

# **SECTION 5**

# **SANITARY SEWER MATERIALS**

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### SANITARY SEWER MATERIALS

#### 5.1 General

This section provides a description of the materials acceptable for the construction of sanitary sewer facilities. Use of other materials which are not specified herein shall only be permitted with the written approval by the City and City Engineer.

#### 5.2 Gravity Sanitary Sewer

##### A. General

The City currently allows the use of the following pipe material:

- Polyvinyl Chloride Pipe (PVC)
- High Density Polyethylene Pipe (HDPE)
- Gravity Centrifugally Cast, Fiberglass Reinforced, Polymer Mortar Pipe (CCFRPM)

All pipe shall be the bell and spigot type with elastomeric seal joints.

All pipe shall be required to withstand a hydrostatic pressure of twenty (20) feet of water (8.6 psi) for two (2) hours while being deflected to the maximum amount recommended by manufacturer. Continuing the hydrostatic pressure, a shear load of one hundred (100) pounds per inch of nominal pipe diameter shall be applied to an unsupported spigot immediately adjacent to joint. During testing period, there shall be no visible leakage at joint.

##### B. Sanitary Sewer Pipe Materials

###### 1. Polyvinyl Chloride Pipe (PVC)

All PVC pipe shall be constructed using watertight joints and methods. The gravity sanitary sewers shall be PVC SDR 35 solid wall pipe. Polyvinyl chloride (PVC) gravity sanitary sewer pipe shall be the integral wall bell and spigot type with elastomeric seal joints and smooth inner walls meeting or exceeding all of the requirements set forth in ASTM D-3034 for pipe diameters 15-inches or less and meeting or exceeding all of the requirements set forth in ASTM F-679 for pipe diameters greater than 15-inches.

For diameters 15-inches or less, the pipe shall have a minimum cell classification of 12454-B and for diameters greater than 15-inches the pipe shall have a minimum cell classification of 12454-C; with all pipe having a minimum tensile strength of 34.50 Mpa as defined in ASTM D-1784.

PVC sanitary sewer pipe shall have a minimum pipe stiffness of 46 psi for each diameter when measured at 5% vertical ring deflection and tested in accordance with ASTM D-2412.

Fittings shall be made of the same class as the pipe they are installed along and shall be manufactured by the pipe manufacturer. Fittings shall meet the same ASTM requirements as the pipe.

Only manufactured fittings made of PVC plastic having a cell classification of 12454-B as defined in ASTM D-1784 shall be used.

Tee/Wye service connections for sewers where existing or proposed grade (to sewer invert) as shown on plans, exceeds 15 feet shall be heavy wall.

*SADDLE CONNECTIONS SHALL NOT BE ALLOWED FOR NEW CONSTRUCTION.*

Flexible gasket joints shall be compression type so that when assembled, the gasket inside the bell will be compressed radially on the pipe spigot to form a watertight seal. The assembly of joints shall be in accordance with the pipe manufacturer's recommendations and ASTM D-3212. The gaskets sealing the joint shall be made of rubber of special composition having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five (5) years' experience in the manufacture of rubber gaskets for pipe joints. The gasket shall be a continuous ring of flexible joint rubber of a composition and texture which is resistant to common ingredients of sewage, industrial wastes and groundwater and which will endure permanently under the conditions imposed by this service. The gasket shall conform to the requirements of ASTM F-477.

*NO SOLVENT CEMENT JOINTS SHALL BE ALLOWED.*

All field-cutting of pipe shall be done in a neat manner as per manufacturer's recommendations and the cut end shall be beveled using a file or wheel to produce a smooth bevel of approximately 15° and be a minimum depth of one-third the pipe wall thickness. Field cut pipe will only be allowed to be installed at manholes, at prefabricated tees and wyes, and at the connection of new sanitary sewer to existing sanitary sewer.

The date of manufacture, class of pipe, specification designation, size of pipe, name or trademark of manufacturer, and identification of plant/location shall be legibly marked on the outside of each pipe section in accordance with the ASTM D-3034.

2. High-Density Polyethylene Pipe (HDPE)

All high-density polyethylene (HDPE) pipe shall be a triple wall pipe with a smooth interior and exterior surfaces with annual inner corrugations. The HDPE pipe shall have a minimum pipe stiffness of 46 PSI when tested in accordance with ASTM D2412. The pipe shall have a Manning's "n" value of 0.012.

The HDPE pipe shall be joined using a bell and spigot joint that meets the requirements of ASTM F2764. The joint shall be watertight in accordance with ASTM D3212 and withstand 15 psi of pressure. Gaskets shall meet the requirements of ASTM F477 and shall be installed by the pipe manufacturer. A joint lubricant provided by the manufacturer shall be used on the gasket and bell during assembly. The bell joint shall be reinforced with a polymer composite band installed by the manufacturer.

Fittings shall conform to ASTM F2764. Bell and spigot connections shall utilize a welded or integral bell and valley or inline gaskets meeting the watertight joint performance requirements of ASTM D3212.

Polypropylene compound for pipe and fitting production shall be an impact modified copolymer meeting the material requirements of ASTM F2764.

3. Gravity Centrifugally Cast, Fiberglass Reinforced, Polymer Mortar Pipe (CCFRPM)

This specification covers fiberglass sewer pipe defined by raw materials in the structural wall and liner, surface layer material and pipe stiffness.

The pipe materials designation code shall consist of the standard designation, ASTM D3262, followed by type, liner and grade indicated in Arabic numerals, and pipe stiffness by a capital letter. Minimum pipe stiffness, when tested in accordance with ASTM D 2412 shall be 46 psi. A complete material code shall conform to ASTM D 3262, three numerals, and a capital letter. Pipe shall be furnished with elastomeric gaskets conforming to ASTM F477.

Pipe section lengths shall be determined based on a length determined by the Contractor, and approved by the Engineer, that will provide ease of installation.

Pipe shall be manufactured and rated at a stiffness class great enough to handle all forces involved for the installation.

Joint type shall be selected by the Contractor, and approved by the Engineer, based on the installation being utilized to install the pipe. In any case, the joint must meet the requirements of ASTM D4161.

The CCFRPM pipe must be specifically designed for the conditions experienced during and after construction of the interceptor system. The Contractor will be responsible for obtaining the correct design from their selected manufacturer.

### 5.3 Sanitary Sewer Force Mains

#### A. General

The City currently allows the use of the following types of pipe for force mains:

- Polyvinyl Chloride Pipe
- Ductile Iron Pipe
- High Density Polyethylene Pipe

#### B. Air/Vacuum Relief Valves

The design of sanitary force mains shall prevent the need for air vacuum relief valves. If high points cannot be eliminated an air relief valve shall be installed at each point. Each valve shall be installed in a manhole structure.

#### C. Force Main Materials

##### 1. Polyvinyl Chloride (PVC) Force Main

###### a. Type 1

PVC plastic pipe shall conform to ASTM Specification D 2241, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe (SDR PR). The material used shall conform to ASTM Specification D 1784, Standard Specification for Rigid Polyvinyl Chloride and Chlorinated Polyvinyl Chloride compounds, Class 12454-B (PVC 1120). Pipe O.D. shall conform with that of steel pipe (IPS).

The pipe fittings shall be pressure rated in accordance with recommendations of the Plastic Pipe Institute. Pressure Class and Standard Dimension Ratios (SDR) shall be as follows:

Class 200 - SDR 21  
Class 250 - SDR 17

###### b. Type 2

This pipe and fittings shall be PVC 1120 pressure pipe made from Class 12454-A or B material and conform with O.D. dimensions of steel pipe (IPS) or cast iron (C.I.). Pressure class and dimension ratio shall be as follows:

Class 200 - DR 14

Type 2 PVC shall comply with AWWA Standard C 900.

All plastic pipe and couplings shall bear identification markings in accordance with Section 2.5.2 and 2.5.3 of AWWA C 900, which shall include the National Sanitation Foundation (NSF) seal of approval. In addition, the plain end of each pipe length shall have two (2) rings, one (1) inch apart, painted around the pipe at the proper location to allow field checking of the correct setting depth of the pipe in the bell or coupling.

The Push-On Joint for PVC and joint components shall meet the requirements for ASTM Specification D 3139, Joint for Plastic Pressure Pipe Using Flexible Elastomeric Seals. The joint shall be designed so as to provide for the thermal expansion and contraction experienced with a total temperature change of seventy-five degrees Fahrenheit (75°F) in each joint of pipe. Details of the joint design and assembly shall be in accordance with joint manufacturers standard practice.

Lubricant shall be non-toxic and shall not support the growth of bacteria and shall have no deteriorating effects on the gasket or the pipe. The lubricant containers shall be labeled with the manufacturer's name.

Gaskets shall meet all applicable requirements of ASA Standard A 21.11.

Gasket dimensions shall be in accordance with the manufacturer's standard design dimensions and tolerances. The gasket shall be made of such size and shape as to provide an adequate compressive force against the spigot and socket after assembly to affect a positive seal under all combinations of joint and gasket tolerances. The trade name or trademark, size, mold number, gasket manufacturer's mark, and year of manufacture shall be molded in the rubber on the back of the gaskets.

Gaskets shall be vulcanized natural or vulcanized synthetic rubber. No reclaimed rubber shall be used. When two (2) hardness's of rubber are included in a gasket, the soft and hard portions shall be integrally molded and joined in a strong vulcanized bond. They shall be free of porous areas, foreign material, and visible defects.

## 2. Ductile Iron

All ductile iron pipe shall conform to the ANSI A21.51 and AWWA C 151, latest revisions. Ductile iron pipe shall be Class 350 for eight (8) inch through twelve (12) inch. For fourteen (14) inch through eighteen (18) inch Class shall be 250.

Pipe shall have either of the following interior coatings:

- a. polyurethane in accordance with ASTM D16 Type V (1000 microns minimum total thickness)

- b. epoxy (40 mils minimum)
- c. polyethylene (1500 microns minimum total thickness)

Fittings shall be standardized for the type of pipe and joint specified and shall comply with ANSI A21.10 and AWWA C110. Fittings shall be either mechanical joint or push-on type. Pipe joints shall use O-ring gaskets in accordance with ANSI 21.11 and AWWA C 111.

3. High Density Polyethylene

A. Pipe

Materials used for the manufacture of polyethylene pipe shall be extra high molecular weight, high density ethylene/hexane copolymer PE 4710 polyethylene resin meeting the requirements of ASTM D-3350 with a cell classification of PE 345434C. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All material shall be listed by the Plastic Pipe Industry in the name of the pipe manufacturer and shall be based on ASTM D2837 and PPI TR-3 testing and validation for samples of the pipe manufacturer's production pipe. Pipe shall be in compliance with ASTM F714 DIPS minimum 160 psi (DR 11) for 3" and greater and ASTM D-3035 IPS minimum 256 psi (DR 13.5) for all mains less than 3" in diameter.

B. Joints

HDPE pipe shall be the joined into continuous lengths on the jobsite above ground per ASTM D2657, Heat Joining Polyolefin Pipe and Fittings. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and interracial fusion pressure. Socket fusion shall not be used.

C. Pipe Packaging, Handling and Storage

The manufacturer shall package the pipe in a manner designed to deliver the pipe to the project site neatly, intact and without physical damage. The transportation carrier shall use appropriate method to ensure the pipe is properly supported, stacked and restrained during transport. On-site the pipe shall be stored on clean, level ground to prevent undue scratching or gouging. When lining fused sections of pipe, chains or cable type chokers must be avoided, nylon slings are preferred. Care must be exercised to avoid cutting or gouging the pipe.

D. Installation

Force main installation shall be in conformance with specifications for installation of flexible pipe as per all applicable ASTM requirements including F-412, D-2321, D-2412, D-3212 and D-3350.

E. Locator Tape

All HPDE pipe shall be installed with a metallic locator tape. Tape shall be color coded and installed above the pipe in accordance with the tape manufacturer's instructions.

F. Certification

The Contractor shall furnish, upon request, certified reports stating that inspection and specified tests have been made and that the results thereof comply with the applicable standards.

G. Markings

During the extrusion production, the HDPE pipe shall be continuously marked with durable printing noting the nominal pipe size, dimension ratio, pressure rating, trade name, material classification, certification bases and date.

H. Fittings

Fittings shall be ductile iron per Section C > 2.0.

D. Locator Wire

Locator wire shall be dual (2), #12 standard solid copper wire with thermoplastic insulation and capable of carrying six hundred (600) volts. Wire shall be installed as set forth under **Section 7**.

**5.4 Building Services/Service Laterals**

Building services shall be SDR 35 PVC pipe conforming to ASTM D 3034. Joints shall be gasket push-on, compression type conforming to ASTM D 3212. Gaskets shall conform to ASTM F 477.

Joint couplings between the new sewer service lateral and existing service lateral shall be manufactured by Fernco or approved equal.



## 5.5 Sanitary Sewer Manholes

### A. General

Location of manholes shall be as required in **Section 4.2(D)(1)**.

### B. Types of Manholes

Manholes shall be either monolithic (cast-in-place) or precast. If monolithic manholes are to be used, the Contractor shall submit drawings showing all reinforcement, dimensions, and connections for City approval. All drawings shall be certified by a registered Professional Engineer.

### C. Precast Manholes

Manholes shall be constructed in accordance with the ASTM Specifications for "Precast Reinforced Concrete Manhole Risers and Tops", Designation C 478. The minimum wall thickness shall be five (5) inches for manholes four (4) feet in diameter. When the depth of the manhole exceeds twelve (12) feet, then the depth in excess of twelve (12) feet shall be reinforced with two cages of reinforcement the same as required for reinforced concrete sewer pipe of same diameter as the riser of the manhole per ASTM Specification Designation C 76 for Class III Pipe. The precast tops shall be of the eccentric cone type. Precast flat covers shall be not less than eight (8) inches thick and reinforced with two layers of steel with a minimum area of 0.39 square inches per linear foot in both directions in each layer. Precast flat bottoms of manholes shall also be reinforced the same as specified herein for precast flat top. Hoisting lugs or hooks shall be cast in place for handling and setting of the rings. Openings of proper sizes and suitable design shall be cast in place for receiving the sewer and/or drop pipes and connections. Adjusting riser rings shall be provided as approved by the City.

All manhole joints shall be tongue and groove and they shall be sealed with an O-ring and joint sealer conforming to Federal Specifications SS-S-00210 and similar to "Kent-Seal No. 2" as manufactured by the Hamilton Kent Manufacturing Co., of Kent, Ohio; "RAM-NEK" as manufactured by the K.T. Snyder Co. of Houston, Texas, or equal. Cracked or damaged barrel joints shall be rejected.

### D. Manhole Steps

The steps provided shall be manufactured of reinforced plastic and shall be twelve (12) inches wide and one (1) inch square.

### E. Manhole Bases

Manhole bases shall be of cast-in-place monolithic concrete or precast concrete. Where sewer lines pass through or enter manholes, the invert channels shall be smooth and semi-circular in cross section and may be formed directly in the concrete of the manhole base, may be half tile laid in the concrete, or may be

constructed by laying the sewer lines continuously through the manhole and break-hardened and neatly trimming the edges. Changes of direction of flow within the manholes shall be made with a smooth curve with as long a radius as possible. The floor of the manhole outside the channels shall be smooth and slope toward the channel not less than one (1) inch per foot.

No mortar or concrete shall be placed in water, and no water shall be allowed to flow over or against the concrete before it has set for a period of time deemed sufficient by the City to prevent damage to the structure. The invert channel through manholes should be made to conform in shape and slope to that of the sewer. All invert channels are to have a properly mortared apron on either side, sloped to prevent solids deposition.

F. Adjusting Rings

Where one (1) solid riser or barrel section cannot be used, final adjustments in elevation of the frame and cover shall only be accomplished by the use of precast concrete adjusting rings conforming to ASTM C 478.

Rings shall be of a nominal thickness of not less than four (4) inches. Not more than twelve (12) inches total of adjusting rings shall be allowed for adjustment of the manhole frame and cover to required elevation. Adjustment rings are required in situations with round, solid steel sized for casting. Expandable rings are not a suitable alternative.

G. Sewer Pipe to Manhole Connections

To connect a sanitary sewer to a manhole, either a flexible boot KOR-N-SEAL 1 or 2, flexible connector, cast-in-place Dura-Seal gasket, "A"-lock gasket or an approved equal shall be used. Connections to an existing manhole shall be a flexible boot KOR-N-SEAL or approved equal.

If the flexible boot connection is used, it shall be placed in the reinforced concrete manhole base and secured to the pipe by a stainless-steel clamp. Flexible connectors shall conform to ASTM C 923.

The cast-in-place inflatable gasket shall conform to ASTM C 923.

All connections shall provide for a watertight seal between the pipe and manhole. The connector shall be the sole element relied upon to assure a flexible watertight seal of the pipe to the manhole.

The rubber for the connector shall comply with ASTM C 923 and shall be resistant to ozone, weather elements, chemicals, including acids and alkalis, animal and vegetable fats, oils and petroleum products.

The stainless-steel elements of the connector shall be totally non-magnetic Series 305 stainless steel. The stainless-steel clamp shall be capable of sustaining applied torque in excess of eighty (80) inch-pounds. It shall be the

responsibility of the Contractor to submit details of the proposed connection to the City for approval. Connections not approved by the City shall be subject to removal and replacement with an approved adapter.

H. Castings

Standard manholes shall have a R-1772 C frame and lid by Neenah Foundry, 1875-3 by East Jordan Iron Works, or approved equal. Material shall be in compliance with ASTM A 48, CL 35B. Each lid shall have two (2) inch high letters indicating "Sanitary Sewer".

Where watertight castings are required, the manholes shall have a R-1916F frame and lid by Neenah Foundry, 1045 HD by East Jordan Iron Works, or approved equal. The frame shall be anchored to through the riser rings (if provided) to the cone section with four (4) galvanized rods.

I. Frame Chimney Seal

An external rubber seal shall be installed on all sanitary manholes. A rubber seal extension, to cover any additional heights of chimney not covered by the seal itself, shall be used when required. The external rubber seal and seal extensions shall be as manufactured by Cretex Specialty Products, or equal.

The sleeves shall be extruded from a high-grade rubber compound conforming to the applicable requirements of ASTM C 923. The bands used for compressing the sleeve and extension against the manhole shall be fabricated from 16-gauge stainless-steel conforming to ASTM A 240 type 304, any screws, bolts or nuts used on this band shall be stainless steel conforming to ASTM F 593 and 594, type 304.

The joint between the manhole frame and chimney or cone shall be 3/4" thick and made using cement mortar. Any sealant used between the adjustment or grade rings of the chimney shall not be used in this joint. Installation of these rubber seals shall be in accordance with the manufacturer's recommendation.