

SECTION 6
MATERIALS

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SECTION 6

MATERIALS

6.01 General

- A. This section provides a description of the materials acceptable for the construction of public works facilities. Use of other materials, which are not specified herein, shall only be permitted with the written approval by the Town and Town's engineering representative.
- B. The quality of all materials, the process of manufacture, and the finished pipe shall be subject to inspection and approval by the Town's Utility Inspector. Such inspection may be made at the place of manufacture or on the work after delivery, or at both places; and the pipe shall be subject to rejection at any time on account of failure to meet any of the standards' requirements even though sample pipes may have been accepted as satisfactory at the place of manufacture.

6.02 Gravity Sanitary Sewer

A. General

The following materials are acceptable for gravity sanitary sewers:

- Ductile Iron Pipe (DIP)
- Polyvinyl Chloride Pipe (PVC)

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

B. Sanitary Sewer Pipe Materials

1. Ductile Iron Pipe (DIP)

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) inches through twelve (12) inches, for fourteen (14) inches through eighteen (18) inches, the Class shall be 250. Pipe shall be sulphate resisting cement lined and seal coated with an approved bituminous seal coat in accordance with AWWA Specification C-104 (ANSI A21.4).

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.

2. Polyvinyl Chloride Pipe (PVC)

a. Smooth Wall PVC

All PVC pipe fifteen (15) inches or less in diameter shall meet the requirements of ASTM Designation D 3034. All PVC pipe greater than fifteen (15) inches in diameter shall meet or exceed the requirement of ASTM F 679. For diameters fifteen (15) inches or less, the pipe shall have a minimum cell classification of 12454-B and for diameters greater than fifteen (15) inches, the pipe shall have a minimum cell classification of 12454-C with all pipe having a minimum tensile strength of 7000 psi as defined in ASTM D 1784.

All PVC pipe shall be tested in accordance with Standard Method of Test for External Loading Properties of Plastic Pipe by Parallel - Plate Loading, ASTM Designation 2412. Minimum pipe stiffness shall be forty-six (46) psi.

C. Depth Restrictions on Pipe Materials

1. The depth limitations for the installation of the different pipe materials, unless a variance is approved by the Engineer, shall be as follows:
 - **PVC Rubber Gasketed SDR 35 – three (3) feet to fifteen (15) feet**
 - **PVC Rubber Gasketed SDR 26 - three (3) feet to twenty (20) feet**
 - **Ductile Iron Pipe Class 50 - three (3) feet to twenty-eight (28) feet**
2. Within each depth range, special pipe bedding requirements may be requested by the Engineer to ensure adequate pipe support.

Flexible gasket joints shall be compression type so that when assembled, the gasket inside the bell will be compressed radially on the pipe sigot to form a watertight seal. The assembly of joints shll be in accordance with the pipe manufacturer’s recommendation and ASTM D-32/2. 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 gaskets 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.

6.03 Sanitary Sewer Force Mains

A. General

The following materials are acceptable for sanitary sewer force mains:

- Polyvinyl Chloride Pipe
- Ductile Iron Pipe

B. Air/Vacuum Relief Valves

The design of sanitary force mains shall preclude 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 pre-cast concrete structure. Air/vacuum relief valves shall have stainless steel internal components. The valves shall be as manufactured by Crispen or Town approved equal.

C. Force Main Materials

1. Polyvinyl Chloride (PVC) Force Main

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

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 or C 90T

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.

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.

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) hardnesses 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 provisions of Section 5.02(B)(1) for Ductile Iron pipe for gravity sanitary sewers shall be the minimum criteria for material and standards of Ductile Iron Force Main.

D. Locator Tape & Wire

Locator wire shall be #12 standard copper wire with thermoplastic insulation and capable of carrying 600 volts.

Marking tape shall be pigmented polyolefin film, three (3) inches wide, with a printed message on one (1) side. Tape shall be a minimum of four (4) mils thick with a minimum tensile strength of thirty-five (35) pounds per three (3) inch wide strip. Tape shall bear a continuous printed message every sixteen (16) to thirty-six (36) inches reading "Caution –

Buried Sewer Line Below”. Color of plastic film shall conform to the latest edition of the “Recommended Standards for Wastewater Facilities” for color-coding. Tape shall be “Terra Tape Standard 250” as manufactured by Reef Industries, Inc., Tape Products Division, Houston, Texas or approved equal.

6.04 Building Sewers/Service Laterals

Building services shall be SDR 35, Schedule 80, bell and spigot type 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. Factory made wye connections shall be provided at connection with municipal sewer line. Vitrified Clay Pipe (VCP) shall not be permitted for building sewer construction. Pipe lubricant meant for pipe will need to be used.

Where required on a service lateral, a cleanout shall be provided (six (6) inch diameter minimum) made of the same material as the mainline pipe. Said cleanout shall include a watertight, detachable lid and conform to the Service Connection detail, pop-off style cap, or threaded-style caps are to be used.

6.05 Sanitary Sewer Manholes/Wet Wells & Valve Pits/Grease Traps

A. General

Location of manholes shall be as required in Section 5.02(D)(1).

B. Types of Manholes

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

C. Pre-cast Manholes

Manholes shall be constructed in accordance with the ASTM Specifications for “Pre-cast 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 (2) 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 pre-cast tops shall be of the eccentric cone type. The top portion of the eccentric cone shall include a minimum three (3) inch vertical surface around the entire opening to facility the installation of an internal chimney seal or external chimney seal. Pre-cast flat covers shall be not less than eight (8) inches thick and reinforced with two (2) layers of steel with a minimum area of (0.39) square inches per linear foot in both directions in each layer. Pre-cast flat bottoms of manholes shall also be reinforced the same as specified herein for pre-cast 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 Town, and no more than twelve (12) inches total of adjusting raiser rings are to be used.

No “see through” lift holes shall be allowed on pre-cast concrete manholes forty-eight (48) inches in diameter or less. All lift holes shall be thoroughly wetted and completely filled with non-shrink mortar or epoxy grout; then smoothed and covered, both inside and out, with a trowelable grad butyl rubber base backplaster material to ensure water tightness.

All manhole joints shall be tongue and groove and they shall be sealed with an O-ring conforming to ASTM C-443.

D. Grease Traps

Grease trap tank shall be constructed of 6000psi concrete. All tank joints shall be sealed watertight with butyl rubber extrudible preformed gasket material. All outside riser ring surfaces shall be waterproofed one-eighth (1/8) inch with trowelable grade butyl rubber back plaster.

E. Manhole Steps (Rungs)

All manholes shall have steps provided at sixteen (16) inches center to center. The steps (rungs) shall be manufactured of reinforced plastic and shall be twelve (12) inches wide and one (1) inch square.

F. Manhole Bases

Manhole bases shall be of cast-in-place monolithic concrete or pre-cast 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 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 Town 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.

G. 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 adjusting rings conforming to ASTM C 478.

Rings shall be of a nominal thickness of not less than one (1) inch and **not more than twelve (12) inches total of adjusting rings shall be allowed for adjustment of the manhole frame and cover to required elevation.**

H. 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 Town for approval. Connections not approved by the Town shall be subject to removal and replacement with an approved adapter.

I. Castings

Standard manholes shall have the following frame and lid:

<i>In Traffic:</i>	<i>Frame</i>	<i>Lid</i>
East Jordan	1022-1 Ex. HD	1020 Type A Ex. HD
Neenah	R-1772-BVH	R-1772-BVH
<i>In Grass:</i>	<i>Frame</i>	<i>Lid</i>
East Jordan	1022-1 Med Duty	1020 Type A Med Duty
Neenah	R-1772-AVH	R-1772-AVH

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 the following frame and lid:

<i>In Traffic:</i>	<i>Frame</i>	<i>Lid</i>
East Jordan	1022-1 PT Ex. HD	1020 PT Type A Ex. HD
Neenah	R-1916-F	R-1916-F
<i>In Grass:</i>	<i>Frame</i>	<i>Lid</i>
East Jordan	1022-1 PT Med Duty	1020 PT Type A Med Duty
Neenah	R-1916-AVH	R-1916-F

The frame shall be anchored to through the riser rings (if provided) to the cone section with four (4) galvanized rods. Each lid shall have two (2) inch high letters indicating “Sanitary Sewer”.

J. Manhole Chimney Seals

All new sanitary sewer manholes shall be constructed with external chimney seals. In situations where existing manholes are being rehabilitated for compliance with the Town's Standards, internal chimney seals may be used.

1. Internal Chimney Seal

The watertight, flexible rubber sleeve shall conform to the physical requirements of ASTM C 923 with a minimum three-sixteenths (3/16) inch thickness for durability and resistance to puncturing or tearing.

Physical Properties:

Tensile Strength	1500psi
Elongation at Break	350% minimum
Hardness (Durometer)	48-5
Chemical Resistance	No weight loss in 1N of sulfuric or Hydrochloric acid
Compression Set	18% maximum decrease
Water Absorption	Maximum 10% increase by weight
Ozone Resistance	Rating 0
Low Temperature Brittle Point	No fracture @ -40°C
Tear Resistance	200 lb. f/in
Splice Strength	180° bend with no visible separation

Expansion Bands

The one (1) piece channeled expansion bands are one-and-three-quarter (1 3/4) inches wide and shall be fabricated from high quality, corrosion resistant, sixteen (16) gauge stainless steel conforming to the requirements of ASTM A-240 type 304. The twelve (12) inch long adjustment slot in the band shall provide for two-and-a-half (2 1/2) inches of diameter range. An easy to use mechanical expansion tool shall expand the band to compress the rubber sleeve against the manhole frame and chimney.

Once expanded, the band shall be locked in place by the tightening of two (2) self-locking stainless steel studs, providing a flexible watertight seal.

Internal rubber sleeve shall be manufactured by Cretex Specialty Products, or equal.

Contractor shall provide to the Owner one (1) mechanical expansion tool.

2. External Chimney Seal

General: This section includes the materials and procedures required for the external sealing of the entire chimney area of all sanitary manholes.

Frame Seal: Frame seals shall be designed to prevent leakage of water through the above described portions of the manhole. The seal shall remain flexible allowing repeated vertical movements of the frame of not less than two (2) inches and/or repeated

horizontal movement of not less than half (1/2) inch, at rates not greater than one-tenth (1/10) inch per minute.

Frame seals shall consist of a flexible external rubber sleeve, extension, and stainless steel compression bands, all conforming to the following requirements:

- (a) Rubber Sleeve and Extension – The flexible rubber sleeve and extension shall be extruded or molded from a high grade rubber compound conforming to the applicable requirements of ASTM C-923, with a minimum (1500) psi tensile strength, maximum 18% compression set and a hardness (durometer) of 48-5.

The sleeve shall be corrugated, with a minimum thickness of three-sixteenths (3/16) inches and shall be available in unexpanded vertical heights of six (6) and nine (9) inches. The top section of the sleeve shall contain multiple sealing fins and be designed to extend both over and under the manhole frames base flange, thereby allowing it to be mechanically locked to the frame. The bottom section of the sleeve shall contain an integrally formed compression band recess and multiple sealing fins.

The extension shall have a minimum thickness of three-sixteenths (3/16) inches. The top portion of the extension shall be shaped to fit into the bottom band recess of the sleeve and have its own integrally formed band recess, which is located such that when assembled this recess is centered over that of the sleeve. The bottom section of the extension shall contain an integrally formed compression band recess and multiple sealing fins.

Any splice used to fabricate the sleeve and extension shall be hot vulcanized and have strength such that the sleeve shall withstand a one hundred eighty (180°) degree bend with no visible separation.

- (b) Compression Bands – The compression bands used to compress the sleeve against the manhole shall be sixteen (16) gauge stainless steel conforming to ASTM A-240, Type 304, with a minimum width of one (1) inch.

The top compression band shall have a shape and width sufficient to, when tightened, mechanically lock the sleeve to the manhole frame's base flange.

The tightening mechanism on both bands shall have the capacity to develop the pressures necessary to make a watertight seal and shall have a minimum adjustment range of four (4) diameter inches. Screws, bolts and nuts used on the bands shall be stainless steel conforming to ASTM F-593 and 594, Type 304.

Installation: The contractor shall field measure the manhole to determine the information required on the manufacturer's "Sizing and Ordering" procedure. This information is needed to obtain the proper size of bands, the size and shape of the rubber sleeve and the need for, and size of any extensions.

The surfaces against which the sleeve and extension are to be compressed shall be circular, clean, reasonably smooth and free of any form offsets or excessive voids. The top external portions of the cone shall have a minimum two (2) inch high vertical surface. The preparation of this vertical surface when none exists shall be in accordance with the frame seal manufacturer's instructions. Any flaws in the manhole frame such as cracks, pits or protrusions, shall be repaired by either filling with mortar or grinding smooth.

The manhole frame shall be set to the required grade while sitting on the three (3) three-quarter (3/4) inch steel spacers which have been totally embedded in a course of cementitious grout mixed to a mortar consistency.

After the rubber sleeve and where needed, an extension has been placed in the proper position, the stainless steel compression bands shall be installed in the proper locations and individually tightened as required to provide a watertight seal.

Installation shall be in accordance with the manufacturer's instructions.

K. Manhole Exterior Joint Collar

All manhole joints shall be installed with an exterior collar. The joint collar shall be **MacWrap** Exterior Joint Sealer as manufactured by **Mar-Mac Manufacturing Company** or an approved equal and shall be installed according to the manufacturer's recommendation. The collar shall consist of a band nine (9) inches wide. The band shall have an outer layer of polyethylene with an under layer of rubberized mastic that is reinforced with a woven polypropylene fabric. There shall be a peelable protective paper against the mastic that is removed when the collar is applied to the joint. Within the collar two (2) steel straps (5/8) inches wide shall be located (3/4) inches from each edge of the band. The straps shall be in tubes that isolate them from the mastic and allow them to slip freely when tightened around the manhole.

L. Extrudable Preformed Gasket Material

A nominal half (1/2) inch size butyl rubber base gasket material, conforming to AASHTO M-198 and Federal Specification SS-S-210A, shall be used for adjusting ring grooves; between adjusting ring and cone; between cone and casting and between adjusting ring and casting. The gasket material shall be as manufactured by Hamilton Kent-Seal, RUB'R-NEK-LT-M by K.T. Snyder Company or an approved equal.

M. Plug Valve

The valve body, bonnet and rotating element (plug) shall be fabricated of cast iron A126 Class B. Valve body and bonnet thickness and flanged end connection shall conform to ANSI B16.1 Class 125 or 250. The manufacturer shall have completed proof of design test as specified under AWWA C504.

Valve box shall be cast iron with permanent ring as applicable. The minimum thickness of the metal shall be three sixteenths (3/16) inch. The word "Sewer" shall be stamped in the cover. A keynut extension shall be installed if the valve nut is greater than four (4) feet in depth.

N. Check Valves

Flapper shall be easily removed without need to remove valve from line.

The valve shall be designed for one hundred seventy-five (175) psi working pressure and shall be provided with an external lever and weight to facilitate back flushing.

O. Air Relief Valves

The minimum air relief valve shall be the APCO air relief valve Model No. 400 or approved equal.

P. Frame Inflow Dish

Manholes that are subject to ponding and/or that are installed in drainage ways shall have a frame inflow dish installed.

The dish shall be made of ultra high density polyethylene copolymer material that meets ASTM specifications designation D1248, Class A, Category 5, Type 111 with a minimum impact brittleness temperature of -180°F . The thickness shall be uniform one-eighth (1/8) inch or greater. This material shall be corrosion proof form all gasses associated with wastewater collection systems.

The lift strap shall be made of woven polypropylene web and is attached to the bowl of the dish by a wide head stainless steel rivet and a stainless steel three-quarter (3/4) inch backup washer. All cut edges are seared to insure against raveling.

Ventilation shall be provided by a vent hole and/or a valve located on the side of the bowl. The hole or valve allows a maximum release of five (5) gallons of water per twenty-four (24) hours and is not affected by debris that might collect in the bottom of the dish. Sewer gas is vented at one (1) psi or less.

The gasket shall be made of closed cell neoprene and is attached by a pressure sensitive adhesive to the weight bearing surface of the dish.

Dish measurement shall be as required by the product manufacturer.

6.06 Pavement Materials

A. General

All materials shall be obtained from a source(s) which currently supply similar approved materials for the Indiana Department of Transportation projects.

B. Concrete Pavement

All concrete pavement shall be composed of Portland cement concrete, with or without reinforcement as may be specified, constructed on a prepared and compacted base course in close conformance with the INDOT Standard Specifications, Section 500, latest edition. Concrete pavements shall contain air entrainment and be finished with a broom-type finish.

C. Bituminous Pavement

Bituminous material for wedge and leveling, approaches, base, binder and surface shall be furnished in accordance with INDOT Standard Specifications, Section 300, 400 and 610, as applicable.

Bituminous surface and base courses shall be Hot Asphaltic Concrete. Unless otherwise directed or permitted by the Town, the base mixture shall be No. 5LV with (4.3) percent asphalt or shall be Compacted Aggregate No. 53. Unless otherwise directed or permitted by the Town, the surface mixture shall be size No. 11LV with (6.0) percent asphalt or No. 12LV with (6.2) percent asphalt.

Bituminous binder shall be Hot Asphaltic Concrete, and unless otherwise directed or permitted by the Town, the binder mixture shall be size No. 9LV with (4.8) percent asphalt or No. 11LV with (5.0) percent asphalt.

Bituminous material for wedge and leveling shall consist of bituminous binder as set out above. Such material shall meet all requirements of Bituminous Binder as set out in the Standards Section 400.

Cover aggregate for type two (2) or type five (5) seal coat shall be limestone chips.

Bituminous mixtures for approaches shall meet all the applicable requirements of the Standards.