

SECTION 1

SANITARY SEWER CONSTRUCTION

GRAVITY MAINS AND FORCE MAINS

MATERIALS

1. GENERAL: All material shall be of the best commercial quality for the purpose specified and shall be free from defects that might impair the strength and durability.

Where two or more materials are specified as acceptable for the same service and where proposals are requested from the bidders for each material, the District reserves the right to select the material to be used and to award the contract on either low prices or other construction that he determines to be in his best interest. This right is further extended to allow the District to award a contract on the basis of using one material in a portion of the contract, or under one set of conditions, and an alternate material in another portion of the contract, or under another set of conditions if such a division is recommended by the Engineer and is determined to be in the District's best interest.

2. PIPE:

A. Concrete: Concrete pipe shall conform to ASTM C-14, High Strength, except for special conditions, such as railroad and river crossings. In these cases, the Engineers shall designate the class of concrete pipe proposed on the working drawings. All concrete pipe 18" and larger shall conform to ASTM C-76. Concrete sanitary sewer pipe shall be laid using an approved rubber gasket joint except for tie-ins to existing system. All concrete pipe shall have an interior coating that shall withstand hydrogen sulfide bacterially corrosive environments down to pH 2. Lining shall be Sewpercoat, Strong Seal, Quadex, Protecto 401, or approved equal.

B. Ductile Iron: Shall conform to the requirements of ANSI A21.51 (AWWA C151). See plans and/or bid items for thickness classifications.

1. Joints: Mechanical ASA Specifications A21.11 (AWWA C111). Push on single gasket conforming to Federal Specifications WW-P-421b, Type II.

2. Pipe Lining: Cement mortar with a bituminous seal coat conforming to ANSI A21.5 (AWWA C104). For pipe sizes 6" or larger, interior coating shall withstand hydrogen sulfide bacterially corrosive environments down to pH 2. Lining shall be Sewpercoat, Strong Seal, Quadex, Protecto 401, or approved equal.

3. Exterior Coating: Bituminous in accordance with manufacturer's specifications.

C. PVC Pipe (Gravity Sewers): All PVC Pipe shall conform to ASTM D-3034, SDR 35.

1. Joints: All joints shall use a rubber gasketed system.
2. Installation: Pipe and fittings will be in accordance with ASTM D-2321. Only Class I, II, III embedment materials will be considered suitable for PVC applications.
3. Fittings: All fittings shall conform to ASTM D1784.

D. PVC Pipe (Sewer Force Mains): PVC Pipe shall be SDR 21 as specified in the contract documents (Schedule of Bid Items). The pipe shall be plainly marked with the following information: manufacturer' s name, size, material (PVC) type and grade or compound, NSF Seal, pressure rating and reference to appropriate product standards. All sewer force mains shall have 12 gauge stranded coated tracer wire duct taped to top of the force main line.

1. PVC pipe used for construction shall comply to the following standards:
 - a. Standard dimension ratio - ASTM D 2241
200 psi pipe SDR 21
 - b. Grade 1 PVC Compound Material - ASTM D 1869
 - c. Rubber Coupling Rings - ASTM D 1599
 - d. Burst Pressure Test, 150 psi - ASTM D 1599
200 psi, SDR-21-minimum quick
burst pressure 800 psi
 - e. Impact Strength - ASTM D 2444

E. High Density Polyethylene Pipe:

1. General: Materials used for the manufacturing of polyethylene pipe and fittings shall be PE 3408 High Density Polyethylene (HDPE) meeting the ASTM D3350 cell classification of 345434C.

High Density Polyethylene Pipe (HDPE) and fittings will be used in accordance with the materials specifications. All additional appurtenances such as tees, gaskets, flange adaptors, etc. will meet the material specifications. Unless specified before hand, the contractor will supply the pipe and fittings and will include its price in the bid. All pipe installed by guided boring will be joined by an approved butt fusion or electrofusion technique according to the manufacturer's specifications.

HDPE pipe shall be produced from resins with a material designation PE3408, and a cell classification PE334434 as specified within ASTM D3350, and dimensions and workmanship as specified by ASTM F714. It will also meet the requirements of AWWA ASTM D3350. Pipe will be legibly marked at intervals of no more than five feet with the manufacturer's name, trademark,

pipe size, HDPE cell classification, appropriate legend such as SDR 11, ASTM D3035, AWWA C901 or C906, date of manufacture and point of origin. Pipe not marked as indicated above will be rejected.

The material used in the production of potable water pipe shall be approved by the National Sanitation Foundation (NSF)

2. Pipe Thickness: The material shall have a minimum Hydrostatic Design Basis (HDB) of 1600 psi at 73° F when tested in accordance with PPI TR-3 and shall be listed in the name of the pipe and fitting manufacturer in PPI TR-4.

Polyethylene pipe shall be manufactured in accordance with AWWA C906 for sizes 4" through 54".

Permanent identification of piping service shall be provided by co-extruding longitudinal blue stripes into the pipes outside surface. The striping material shall be the same material as the pipe material except for color.

3. Joints: Butt fusion or electrofusion welded in accordance with ASTM D3261.

4. Marking: The net weight, pressure class or nominal thickness, sampling period and manufacturer shall be marked on each pipe.

F. Service Connection: The 4" and 6" pipe and fittings used shall be Schedule 40 PVC conforming to ASTM D-2665 and ASTM D-2466 respectively. Submittals of materials to be used shall be submitted to the District before construction begins. All newly installed sewer services shall use either a Romac sewer saddle with a 12" stainless universal band or an in-line PVC sewer service tee. The tee shall be 8" schedule 35 by 4" schedule 40 hub. The 8" ends shall be gasketed to slide over 8" schedule 35 sewer main line and the 4" schedule 40 hub shall be manufactured so that 4" schedule 40 PVC pipe can be glued into the hub with no additional fittings needed. 4" service connection shall be no deeper than 5' from existing grade to the end of the service connection unless approved by the District Inspector. Some low elevated properties may require the end of the service connection to be deeper than the 5' requirement to connect to the gravity sewer. Required fall from the end of the service connection to the customer's structure is 1' of fall per 100' of distance to the structure for 4" line. For 6" line, the required fall from the end of the service connection to the customer's structure is 6" of fall per 100' of distance to the structure.

3. FITTINGS (Sewer Force Mains):

A. Ductile Iron: Ductile iron special castings or fittings shall be all mechanical joint. The special castings or fittings shall be manufactured in strict accordance with Specifications ANSI A21.10 (AWWA C110). Fittings 3" - 12" shall be Class 250; 14" and larger may be Class 150.

In the case of mechanical joint fittings, payment shall be made on a per unit basis and shall include the body and accessories.

All ductile iron fittings shall be lined with one-half thickness cement lining, commonly known as "enameling" and have a bituminous coating both inside and out. For pipe sizes 6" or larger, interior coating shall withstand hydrogen sulfide bacterially corrosive environments down to pH2. Lining shall be Sewpercoat, Strong Seal, Quadex, Protecto 401, or approved equal.

4. VALVES (Sewer Force Mains):

A. Gate Valves: Gate valves shall be designed and manufactured in accordance with the requirements of the latest revision of AWWA C-500. All valves shall be of iron body, bronze mounted, double disc parallel seat type with non-rising stems and a 2" square operating nut. Gate valves shall be resilient seat valves. Valves 16" and larger shall have a by-pass to equalize pressure on both of the valves to facilitate opening. All valves 24" and larger shall be equipped with gearing.

Valve ends shall be of the size and type required for connections to the type service line used. Standard connections shall be push-on with gaskets for PVC pipe, or M.J. or M.J. for DI pipe.

Pressure ratings for the valves shall be as follows:

<u>SIZE</u>	<u>WORKING PRESSURE</u>	<u>HYDROSTATIC TEST PRESSURE (SHELL)</u>
2" - 12"	200 psi	400 psi
14" - 24"	150 psi	300 psi

Mueller or American-Darling will only be accepted.

B. Air Release Valves: The District accepts only GA Industries and Crispin Valves. The valve shall have a shut-off valve located in a separate valve box between the force main line and the valve. All Air Release Valves shall have a manhole cone with a ring and cover over them for access purposes. All valves shall have a minimum 12" of #57 wash stone under the valve for drainage purposes. All valves shall be located by installing a concrete protector wheel around the separate valve box and a concrete marker pole at the valve with the letters ARV pointed towards the valve.

Standard Sewage Air Release Valve - Valve shall be float operated and shall employ a compound lever mechanism to enable the valve to automatically release accumulated air and gases from a sewage pipeline while the system is pressurized and operating. The Air Release Valve shall close drop tight, incorporating an adjustable Buna-N orifice button. All internal metal parts

shall be of stainless steel. The linkage/lever mechanism shall be able to be removed from the valve without disassembly of the mechanism. The float shall be stainless steel and be capable of withstanding a 1000 PSIG test pressure. The body and cover shall be of cast iron conforming to ASTM A126 Class B. Inlet connection shall be 2" or 3" NPT, or 4" FLG, as required. Outlet connection shall be ½" NPT. When specified, the valve shall be supplied with a "flushing attachment" consisting of: bronze shut-off valves, quick-connect couplings and rubber hose, for backwashing with clear water. The Air Release Valve shall conform to AWWA Standard C512-92.

Sewage Air/Vacuum Valve – The valve shall automatically exhaust large quantities of air and gases while the pipeline or system is being filled and allow air to re-enter during draining or when a negative pressure exists. The valve shall be spherical float operated and shall close drop tight against a renewable rubber seat. All internal parts shall be made of stainless steel. Body and cover shall be of cast iron conforming to ASTM A126, Class B. Inlet connection shall be NPT to 3" size, CL. 125 FLG in 4" and larger. Outlet shall be NPT. When specified, valve shall be supplied with "flushing attachment" consisting of: bronze shut-off and flushing valves, quick-connect coupling and 5 ft. of rubber hose, for backwashing with clear water.

Standard Custom Sewage Combination Air Valve – The valve assembly shall be designed to exhaust large amounts of air during filling, release small amounts of accumulated air during operation and open upon impending vacuum to admit large amounts of air while draining. The valve assembly shall consist of two independent valves: a large orifice Air & Vacuum Valve and a small orifice Air Release Valve, piped together so that a single, common connection can be made to the force main. The assembly shall be tested as a unit to insure there are no leaking joints. All necessary fittings between the two valves shall be either brass or Sch. 40 PVC. All internal metal trim components shall be stainless steel. When specified, the Combination Air Valve shall be supplied with "flushing attachment" to allow periodic flushing of sediment, grease and solids. Attachments consist of: bronze blow-off and flushing valves, with a minimum of 5 ft. of rubber hose, and quick disconnects to allow connection to a clean water source.

C. Valve Boxes: Adjustable valve boxes shall be of quality and workmanship to those manufactured by Mueller Company, or Resslerer Valve Company or an approved equal. Valve boxes shall be of close-grained gray cast iron. The valve boxes shall be the two piece screw type and the cover or cap shall have cast on the upper surface in raised letters the word "Sewer". Valve boxes shall be painted with a coat of protective asphaltum paint before being shipped from the factory. Concrete protector rings shall be placed around all valve boxes with concrete marker poles installed to show the placement of all valves.

5. MANHOLES: Manholes may be built of pre-cast concrete sections only.

A. Pre-cast Concrete Manholes: Pre-cast Concrete Manholes sections shall conform to ASTM C478 latest revision. The successful bidder shall submit three copies of shop drawings of the pre-cast manholes proposed to be used for approval to the District and Engineer before ordering the manholes for the proposed project. Pre-cast manholes with preformed bottoms shall be set on a minimum of 6" of gravel or stone base. The stone or gravel base shall be placed over an area not less than 7' x 7' centered on the centerline of the proposed manhole location. All manholes shall have installed at the pre-cast manufacturer, a set of steps as described in the next section. All pre-cast manholes shall have pre-cast inverts installed at the manufacturer unless the Contractor is tying into an existing sewer main line and the need for a "doghouse" type base section is needed. All pre-cast manholes shall be manufactured to meet or exceed the latest ASTM C-478 reinforcement requirement and have a 28 day compressive strength factor of 4,500 psi. All pre-cast manholes shall be manufactured with the desired cored openings as required when possible. All manholes that will be receiving sewer from a proposed sewer force main will be required to have the manhole manufacturer install interior coating which shall withstand hydrogen sulfide bacterially corrosive environments down to pH 2. Lining shall be Sewpercoat, Strong Seal, Quadex, Protecto 401, or approved equal.

B. Steps: All pre-cast manholes shall have co-polymer polypropylene steel reinforced steps meeting the latest version of ASTM-478. All steps shall be located at the same position or angle in all sections of the manhole so that the steps shall be aligned straight. All steps shall be located over either bench in the manhole and not over any invert. Manhole steps shall be placed inside of the manhole if it is more than 4' in depth. Steps shall also be provided on the outside of all manholes rising more than 4' above finished ground level. Manhole steps shall be 15" apart beginning 2' from the bottom and ending 3' from the top of the manhole casting. The steps shall be pre-cast in the manhole, thoroughly bonded, accurately spaced, and aligned.

C. Manhole Frames and Covers: Manhole frames and covers shall be designed for heavy traffic weighing not less than 310 lbs. The iron shall be tough, dense, and even grained, cast in a true symmetrical pattern free from defects of any kind. Approved frames and covers manufacturers are: Sumter Foundry, East Jordan Iron Works, or approved equal. Any other manufacturer shall have inter-changeable lids with ones listed above.

6. CASING PIPE:

A. Boring Under Paved Roads and Highways: The inside diameter of the casing pipe shall not be less than 2" greater than the largest outside diameter of the joints and couplings for

carrier pipe less than 6" O.D., and 4" greater for carrier pipe 6" and larger. It shall, in all cases, be great enough to easily remove carrier pipe without disturbing the casing pipe. The Contractor should contact the local South Carolina Department of Transportation for any questions and permitting for any road or highway bores. Casing spiders shall be installed by the contractor to center the carrier pipe inside the casing pipe.

1. Pipe Size 8" and Smaller: Schedule 40 wrought steel or wrought iron pipe having a wall thickness as shown below may be used for casing pipe 8" and smaller.

DIAMETER OF PIPE INCHES	WROUGHT STEEL WALL THICKNESS INCHES	WROUGHT IRON WALL THICKNESS INCHES
2-1/2	.203	.208
3	.216	.221
3-1/2	.226	.231
4	.237	.242
5	.258	.263
6	.280	.286
8	.322	.329

2. Pipe Sizes 8" and Larger: Steel pipe for casings 8" and larger shall be manufactured from steel having a minimum yield strength of 35,000 psi with the minimum wall thickness as shown below:

DIAMETER INCHES	MINIMUM WALL THICKNESS INCHES
10"	.188
12"	.188
16"	.250
18"	.250
20"	.250
24"	.250

30"	.312
36"	.375

B. Boring Under Railroads: The inside diameter of the casing pipe shall not be less than 2" greater than the largest outside diameter of the joints and couplings for the carrier pipe less than 6" O.D. and 4" greater for carrier pipe 6" and larger. It shall, in all cases, be great enough to easily remove carrier pipe without disturbing the casing pipe. The Contractor should contact the railway for any questions and permitting for any railroad bores. Casing spiders shall be installed by the contractor to center the carrier pipe inside the casing pipe.

Steel pipe manufactured from steel having a minimum yield strength of 35,000 psi and having a minimum permissible wall thickness as listed below shall be used as casing pipe.

DIAMETER OF PIPE INCHES	MINIMUM WALL THICKNESS INCHES
10"	.188
12"	.251
16"	.312
18"	.313
20"	.375
24"	.407
30"	.469
36"	.532
