

**TECHNICAL SPECIFICATIONS**

**FORCE MAIN SEWER LINES**



**CITY OF SANFORD  
SANFORD, NORTH CAROLINA**

# TECHNICAL SPECIFICATIONS

## FORCE MAIN SEWER LINES

### SCOPE OF WORK

Work under this section shall consist of installation of a force main as shown on the plans and described in the specifications. Work shall include all material, labor, equipment, casings and any other items necessary for a proper and acceptable completion.

#### **I. MATERIAL: FORCE MAIN SEWER LINE**

**A. PVC (Polyvinyl Chloride) Pipe:** PVC pipe shall be John Manville "Blue Brute" or approved equal conforming to all requirements of American Water Works Associations Standard AWWA C900-89. No PVC fittings shall be used under any circumstances. Pipe shall be joined by means of a rubber ring bell joint, which shall be integral and homogenous part of the pipe barrel.

**B. Cast Iron Pipe:** All cast iron pipe shall be manufactured in strict accordance with USA Specifications A21.6 or A21.8; AWWA Specifications C106 or C108 and Federal Specifications WW-P-421 and shall be class 150 or 200.

Joints for line pipe shall be mechanical joint or push-on joint in accordance with USA Specifications A21.11 (AWWA C111) joints for plant pipe, where called for, shall be flanged joints. Flanged fittings shall be faced and drilled and conform to the 125-pound American Standard Weight classification and flange dimensions.

The interior of all cast iron pipe shall have a cement lining of standard thickness in accordance with USA A21.4 (AWWA C104).

**C. Ductile Iron Pipe:** All ductile iron pipe furnished for diameters 4" through 24" shall be as manufactured in accordance with ANSI Specifications A21.51-1986, tentative, (AWWA C151-86, tentative) or latest specifications, in 18-foot lengths with single rubber gasket joints in accordance with ANSI Specifications A21.11-1972 (AWWA C111-85) or latest specifications. Four-inch diameter pipe shall be Class 51 wall thickness and 6" through 24" diameter pipe shall be Class 50 wall thickness in accordance with ANSI Specification A21.50-1978, tentative (AWWA C-150-86, tentative) or latest specification, unless otherwise specified or shown on the plans. All ductile iron pipe shall be cement lined

in accordance with ANSI Specifications A21.4-1971 (AWWA C104-90) or latest specifications.

- D. **Fittings:** All fittings shall be manufactured in accordance with ASA Specifications A21.10-1964 and AWWA C110 or latest revision. Fittings shall be all bell mechanical joint, ASA Specifications A21.10-1964, latest revision, unless otherwise noted, and shall have interior cement mortar lining in accordance with ASA Specification A21.4-1964, latest revision, for cast iron Ductile and PVC pipe shall conform to AWWA Standard CC100, Class D, or USA Standard A21-10, 150 psi pressure rating unless otherwise specified. Cast iron fittings and specials shall be cement-mortar lined with seal coat in conformance with USAS A21.4. Fittings for PVC pipe shall be epoxy lined ductile iron fittings with slip-on joints as manufactured by Ductile Iron Corporation of America.

All fittings shall have a pressure rating of 250 psi. Fittings 4" through 12" shall be cast iron with an iron strength of 25,000 psi. Fittings 14" and greater shall be ductile iron. Fittings subject to hydraulic thrust shall be blocked with 3,000 psi concrete. Blocking shall be formed and placed in such a manner that the pressure to be exerted at the point of blocking shall be transferred to firm, undisturbed earth at a maximum load of 2,000 psf.

- E. **Air Release Valves:** Air release valves shall be of the Universal air type to permit the automatic escape of air from pipelines when pipe is being filled and to permit air to enter the pipeline when pipe is being drained. Valves shall be as manufactured by Multiplex Manufacturing Company, Apco Valve and Primer Corporation or approved equal. The air release valve shall be installed within a 4' inside diameter manhole as shown on the plans. The need for air relief valves shall be evaluated at all high points along force mains.

- F. **Gate Valves:** All gate valves shall conform in all respects to latest AWWA Specifications and shall be American Darling or Mueller O-ring or M&H, or equal.

Gate valves shall be vertical open-left of the non-rising stem type with mechanical joint ends and 2" square operating nut. Gate valves shall be iron body, double disc, parallel seat, fully bronze mounted.

Gate valves shall be designed for the following pressures:

Valve Size	6"-12"
Working Pressure	150
Hydrostatic Test Pressure	200

- G. **Butterfly Valves:** Butterfly valves shall be Class 150-B, meeting or exceeding AWWA Specification C504-87.

Valve bodies shall be of close grain cast iron conforming to ASTM designation A126, Class B. Valve disc shall be cast bronze or cast iron with bronze or stainless steel sealing surfaces. The disc shall be natural rubber

warranted for five years from the date of acceptance by owner. Butterfly valves shall be manually operated with the operator assembly meeting all requirements of Section 12, AWWA C504-87. Operating torque shall be open left and provided with 2" operating nut. The operator assembly shall be suitable for trench bury.

Butterfly valves shall be American-Darling, Henry Pratt "Ground Hog" or approved equal.

- H. **Valve Boxes:** Adjustable valve boxes shall be subject to the approval of the engineer and shall be of equal quality and workmanship to Tyler 562S or equal and AWWA approved. Valve boxes shall be of close-grained, gray cast iron, in two pieces consisting of a lower base piece, which shall be flanged at the bottom to fit around the stuffing box gland and rest on tamped backfill and not touch the valve assembly, and an upper part which shall be manufactured on the lower end such that it will screw connect over the lower part and the upper end being constructed in the form of a socket to receive the cover. The cover shall have cast on the upper surface, in raised letters, the word "SEWER". Valve boxes shall be painted prior to shipment with a coat of protective asphaltum paint.
- I. **Concrete:** Shall be mixed in standard-type batch mixer with drum speed of 220 to 225 peripheral feet per minute. Mixing time shall be not less than one minute and shall be increased 15 seconds for each additional ½ yard, or fraction thereof, above 1 cubic yard. Tempered concrete shall not be used. Contents of mixer shall be completely discharged before each new batch is loaded.

Ready-mixed concrete may be used provided that concrete produced conforms to ASTM C-94.

## II. CONSTRUCTION METHODS

- J. **General:** Force mains shall be installed in strict accordance with the plans and these specifications. Work shall be planned and arranged so that the existing service shall be interrupted to the least possible degree. Access to property along the route of proposed construction shall be maintained at all times.
- K. **Trench Excavation:** Excavation shall be made to the lines and grades as directed by the engineer or as shown on the plans. The width of the trench shall not be more than is necessary for proper installation of the pipe. Depth of trench shall, generally, be such as provide a minimum depth of cover over the pipe of 4' below the finished grade of the street or ground. Bell holes shall be hand-dug at each joint to permit thorough making up of the joint. Bottom of the trench shall be hand-shaped to

support the pipe throughout its entire length. It shall be the responsibility of the contractor to provide adequate bearing for all pipe lines laid in uncertain soil conditions or, if the trench bottom should be softened by rain, flooding or other causes, the unsuitable material shall be removed and replaced with suitable material properly shaped and tamped to grade. The contractor shall, however, make efforts to prevent surface water from flowing into the trench. The contractor, at his expense, will remove any water which may accumulate in the trench by pumping or other approved means. Further, the contractor shall make every effort to prevent water and other materials from entering the pipe during construction. At the end of the day the line shall be plugged or capped and the trench filled in if necessary to protect the line. The use of timber or other material to support the pipe shall not be used. If rock is encountered, the excavation shall be carried to such depth below the established grade as to provide clear space of not less than 6" between rock at any point along the line. This space shall be filled with suitable material or stabilizing material and shall be included in the unit price for pipe as stated in the proposal. All excavation is unclassified. Cost of any rock excavation shall be included in the unit price bid per linear foot for pipe, complete in place. Trench excavations shall be seeded and stabilized as soon as possible to prevent erosion.

- L. **Pipe Laying:** Shall be accomplished in accordance with the pipe manufacturer's published instructions. All pipe shall be installed by experienced, skilled workmen. Pipe shall be laid with straight and smooth lines and to the grades indicated on the plans, with all joints perfectly fitted. Changes in alignment or grade without fitting shall be made uniformly with several joints, with deflection at joint not to exceed the recommendations of the pipe manufacturer.
- M. **Backfilling:** After the pipe has been satisfactorily installed, the trench shall be backfilled with approved material, free from large stones or clods, in 6" layers, loose measurement, and shall be thoroughly tamped and compacted with a rapid hitting mechanical tamper capable of exerting at least 185 lb./square foot of tamping area per blow. Other mechanical equipment may be used if approved by the engineer. The trench shall be compacted to a minimum of 90% standard proctor dry density.
- N. **Water Main Crossing Sewer:** Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. If local conditions prevent an 18" vertical separation, then both the water main and the sewer main shall be constructed of ductile iron pipe materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the crossing. Both the water main and the sewer line shall be pressure tested to assure water tightness prior to backfilling.

Whenever it is necessary for a water main to cross under a sewer, both shall be constructed of ductile iron pipe materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the crossing. A section of water main pipe shall be centered at the crossing. Both the water main and sewer line shall be pressure tested to assure water-tightness prior to backfilling.

O. **Valve Box Installation:** Valve boxes shall be installed on each valve. The bell of the valve box shall completely enclose the valve opening nut and shall be seated on tamped backfill and shall not touch the valve assembly. When valve boxes are located in pavement, the box shall be adjusted to finished street grade. When valves are located out of pavement, the boxes shall be adjusted to finish grade and a concrete block 2' square and 6" thick shall be poured around the box  $\frac{1}{2}$ " from the top.

P. **Hydrostatic Pressure Testing of Force Mains:** Upon completion of force mains, the contractor shall hydrostatically test between each main line valve. The contractor shall furnish a suitable test pump, measuring device, materials, labor, equipment, etc., to perform the test to the satisfaction of the engineer. Force main piping will be hydrostatically pressure tested to water main standards.

The line shall be filled slowly, with care being taken to insure complete removal of air from the line. The contractor shall install, at his expense, any corporation stops which may be required for this purpose. After the line has been filled, each portion between valves shall be hydrostatically tested to 150 psi and maintained for a period of three hours. Leakage shall not exceed 3 gallons per inch of diameter per mile of pipe.

Any visible leakage shall be repaired to a watertight condition. Defective materials disclosed by the test shall be replaced and the test repeated. The cost of all testing shall be included in the unit price per foot of pipe. Care will be taken to maintain the pipe in a reasonable, sanitary condition during installation.

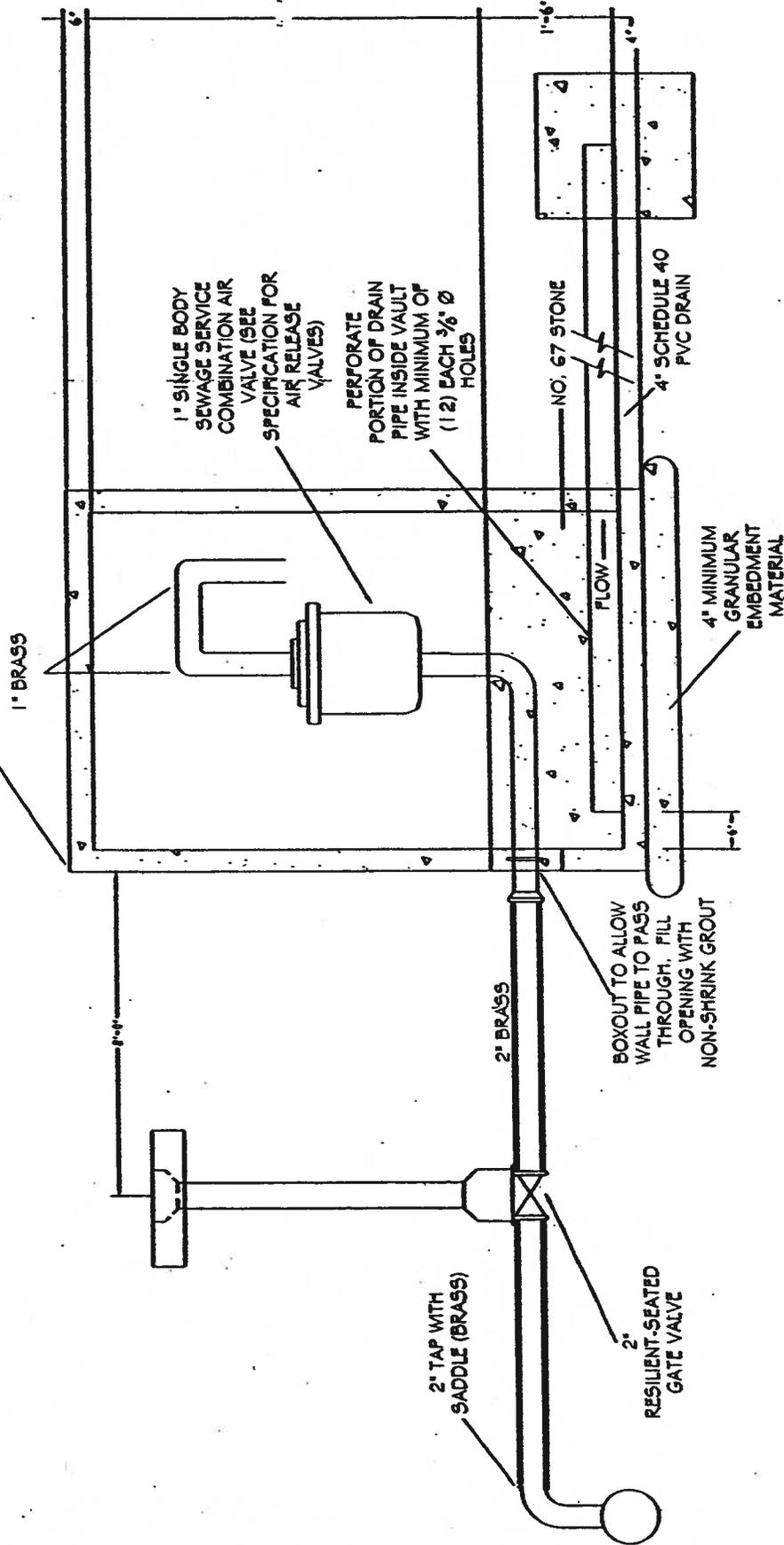
### III. METHOD OF MEASUREMENT

A. **Force Main Pipe:** Pipe will be measured from the bell or connection at the end of the line, such measurements to be made through all intermediate valves and fittings. Where changes in size or direction occur, measurement shall be to the center of the connecting fitting. Such measurement shall include the total linear feet of pipe installed, complete, in place, and accepted, including the furnishing of labor, tools, materials, and equipment necessary for benching, laying pipe, jointing, testing, backfilling and all other necessary incidentals.

- B. **Valves:** Valves shall be counted by unit, complete, in place, and accepted, including tapping valve and boxes.
- C. **Cast Iron Fittings:** The total number of installed fittings 12" and smaller will be counted by unit, complete, in place, and accepted. Both ductile and cast iron shall be included in this category.
- D. **Basis of Payment:** Payment will be made for all items based on the unit and lump sum prices stated in the proposal and measured as previously described. The prices stated in the proposal shall cover all work required to properly install the force mains complete with all necessary appurtenances in accordance with the plans and specifications.

# AIR RELEASE VALVE SPECIFICATION

36"x36" BOX TO MEET H-20 LOADING WITH 24"x24" STEEL, ANGLE FRAME SINGLE DOOR DESIGNED TO MEET H-20 LOADING



1" SINGLE BODY SEWAGE SERVICE COMBINATION AIR VALVE (SEE SPECIFICATION FOR AIR RELEASE VALVES)

PERFORATE PORTION OF DRAIN PIPE INSIDE VAULT WITH MINIMUM OF (12) EACH 3/8" Ø HOLES

NO. 67 STONE

4" SCHEDULE 40 PVC DRAIN

4" MINIMUM GRANULAR EMBEDMENT MATERIAL

BOXOUT TO ALLOW WALL PIPE TO PASS THROUGH. FILL OPENING WITH NON-SHRINK GROUT

2" TAP WITH SADDLE (BRASS)

2" RESILIENT-SEATED GATE VALVE