

SECTION 13

STORM SEWER MATERIALS

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13.1 General

This section provides a description of the materials acceptable for the construction of storm 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.

13.2 Storm Sewer Pipe

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

- Reinforced Concrete Pipe (RCP)
- Ductile Iron (DI)
- Polyvinyl Chloride (PVC)
- High Density Polyethylene (HDPE)

A. Reinforced Concrete Pipe (RCP)

Reinforced concrete pipe shall be Reinforced Concrete Culvert, Storm Drain and Sewer Pipe conforming to ASTM Designation C 76. Pipe shall be wall thickness "B" or "C" as required by site conditions. Class shall be as required by loading conditions but shall not be less than Class III.

Reinforced concrete pipe shall be tested in accordance with ASTM Designation C 497.

Joints for sewer pipe manufactured of reinforced concrete shall be flexible watertight joints conforming to "Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible, Watertight, Rubber Gaskets" (ASTM Designation C443). Joints shall be made using rubber or rubber-like materials manufactured to fit tongue and groove or bell-and spigot type concrete pipe. The joint shall be installed in accordance with the manufacturer's recommendations.

Lateral connections to the RCP sewer shall be subject to City approval. Where lateral connections must be made to the RCP sewer, a rubber connector with stainless steel clamp shall be used. The connector shall be the sole element relied on to assure a flexible watertight seal of the pipe.

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

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 adaptor.

B. Ductile Iron Pipe (DIP)

All ductile iron pipe shall conform to the ANSI A21.51 and AWWA C151, latest revisions. Ductile iron pipe shall be Class 350, 300, 250, 200, or 150 for eight (8) inch through eighteen (18) inch. Pipe shall be standard 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 AWWA C 110 (ANSI A-21.10) or AWWA C 153 (ANSI A-21.53). Pipe joints shall use O-ring gaskets in accordance with ANSI 21.11 and AWWA C 111.

The class designations for the various classes of pipe and fittings, manufacturer's name, and year of manufacture shall be cast onto fittings in raised numerals and cast or stamped on the outside of each joint of pipe.

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

C. Polyvinyl Chloride Pipe (PVC)

All PVC pipe shall be considered "flexible" and shall be installed as such. PVC pipe shall not be installed where exposed to sunlight unless current material certifications guarantee that it will not be subject to ultraviolet degradation.

1. Material

- a. Poly (Vinyl Chloride) (PVC) gravity storm 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 fifteen (15) inches or less and meeting or exceeding all of the requirements set forth in ASTM F-679 for pipe diameters greater than fifteen (15) inches.
- b. 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 34.50 psi as defined in ASTM D-1784.
- c. PVC storm sewer pipe shall have a minimum pipe stiffness of forty-six (46) psi for each diameter when measured at five (5) percent vertical ring deflection and tested in accordance with ASTM D-2412.
- d. NOTE: Poly (Vinyl Chloride) (PVC) Ribbed Sewer Pipe meeting or exceeding all of the requirements set forth in ASTM F 949-86a or ASTM F 794 is acceptable. The minimum cell classification

acceptable shall be 12454-B as defined in ASTM D-1784. PVC Ribbed Sewer Pipe shall have a minimum pipe stiffness of fifty (50) psi when measured in accordance with ASTM D-2412 for eight (8) inch through eighteen (18) inch pipe and forty-six (46) psi for twenty-one (21) inch and greater.

2. Joints

- a. 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.
- b. **NO SOLVENT CEMENT JOINTS SHALL BE ALLOWED.** Connections at manholes shall be watertight.
- c. 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 is only allowed at manholes, at prefabricated fittings, and at the connection of new storm sewer and other structures to existing storm sewer pipe.

3. Fittings

- a. Only manufactured fittings made of PVC plastic having a cell classification of 12454-B as defined in ASTM D-1784 shall be used.
- b. Tee/Wye service connections for storm sewers where existing or proposed grade (to sewer invert), exceeds fifteen (15) feet shall be heavy wall.
- c. **SADDLE CONNECTIONS SHALL NOT BE ALLOWED FOR NEW CONSTRUCTION.**

4. Design

- a. The minimum wall thickness for PVC sewer pipe and lateral sewer pipe fifteen (15) inches or less in diameter shall conform to SDR-35 Type PSM as specified in ASTM D-3034. The minimum wall thickness for PVC sewer pipe greater than fifteen (15) inches in

diameter shall conform to T-1 as specified in ASTM F-679.

5. Markings

- a. 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.

6. Certification

- a. 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.

D. High Density Polyethylene Pipe (HDPE)

All HDPE pipe shall be considered “flexible” and shall be installed as such. HDPE pipe shall not be installed where exposed to sunlight unless current material certifications guarantee that it will not be subject to ultraviolet degradation.

The drainpipe for the various pipe diameters may be “Sure-Lok” High Density Polyethylene (HDPE) pipe as manufactured by Hancor of Findlay, Ohio, N-12 High Density Polyethylene Pipe (HDPE) as manufactured by ADS, Inc. of Columbus, Ohio, or approved equal. Bedding shall be Class I or II only as described in ASTM D-2321.

1. Production and Material Standards for HDPE

- a. Corrugated High Density Polyethylene (HDPE) pipe shall be manufactured in accordance with AASHTO M 294 Type S. Pipe manufactured under this specification shall have a minimum cell class of 335420C in accordance with ASTM D-3350.
- b. Ribbed Polyethylene pipe shall be in accordance with ASTM F-894 for the specified sizes, meeting the requirements for RSC 160. Pipe manufactured under this specification shall have a minimum cell class of 335420C in accordance with ASTM D-3350.
- c. Smooth wall Polyethylene pipe shall be in accordance with ASTM F-714 for the specified sizes. Pipe manufactured under this specification shall have a minimum cell class of 335420C in accordance with ASTM D-3350.
- d. All polyethylene pipe and fittings shall be made from high molecular weight high density polyethylene material meeting the application cell class requirements. All polyethylene material used in drainpipe manufacture shall be virgin resin.

2. HDPE Joints
 - a. High-density polyethylene pipe shall possess male and female pipe ends or molded HDPE or PVC couplers that allow the construction of overlapping, gasketed pipe joints in accordance with the requirements of ASTM D-3212 for a gasketed joint. The gasket material shall conform to all requirements of ASTM F-477.
3. Rejection of Damaged HDPE Pipe and Fittings
 - a. High density polyethylene pipe and fittings possessing the following defects may be rejected for installation: variations from straight centerline; elliptical shape in pipe intended to be round; illegible or improper markings as required herein; deep or excessive gouges or scratches on the pipe wall; fractures, punctures, or cracks; damaged or cracked ends where such damage would prevent making a satisfactory joint.
4. HDPE Pipe Markings
 - a. For high density polyethylene pipe products, each length of pipe shall be clearly marked with the following information as a minimum: manufacturer's name or identification symbol; nominal pipe size; and production/extrusion code.

E. High Density Polyethylene Tubing (Perforated Pipe)

1. Six (6) inch HDPE tubing shall be manufactured by Hancor of Findlay, Ohio, ADS, Inc., of Columbus, Ohio, or approved equal, and shall meet all applicable standards of ASTM F405.
2. The perforated pipe for subsurface drains shall be installed within the bedding of the pipe trench as indicated on the plans. All manufacturer's recommended installation procedures shall be followed. Due to the nature of the soils, a geotextile fabric sock shall be provided with the pipe when recommended by the manufacturer for the given soil.

F. End Sections

1. End sections shall be precast concrete or galvanized steel as indicated by the Detail Specifications or Drawings unless otherwise approved by the Engineer. Where differing materials are used, an appropriate water-tight connection shall be made to join the pipe to the end section.

13.3 Storm Sewer Manholes

Location of manholes shall be as required in **Section 12**.

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.

A. 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.

B. Manhole Steps

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

C. 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 as 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.

D. 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.

E. Sewer Pipe to Manhole Connections

To connect a storm 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.

F. 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 "Storm 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.

G. Frame Chimney Seal

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.

13.4 Storm Sewer Catch Basins

Location of catch basins shall be as required in **Section 12**.

Catch basins shall be either monolithic (cast-in-place) or precast. If monolithic structures 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.

All inlets shall be constructed of reinforced pre-cast concrete sections with plain joints and 2" extrudable gasket to produce soil tightness (minimum). Inlets shall have tops as shown on the plans. Joints between sewer pipe and inlet walls shall be sealed with grout.

Precast concrete inlets shall be constructed in accordance with ASTM Standard C-478. Adjustment to final grade of inlet casting shall be accomplished by utilizing pre-cast concrete adjusting rings. Adjusting rings when required should be sized to adjust to Final Grade by using a maximum of three (3) adjusting rings. Adjusting rings shall be limited to less than one (1) foot of inlet depth. All inlet joints, along with the adjusting rings and top casting are to be sealed with 2-inch extrudable gasket (Kent Seal, Rub'R Nek LTM by Henry Co., or approved equal) to produce soil-tight joint (minimum).

A. Sewer Pipe to Catch Basin Connections

To connect a storm sewer to a catch basin, 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 catch basin 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 catch basin 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 structure. The connector shall be the sole element relied upon to assure a flexible watertight seal of the pipe to the structure.

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.

B. Castings

The castings shall be as indicated on the plans. Both the frame and cover shall be heavy duty as manufactured by Neenah, East Jordan, or approved equal. The inlet and castings shall be capable of supporting H-20 traffic loadings.

13.5 PVC Surface Drainage Inlets

- A. PVC surface drainage inlets, if approved by the Owner for use in writing, shall include inline drains or drain basins as indicated on the contract drawings and referenced within the contract specifications. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage inlet. The surface drainage inlets shall be as manufactured by Nyloplast, Harco Fittings, Inc., or approved equal.
- B. The inline drains and drain basins shall be manufactured from PVC pipe stock, utilizing a thermomoulding process to reform the pipe stock to the furnished configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the piping system specified. This joint tightness shall conform to ASTM D3212.
- C. Surface drainage products shall meet the mechanical property requirements for fabricated fittings as described in ASTM F794, F949 and F1336.
- D. The grates furnished for all surface drainage inlets shall be ductile iron and shall be made specifically for each fitting. Grates for 12" and larger drain basins and inline drains shall be capable of supporting H-20 wheel loading for standard grates and solid covers. Grates for drain basins and inline drain inlets smaller than 12" shall be capable of supporting light wheel load traffic. Metal used in the manufacture of the castings shall conform to ASTM A-48-83 Class 30B for cast iron or A536 grade 70-50-05. The castings shall be furnished with a black paint.

13.6 Other Structures

- A. Other structures provided for a project shall generally conform to the requirements of the above manhole and inlet specifications. Structures such as cleanouts, end sections, grated box end sections, pipe anchors, headwalls, slotted drains and other similar drainage structures are generally covered in the latest edition of the Indiana Department of Transportation (INDOT) Standard Details and Specifications. These are readily available through INDOT by purchasing a hard copy or CD from INDOT or by accessing their web page. Therefore, INDOT information is not repeated herein and is the responsibility of the Contractor/Bidder.

- B. If a structure is not completely detailed in the specifications or the plans, the INDOT standard details for that item shall be used. If no such details are available, the Contractor shall be required to detail out a structure and submit it to the Engineer for approval as part of the shop drawing process. In such latter cases, the Contractor shall submit shop drawings certified by an Indiana Registered Professional Engineer.

13.7 Pipe Connections

- A. Joints between a manhole or inlet and a sewer pipe may be sealed with high strength, non-shrink grout or a flexible boot KOR-N-SEAL 1 or 2, flexible connector, cast-in-place Dura-Seal gasket, "A"-lock gasket or an approved equal. All connections shall provide for a watertight seal between the pipe and manhole or inlet.