulled with no tensile forces exerted on any pipeline joints.

END OF SECTION 7



**8. TESTING**

- 8.01 TESTING WATER MAIN LINES
- 8.02 TESTING WATER SERVICE LINES
- 8.03 TESTING FORCE MAIN LINES
- 8.04 TESTING GRAVITY SEWER MAIN LINES
- 8.05 TESTING GRAVITY SEWER LATERALS
- 8.06 VISUAL INSPECTION GRAVITY SEWER MAIN LINES
- 8.07 BCOES T.V. INSPECTION GRAVITY SEWER MAIN LINES
- 8.08 TESTING BACKFILL

## 8.01 Testing Water Main Lines

Water mains shall be tested in accordance with ANSI/AWWA Standard C600 latest revision.

### A. Hydrostatic Tests:

1. After a new water main has been laid and backfilled, it shall be pumped to a pressure of 150 PSI and all visible leaks stopped by approved methods. During the test, the pressure cannot drop more than 5 PSI below the starting pressure point.
2. A leakage test shall then be conducted at the above mentioned pressure and no installation will be acceptable by the Engineer until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = (S \times D \times SP) \div 133200$$

in which L equals the allowable leakage in gallons per hour; S is the length of line in feet being tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in pounds per square inch. The test is usually maintained for two hours but it may be continued for one additional hour if it becomes apparent that the leakage is equal to or greater than the amount allowable. Water supplied to the main during the test to maintain the required pressure shall be measured by a 5/8-inch meter installed on the discharge side of the test pump, or by pumping from a calibrated container. A hose bib connection will be provided to accept the test gauge supplied by Broward County.

3. The section of main being tested shall be limited to a maximum length of 2000'. When testing against closed metal-seated mainline valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size shall be allowed. Any questions pertaining to procedures used during the test shall be decided by the County.
4. No allowable leakage shall be permitted for fire hydrants.

### B. Bacteriological Tests:

1. After the water mains have satisfied the leakage requirements they shall be flushed through openings of the required size as detailed in ANSI/AWWA Standard C601 latest revision. The main shall then be sterilized in accordance with the provisions of the applicable sections of the above named specifications. On main breaks, cut-ins, etc. a liberal application of calcium hypochlorite shall be made; 50 PPM Chlorine during a 24 hour period.
2. Mains shall not be put into domestic service until the necessary bacteriological samples have been approved by the applicable regulatory agencies.

## **8.02 Testing Water Service Lines**

### A. Hydrostatic Testing

1. Hydrostatic testing of water service lines shall be done in conjunction with the testing of the lateral or main line. No additional leakage allowance will be made for service lines or fire hydrants.

### B. Sterilization

1. Sterilization of service lines shall be done in conjunction with the sterilization of the lateral or main line. Sufficient sampling points shall be taken from service line connections to assure uniform results throughout the system being tested.

## **8.03 Testing Force Main Lines**

Force mains shall be tested in accordance with AWWA Standard C600 latest revision.

### A. Hydrostatic Tests:

1. After a new force main has been laid and backfilled, it shall be pumped to a pressure of 150 PSI and all visible leaks stopped by approved methods. During the test, the pressure cannot drop more than 5 PSI below the starting pressure point.

2. A leakage test shall then be conducted at the above mentioned pressure and no installation will be acceptable by the Engineer until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = (S \times D \times SP) \div 133200$$

in which L equals the allowable leakage in gallons per hour; S is the length of line in feet being tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in pounds per square inch. The test is usually maintained for two hours but it may be continued for one additional hour if it becomes apparent that the leakage is equal to or greater than the amount allowable.

Water supplied to the main during the test to maintain the required pressure shall be measured by a 5/8-inch meter installed on the discharge side of the test pump, or by pumping from a calibrated container. A hose bib connection will be provided to accept the test gauge supplied by Broward County.

3. The section of main being tested shall be limited to a maximum length of 2000'. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size shall be allowed. Any questions pertaining to procedures used during the test shall be decided by the County.

### B. Cleaning and Flushing

1. Upon completion of the hydrostatic testing, all force main piping shall be flushed

with a sufficient amount of clear water to displace test water. If the discharged water shows evidence of excessive mud, sand or other deposits, the Engineer may direct the Contractor to continue flushing, or to clean the entire force main system by other approved methods to insure the removal of such deposits.

#### **8.04 Testing Gravity Sewer Main Lines**

##### **A. Infiltration, Exfiltration Gravity Sewer Main Line**

1. The allowable limits of infiltration or exfiltration for the entire system, or any portion thereof, shall not exceed a rate of 100 gallons per inch of inside pipe diameter per mile of pipe per 24 hours. No additional allowance will be made for house service lines. The allowable limits of infiltration or exfiltration of manholes shall not exceed a rate of four gallons per manhole per 24 hours.
2. Any part or all of the system may be tested for infiltration or exfiltration, as directed by the Engineer. Prior to testing for infiltration, the system shall be pumped out so that normal infiltration conditions exist at the time of testing. The amounts of infiltration or exfiltration shall be determined by pumping into or out of calibrated drums or by other methods approved by the Engineer.
3. The exfiltration test will be conducted by filling the portion of the system being tested with water to a level equal to the lowest part of the manhole frame.
4. Tests shall be conducted on portions of the system not exceeding three manhole runs or maximum of 1200' (feet) whichever is greater unless otherwise directed by the Engineer. Tests shall be run continuously for two hours.
5. Where infiltration or exfiltration exceed the allowable limits specified herein, the defective pipe, joints, or other fault construction shall be located and repaired by the Contractor. If the defective portions cannot be located, the Contractor shall remove and reconstruct as much of the work as is necessary in order to conform to the specified allowable limits.
6. The Contractor, at no expense to the County, shall provide all labor, equipment and materials and shall conduct all testing required, under the direction of the Engineer.

##### **B. Air Testing**

1. Air testing is a method of testing the integrity of the pipeline and the structures that may be used in lieu of the method prescribed in paragraph A. (above). Also, the County may direct the use of air testing under certain circumstances.
2. Testing procedures shall be in accordance with the following requirements. The results of the testing can be evaluated either by calculating the allowable

times in accordance with charts or by using Pass/Fail charts that have been created by OES.

3. At the start of the test, the pipelines are stabilized by pumping the lines with air to achieve a constant test pressure (for piping above the ground water table, it is necessary to achieve a constant 3.5 PSI; do not exceed 5 PSI). Maintain the test pressure for 5 minutes and do not permit the pressure to drop more than 0.5 PSI below the test pressure.
4. The test period begins when the pressure is adjusted to exactly 3.5 PSI (for piping above the water table) and the pressure supply is shut off. When the pressure bleeds to 3.0 PSI, start the test timing. Stop the time when the pressure bleeds to 2.5 PSI. Determine the time differential and compare it to the applicable charts (when calculating the allowable times).
5. If the bleed down time exceeds the allowable time per the chart, then the line passes. If the line reaches 2.5 PSI prior to reaching the allowable time, then it fails.
6. For piping that is below the water table, the above procedures are the same, except that all pressures shall be adjusted (+) 0.433 psi/ft below the water table.

#### **8.05 Testing Gravity Sewer Lateral**

- A. Infiltration/Exfiltration Gravity Sewer Laterals
  1. Infiltration and exfiltration testing (Two feet of Head for exfiltration; zero head for infiltration) of service connection lines shall be done in conjunction with the testing of the lateral and/or main line sewer. No additional leakage allowance will be made for service lines.
  2. Infiltration testing of service lines will not be permitted unless a minimum 2' (feet) static head of ground water exists over the shallow end of the service line at cleanout.

#### **8.06 Visual Inspection Gravity Sewer Main Lines**

- A. On completion of each block or section of sewer, or such other times as the Engineer may direct, the block or section of sewer is to be cleaned, tested and inspected. Each section of the sewer is to show, in examination from either end, a full circle of light between manholes. Each manhole or other appurtenance to the system, shall be of the specified size and form, be water tight, neatly and substantially constructed, with the top set permanently to exact position and grade. All repairs shown necessary by the inspection are to be made; broken or cracked pipe replaced; all deposits removed and the sewers left true to line and grade entirely clean and ready for use.

**8.07 BCOES T.V. Inspection Gravity Sewer Main Lines**

- A. After all other testing has been successfully completed, a television inspection of any or all lines may be made at Broward County's expense. Any defective work or necessary corrections brought out during this inspection must be corrected by the Contractor, at his expense, before the lines can be accepted for maintenance by Broward County. All mud, sand, debris and other deposits shall be removed by approved methods prior to inspection.
- B. The OES detailed procedure must be followed when televising new gravity sewers. Review and approval of the tapes must be done by NASSCO certified personnel.
- C. The percent of standing water at a sag in a sewer main will determine if the pipe is acceptable or not.
  - 1. Sags that make up 5% or less of the pipe area are approved.
  - 2. Sags that are between 5-10% of the pipe area are at the discretion of the County to accept or reject.
  - 3. Sags that are more than 10% of the pipe area are unacceptable and should be rejected unless justified by the Engineer of Record to the County. Acceptance is not final until agreed to by the OES operations and engineering divisions. A letter of credit or a performance bond will be required for sags such as this; warranty extensions without this protection are not acceptable.

**8.08 Testing Backfill**

A. Compaction and Densities Testing

Methods of control and testing of backfill construction to be employed in this work are:

- 1. Maximum density of all backfill material shall be determined by ASSHTO Method Designation T-180-C.
- 2. Laboratory and field density tests, which, in the opinion of the County are necessary to establish compliance with the compaction requirements of these specifications, shall be made at such depths and locations as selected by the County.
- 3. Trench backfill which does not comply with the specified densities, as indicated by such tests, shall be reworked and recompacted until the required compaction is secured, at no additional cost to Broward County.
- 4. The first test shall be 12" above the top of pipe or the water table, and in 6"

lifts thereafter.

END OF SECTION 8