

STRUCTURES FOR SANITARY AND STORM SEWERS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Manholes and Intakes for Storm Sewers
- B. Manholes for Sanitary Sewers
- C. Adjustment of Existing Manholes and Intakes
- D. Connection to Existing Manholes and Intakes
- E. Removal of Manholes and Intakes
- F. Special Structures for Storm Sewers
- G. Excavation and Backfill of Structures

1.02 DESCRIPTION OF WORK

- A. Construct sanitary and storm sewer manholes to provide access to sewer systems for maintenance and cleaning purposes.
- B. Construct storm sewer intakes for collection of surface water and conveyance to the storm sewer system.
- C. Modify existing manholes and intakes as necessitated by other improvements adjacent to the manholes or intakes.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants, as well as the following:

- A. Shop drawings of steel reinforcement, showing sizes, lengths, bends, and counts, if required.
- B. Concrete mix design, if required by Engineer.
- C. Shop drawing schedule of new manholes and/or intakes showing total depth, relative elevations of all connecting sanitary or storm sewer lines, all drops, and orientation of connecting lines.
- D. Results of required testing.
- E. Catalog cuts of iron castings and sewer line connection gaskets.
- F. Gradation and soil classification reports for structure bedding and backfill materials.
- G. Dewatering plan.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants, as well as the following:

- A. Store reinforcing steel only on pallets or lagging.
- B. Follow the aggregate storage and concrete transport requirements in [Iowa DOT Article 2301.02, C.](#)

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

- A. Do not place concrete when stormy or inclement weather will prevent good quality work.
- B. Cold weather placement is restricted per [Iowa DOT Article 2403.03, F.](#)

1.08 MEASUREMENT AND PAYMENT**A. Manhole:**

- 1. **Measurement:** Each type and size of manhole will be counted.
- 2. **Payment:** Payment will be at the unit price for each type and size of manhole.
- 3. **Includes:** Unit price includes, but is not limited to, excavation; furnishing and installing pipe; lining (if specified); furnishing, placing, and compacting bedding and backfill material; base; structural concrete; reinforcing steel; precast units (if used); concrete fillets; pipe connections; infiltration barriers (sanitary sewer manholes only); castings; and adjustment rings.

B. Intake:

- 1. **Measurement:** Each type and size of intake will be counted.
- 2. **Payment:** Payment will be at the unit price for each type and size of intake.
- 3. **Includes:** Unit price includes, but is not limited to, excavation; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; base; structural concrete; reinforcing steel; precast units (if used); concrete fillets; pipe connections; castings; and adjustment rings.

C. Drop Connection:**1. Internal Drop Connection:**

- a. **Measurement:** Each size of internal drop connection will be counted.
- b. **Payment:** Payment will be at the unit price for each size of internal drop connection.
- c. **Includes:** Unit price includes, but is not limited to, cutting the hole and installing a flexible watertight connector, providing and installing the receiving bowl, flexible coupler between the bowl and the drop pipe, the PVC drop pipe, pipe brackets and bolts, the bottom elbow, repair of fillet if required, and a splash guard if required.

2. External Drop Connection:

- a. **Measurement:** Each size of external drop connection will be counted.
- b. **Payment:** Payment will be at the unit price for each size of external drop connection.
- c. **Includes:** Unit price includes, but is not limited to, the connection to the manhole and all pipe; fittings; concrete encasement; and furnishing, placing, and compacting bedding and backfill material.

1.08 MEASUREMENT AND PAYMENT (Continued)**D. Casting Extension Rings:**

1. **Measurement:** Each casting extension ring will be counted.
2. **Payment:** Payment will be at the unit price for each casting extension ring.
3. **Includes:** Unit price includes, but is not limited to, furnishing and installing each casting extension ring and reinstalling the casting lid.

E. Manhole or Intake Adjustment, Minor:**1. Manhole Adjustment, Minor:**

- a. **Measurement:** Each existing manhole adjusted to finished grade by addition or removal of adjustment rings or adjustment of adjustable casting will be counted.
- b. **Payment:** Payment will be made at the unit price for each minor manhole adjustment.
- c. **Includes:** Unit price includes, but is not limited to, removing existing casting and existing adjustment rings, furnishing and installing adjustment rings, furnishing and installing new casting, and installing new infiltration barrier (sanitary sewer manholes only).

2. Intake Adjustment, Minor:

- a. **Measurement:** Each existing intake adjusted to finished grade by addition or removal of adjustment rings or adjustment of adjustable casting will be counted.
- b. **Payment:** Payment will be made at the unit price for each minor intake adjustment.
- c. **Includes:** Unit price includes, but is not limited to, removing existing casting and existing adjustment rings, furnishing and installing adjustment rings, and furnishing and installing new casting.

F. Manhole or Intake Adjustment, Major:**1. Manhole Adjustment, Major:**

- a. **Measurement:** Each existing manhole adjusted to grade by addition or removal of riser, cone or flat top sections, or the exchange of existing riser sections with sections having different vertical dimensions will be counted.
- b. **Payment:** Payment will be at the unit price for each major adjustment.
- c. **Includes:** Unit price includes, but is not limited to, removal of existing casting, adjustment rings, top sections, and risers; excavation; concrete and reinforcing steel or precast sections; furnishing and installing new casting; installing new infiltration barrier (sanitary sewer manholes only); placing backfill material; and compaction.

2. Intake Adjustment, Major:

- a. **Measurement:** Each existing intake adjusted to grade by addition or removal of riser, cone or flat top sections, or the exchange of existing riser sections with sections having different vertical dimensions will be counted.
- b. **Payment:** Payment will be at the unit price for each major adjustment.
- c. **Includes:** Unit price includes, but is not limited to, removal of existing casting, adjustment rings, top sections, and risers; excavation; concrete and reinforcing steel or precast sections; furnishing and installing new casting; placing backfill material; and compaction.

1.08 MEASUREMENT AND PAYMENT (Continued)**G. Connection to Existing Manhole or Intake:****1. Connection to Existing Manhole:**

- a. Measurement:** Each connection made to an existing manhole will be counted.
- b. Payment:** Payment will be made at the unit price for each sewer connection.
- c. Includes:** Unit price includes, but is not limited to, coring or cutting into the existing manhole or intake, removal of existing fillet, pipe connections, replacement of fillet, grout, and waterstop (when required).

2. Connection to Existing Intake:

- a. Measurement:** Each connection made to an existing intake will be counted.
- b. Payment:** Payment will be made at the unit price for each sewer connection.
- c. Includes:** Unit price includes, but is not limited to, coring or cutting into the existing manhole or intake, removal of existing fillet, pipe connections, replacement of fillet, grout, and waterstop (when required).

H. Remove Manhole or Intake:**1. Remove Manhole:**

- a. Measurement:** Each manhole removed will be counted.
- b. Payment:** Payment will be made at the unit price for each manhole.
- c. Includes:** Unit price includes, but is not limited to, removal of casting, concrete, and reinforcement; plugging pipes; filling remaining structure with flowable mortar; and placing compacted fill over structure to finished grade.

2. Remove Intake:

- a. Measurement:** Each intake removed will be counted.
- b. Payment:** Payment will be made at the unit price for each intake.
- c. Includes:** Unit price includes, but is not limited to, removal of casting, concrete, and reinforcement; plugging pipes; filling remaining structure with flowable mortar; and placing compacted fill over structure to finished grade.

PART 2 - PRODUCTS**2.01 MANHOLE AND INTAKE TYPES****Table 6010.01: Manhole and Intake Types**

	Figure No.	Type	Description
Sanitary Sewer Manholes	6010.301	SW-301	Circular Sanitary Sewer Manhole
	6010.302	SW-302	Rectangular Sanitary Sewer Manhole
	6010.303	SW-303	Sanitary Sewer Manhole Over Existing Sewer
	6010.304	SW-304	Rectangular Base/Circular Top Sanitary Sewer Manhole
	6010.305	SW-305	Tee-section Sanitary Sewer Manhole
Storm Sewer Manholes	6010.401	SW-401	Circular Storm Sewer Manhole
	6010.402	SW-402	Rectangular Storm Sewer Manhole
	6010.403	SW-403	Deep Well Rectangular Storm Sewer Manhole
	6010.404	SW-404	Rectangular Base/Circular Top Storm Sewer Manhole
	6010.405	SW-405	Tee-section Storm Sewer Manhole
	6010.406	SW-406	Shallow Rectangular Storm Sewer Manhole
Intakes	6010.501	SW-501	Single Grate Intake
	6010.502	SW-502	Circular Single Grate Intake
	6010.503	SW-503	Single Grate Intake with Manhole
	6010.504	SW-504	Single Grate Intake with Flush-top Manhole
	6010.505	SW-505	Double Grate Intake
	6010.506	SW-506	Double Grate Intake with Manhole
	6010.507	SW-507	Single Open-throat Intake, Small Box
	6010.508	SW-508	Single Open-throat Intake, Large Box
	6010.509	SW-509	Double Open-throat Intake, Small Box
	6010.510	SW-510	Double Open-throat Intake, Large Box
	6010.511	SW-511	Rectangular Area Intake
	6010.512	SW-512	Circular Area Intake
	6010.513	SW-513	Open-sided Area Intake
	6010.515	SW-515	Triple Rectangular Area Intake
	6010.541	SW-541	Open-Throat Curb Intake Under Pavement
	6010.542	SW-542	Extension Unit for Open-Throat Curb Intake Under Pavement
	6010.545	SW-545	Single Open-Throat Curb Intake with Extended Opening

2.02 PRECAST

Comply with ASTM C 478 (circular) and ASTM C 913 (rectangular).

2.03 CAST-IN-PLACE

A. Concrete: Use Class C concrete. Comply with the following Iowa DOT Specifications and Materials I.M.s.

1. Iowa DOT Specifications Sections:

- a. [2403](#) – Structural Concrete
- b. [4101](#) – Portland Cement
- c. [4102](#) – Water for Concrete and Mortar
- d. [4103](#) – Liquid Admixtures for Portland Cement Concrete
- e. [4104](#) – Burlap for Curing Concrete
- f. [4106](#) – Plastic Film and Insulating Covers for Curing Concrete
- g. [4108](#) – Supplementary Cementitious Materials
- h. [4109](#) – Aggregate Gradations
- i. [4110](#) – Fine Aggregate for Portland Cement Concrete
- j. [4115](#) – Coarse Aggregate for Portland Cement Concrete

2.03 CAST-IN-PLACE (Continued)**2. Iowa DOT Materials I.M.s:**

- a. [316](#) – Flexural Strength of Concrete
- b. [318](#) – Air Content of Freshly Mixed Concrete by Pressure
- c. [403](#) – Chemical Admixtures for Concrete
- d. [528](#) – Structural Concrete Plant Inspection
- e. [529](#) – Portland Cement Concrete Proportions
- f. [534](#) – Mobile Mixture Inspection

B. Reinforcement: Comply with [Iowa DOT Section 4151](#) for epoxy coated reinforcement.

2.04 NON-SHRINK GROUT

Comply with [Iowa DOT Materials I.M. 491.13](#).

2.05 PRECAST RISER JOINTS**A. Joint Ends:**

1. Use tongue and groove ends.
2. If cast-in-place base is used, provide bottom riser with square bottom edge.

B. Joint Sealant:**1. Sanitary Sewers:**

- a. **Rubber O-ring or Profile Gasket:** Flexible joint, complying with ASTM C 443.
- b. **Bituminous Jointing Material:** Use a cold-applied mastic sewer joint sealing compound recommended by the manufacturer for the intended use and approved by the Engineer. Comply with ASTM C 990.
- c. **Butyl Sealant Wrap:** Comply with ASTM C 877.

2. Storm Sewers: All joint sealants used on sanitary sewers may also be used for storm sewers. The following may also be used.

- a. **Rubber Rope Gasket Jointing Material:** Comply with ASTM C 990.
- b. **Engineering Fabric Wrap:** If specified in the contract documents, supply engineering fabric wrap complying with [Iowa DOT Article 4196.01, B](#).

2.06 MANHOLE OR INTAKE TOP

- A. Capable of supporting HS-20 loading.
- B. Use eccentric cone on sanitary sewer manholes unless otherwise specified or allowed.

2.07 BASE**A. Sanitary Sewer Manhole:**

1. **Circular Manhole:** Integral base and lower riser section according to ASTM C 478.
2. **All Other Manholes:** Use precast or cast-in-place concrete base.

B. Storm Sewer Manhole: Use precast or cast-in-place concrete base.

C. Intake: Use precast or cast-in-place concrete base.

2.08 PIPE CONNECTIONS

- A. Flexible, Watertight Gasket:** Comply with ASTM C 923.
- B. Non-Shrink Grout:** Comply with Section 6010, 2.04.
- C. Waterstop:** Provide elastomeric gasket that surrounds pipe and attaches with stainless steel bands and is designed to stop the movement of water along the interface between a pipe and a surrounding concrete collar.
- D. Concrete Collar:** Comply with Section 6010, 2.02 and 2.03.

2.09 MANHOLE OR INTAKE ADJUSTMENT RINGS (Grade Rings)

- A. Use one of the following materials for grade adjustments of manhole or intake frame and cover assemblies:
 - 1. Reinforced Concrete Adjustment Rings: Comply with ASTM C 478. Provide rings free from cracks, voids, and other defects.
 - 2. High Density Polyethylene Adjustment Rings: Comply with ASTM D 1248 for recycled plastic.
 - a. Test and certify material properties by the methods in the following table.

Table 6010.02: Test Methods

Property	Test Method	Acceptable Value
Melt Flow Index	ASTM D 1238	0.30 to 30 g/10 min.
Density	ASTM D 792	0.94 to 0.98 g/cm ³
Tensile Strength	ASTM D 638	2,000 to 5,000 lb/in ²

- b. Do not use polyethylene grade adjustment rings when they are exposed to heat shrink infiltration barriers.
 - c. When used in a single configuration, provide tapered adjustment ring with thickness that varies from 1/2 inch to 3 inches.
 - d. Install adjustment rings on clean, flat surfaces according to the manufacturer's recommendations. Comply with ASTM D 36 with minimum 350°F softening point for butyl rubber sealant.
 - 3. Expanded Polypropylene Adjustment Rings: Comply with ASTM D 4819 for expanded polypropylene when tested according to ASTM D 3575.
 - a. Use adhesive meeting ASTM C 920, Type S, Grade N5, Class 25.
 - b. Provide finish rings with grooves on the lower surface and flat upper surface.
 - c. If a heat shrinkable infiltration barrier is used, ensure surface temperature does not exceed 300° during installation process.
- B. Ensure the inside diameter of the adjustment ring is not less than the inside diameter of the manhole frame or not less than the inside dimension of the intake grate opening.

2.10 CASTINGS (Ring, Cover, Grate, and Extensions)

- A. Gray Cast Iron:** AASHTO M 306.
- B. Ductile Iron:** ASTM A 536, Grade 80-55-06 or 70-50-05.

2.10 CASTINGS (Ring, Cover, Grate, and Extensions) (Continued)**C. Composite:** AASHTO M 306.

1. **Hardware:** Attach lid to frame with 316 stainless steel hardware.
2. **Slip Resistance:** Greater than 0.6 when tested according to ASTM C 1028.
3. **Ultraviolet Resistance:** Meet ASTM G 154 Cycle 1 for a minimum of 1,000 hours.
4. **Detection:** Must be detectable using standard detection equipment.

D. Load Capacity: Standard duty unless otherwise shown on the casting figures.

1. **Standard Duty:** Casting certified for 40,000 pound proof-load according to AASHTO M 306.
2. **Light Duty:** Casting certified according to requirements of AASHTO M 306 for a 16,000 pound proof-load (HS-20). 40,000 pound proof-load is not required.

E. Casting Types:

1. **Manholes:** The following table lists the manhole casting types.

Table 6010.03: Manhole Casting Types

	Figure No.	Casting Type	Number of Pieces	Ring/Cover	Bolted Frame	Bolted Cover (Floodable)	Gasket
Sanitary Sewer	6010.601	SW-601, A	2	Fixed	Yes	No	Yes ¹
	6010.601	SW-601, B	3	Adjustable	No	No	Yes ¹
	6010.601	SW-601, C	2	Fixed	Yes	Yes	Yes ¹
	6010.601	SW-601, D	3	Adjustable	No	Yes	Yes ¹
Storm Sewer	6010.602	SW-602, E ²	2	Fixed	Yes	No	No
	6010.602	SW-602, F ²	3	Adjustable	No	No	No
	6010.602	SW-602, G ²	2	Fixed	No	No	No

¹ Machine bearing surfaces required.² Storm sewer casting may include environmental symbols and/or messages such as "DUMP NO WASTE, DRAINS TO RIVER."**2. Intakes:**

- a. Comply with [Figures 6010.602](#), [6010.603](#), [6010.604](#), and the contract documents.
- b. Castings may include environmental symbols and/or messages such as "DUMP NO WASTE, DRAINS TO RIVER."

3. Manhole Casting Extension Ring:

- a. Match the dimensions of the existing ring and cover with an allowable diameter tolerance of -1/4 inch for the frame ridge and +1/4 inch for the cover recess.
- b. Provide extension ring with height as required to raise the top of the casting to make it level or no more than 1/4 inch below the finished pavement surface. Maximum ring height is 3 inches.

2.11 ADDITIONAL MATERIALS FOR SANITARY SEWER MANHOLES**A. Infiltration Barrier:****1. External Chimney Seal:****a. Rubber Sleeve and Extension:**

- 1) Corrugated; minimum thickness of 3/16 inches, according to ASTM C 923.
- 2) Minimum allowable vertical expansion of at least 2 inches.

b. Compression Bands:

- 1) One-piece band assembly to compress sleeve or extension against manhole and casting surfaces.
- 2) 16 gauge ASTM C 923, Type 304 stainless steel, minimum 1 inch width, minimum adjustment range of 4 inches more than the manhole outside diameter.
- 3) For standard two-piece castings, shape top band to lock sleeve to manhole frame's base flange. For three-piece adjustable castings, shape top band to lock sleeve to upper piece of adjustable frame.
- 4) Stainless steel fasteners complying with ASTM F 593 and 594, Type 304.

2. Internal Chimney Seal:**a. Rubber Sleeve and Extension:**

- 1) Double pleated, minimum thickness 1/8 inch thick, according to ASTM C 923.
- 2) Minimum allowable vertical expansion of at least 2 inches.
- 3) Integrally formed expansion band recess top and bottom with multiple sealing fins.

b. Expansion Bands:

- 1) One-piece band assembly to compress sleeve or extension against manhole and casting surfaces to make a watertight seal.
- 2) 16 gauge ASTM C 923, Type 304 stainless steel, minimum 1 inch width, minimum adjustment range of 2 inches more than the manhole inside diameter.
- 3) Positive stainless steel locking mechanism permanently securing the band in its expanded position after tightening.

3. Molded Shield:**a. Barrier Shield:**

- 1) Medium density polyethylene, according to ASTM D 1248.
- 2) Certified for 40,000 pound proof-load according to AASHTO M 306.
- 3) Diameter to match cone section and internal dimension of casting.

b. Sealant: Butyl material meeting ASTM C 990.**4. Heat Shrink Sleeve:** Heat-shrinkable wrap around sleeve designed for protection of buried and exposed sanitary sewer manholes. Do not use with polyethylene adjustment rings.**a. Primer:** Compatible with concrete, ductile and cast iron, and sleeve material.**b. Sleeve and Backing:**

Property	Standard	Value
Water Absorption	ASTM D 570	0.05% maximum
Low Temperature Flexibility	ASTM D 2671	-40° F
Tensile Strength	ASTM D 638	2,900 psi minimum
Elongation	ASTM D 638	600% minimum
Hardness	ASTM D 2240	Shore D: 46
Shrink Factor	---	40% minimum
Thickness	---	0.1 inch minimum

c. Adhesive: Softening point of 212° F maximum meeting ASTM E 28.

2.11 ADDITIONAL MATERIALS FOR SANITARY SEWER MANHOLES (Continued)**B. Riser Section Coating:**

1. **Exterior:** When exterior waterproof coating is specified, provide bituminous or coal tar coating.
2. **Interior:** When interior manhole lining is specified, provide lining according to [Section 4010, 2.01](#) (lined, reinforced concrete pipe).

2.12 CONCRETE FILLET

A. Cast-in-place Base: Provide a cast-in-place concrete fillet with concrete complying with the requirements of Section 6010, 2.03.

B. Precast Base Section:

1. For sanitary sewers, provide a precast concrete fillet, unless otherwise allowed by the Engineer. Comply with Section 6010, 3.01.
2. For storm sewers, provide a cast-in-place concrete fillet with concrete complying with the requirements of Section 6010, 2.03.

2.13 STEPS**A. Depths:**

1. For manholes and intakes less than 20 feet deep, do not install steps unless otherwise specified in the contract documents.
2. For manholes and intakes deeper than 20 feet, install steps to meet OSHA regulations.

B. Requirements:

1. ASTM C 478.
2. Manufacture using polypropylene encased steel.
3. Uniformly space steps at 12 to 16 inches.
4. Align with vertical side of eccentric top section.
5. Place first step no more than 36 inches from top of casting.

2.14 PRECAST CONCRETE TEE

A. Tee and Eccentric Reducers: ASTM C 478.

B. Composite Tee: Comply with [Figure 6010.305](#). May be substituted for pipe diameters less than 48 inches.

2.15 CASTING ANCHOR BOLTS AND WASHERS

- A. Material:** Stainless steel or hot-dipped galvanized.
- B. Diameter:** Provide bolts and washers 1/8 inch smaller than hole or slot in the casting frame, but no less than 1/2 inch diameter.
- C. Bolt Length:** As required to pass through adjustment rings and into manhole or intake structure to embedment depth recommended by anchor manufacturer.

2.16 DROP CONNECTION**A. Internal:**

- 1. Receiving Bowl:** Marine grade fiberglass meeting ASTM D 790, ASTM D 638, and ASTM D 2583 with non-magnetic stainless steel anchor bolts meeting the manufacturer's recommendation.
- 2. Flexible Coupler:** Provide flexible couple matching the size of the receiving bowl and the drop pipe.
- 3. Drop Pipe and Bottom Elbow:** Provide drop pipe an equivalent diameter of the influent pipe. Limit pipe size to maintain space available for maintenance activities. Provide solid wall SDR 35 PVC pipe and elbow complying with [Section 4010, 2.01, A](#) or Schedule 40 PVC pipe and elbow complying with ASTM D 1785.
- 4. Pipe Brackets:** ASTM A 240, Type 304 or Type 316 stainless steel with stainless steel nuts and bolts.

B. External:

- 1. Pipe and Fittings:** Comply with [Section 4010, 2.01, G](#) for ductile iron pipe and fittings.
- 2. Concrete Encasement:** Comply with [Section 7010, 2.02](#).
- 3. Embedment Material:** Comply with [Section 3010, 2.02, A](#) or [2.06](#) for backfill material from the top of the elbow to the bottom of the sewer main.

2.17 EXCAVATION AND BACKFILL MATERIAL

Comply with [Section 3010](#) for bedding and backfill materials.

PART 3 - EXECUTION**3.01 GENERAL REQUIREMENTS FOR INSTALLATION OF MANHOLES AND INTAKES**

- A. Excavation:** Excavate according to [Section 3010](#).
- B. Subgrade Preparation:**
- 1. Cut Sections (Undisturbed Soil):** Prepare subgrade to accurate elevation required to place subbase.
 - 2. Fill Sections:** Compact to 95% of maximum Standard Proctor Density and hand grade to accurate elevation required to place subbase, or install stabilization material as directed by the Engineer.
 - 3. Unstable Soil:** Install stabilization material as directed by the Engineer.
- C. Subbase:** Install 8 inch thick pad of Class I bedding material a minimum of 12 inches outside footprint of the structure.
- D. Installation of Manhole or Intake Structure:** When necessary, adjust wall height and depth of base to provide a minimum of 48 inches between form grade elevation and top of base. Form walls and construction joints for cast-in-place intakes or install precast intake boxes to ensure intake lids are set to match the longitudinal slope of the adjacent street unless otherwise specified in the contract documents.
- 1. Cast-in-place:** Comply with Section 6010, 3.02.
 - 2. Precast:** Comply with Section 6010, 3.03.
- E. Pipes:** Install and bed pipes and connect to manhole or intake. Install pipe flush with inside wall of structure. Place bedding and pipe embedment material according to [Section 3010](#).
- 1. Cast-in-place Structures:**
 - a. Storm:** Form structure walls around pipe.
 - b. Sanitary:** Form or core circular opening and install flexible, watertight gasket according to Section 6010, 2.08. Keep void between pipe and manhole section free of debris and concrete.
 - 2. Precast Storm Sewer Manholes or Intakes:** If annular space between pipe and structure is less than 2 inches, fill with non-shrink grout. If annular space is 2 inches or greater, construct a concrete collar around the pipe according to Section 6010, 3.05.
 - 3. Precast Sanitary Sewer Manholes:** Connect to structure with flexible, watertight gasket according to Section 6010, 2.08. Keep void between pipe and manhole section free of debris and concrete.
 - 4. Sanitary Sewer Manholes on Existing Pipe:** Install waterstop according to Section 6010, 2.08.
- F. Joint Sealant:**
- 1. Sanitary Sewer Manholes:**
 - a.** Install rubber O-ring or profile gasket (precast structures).
 - b.** Apply bituminous jointing material or butyl sealant wrap to exterior of all sanitary sewer manhole joints.

**3.01 GENERAL REQUIREMENTS FOR INSTALLATION OF MANHOLES AND INTAKES
(Continued)****2. Storm Sewer Manhole and Intakes:**

- a. Apply bituminous jointing material or install rubber rope gasket.
- b. If indicated in the contract documents, apply engineering fabric wrap to joints.

G. Fillet:

1. Construct manhole or intake fillet up to one-half of pipe diameter to produce a smooth half-pipe shape between pipe inverts.
2. Slope fillet top toward pipe 1/2 inch per foot perpendicular to flow line.
3. For sanitary sewer, keep void between pipe and structure wall free of debris and concrete.
4. For precast fillets, remove any projections and repair any voids to provide a hydraulically smooth channel between ends of pipes.

H. Top Sections: Install manhole eccentric cone or flat top section or install intake top.**I. Adjustment Ring(s):**

1. Bed each concrete ring with bituminous jointing material in trowelable or rope form.
2. Bed each polyethylene or expanded polypropylene ring with manufacturer's approved product and according to manufacturer's recommended installation procedure.
3. Construct manholes and intakes with the following adjustment ring stack heights:
 - a. Minimum: 4 inches for new manholes and intakes. No minimum for rehabilitation projects.
 - b. Maximum: 12 inches for new manholes and intakes; 16 inches for existing manholes and intakes.
4. For greater adjustment, modify lower riser section(s).

J. Casting:

1. Install the type of casting specified in the contract documents and adjust to proper grade.
2. Where a manhole or intake is to be in a paved area, adjust the casting to match the slope of the finished surface.
3. Three-piece Castings:
 - a. Attach the frame to the structure with four anchor bolts.
 - b. Set initial position of movable portion of the casting in the center of the adjustment range.
 - c. Remove height-adjustment bolts or mechanism after the paving is completed.

**3.01 GENERAL REQUIREMENTS FOR INSTALLATION OF MANHOLES AND INTAKES
(Continued)****K. Infiltration Barrier:** Install on sanitary sewer manholes.**1. Internal or External Chimney Seal:**

- a. Do not use external chimney seal if seal will be permanently exposed to sunlight.
- b. Extend seal 3 inches below the lowest adjustment ring.
- c. Extend seal to 2 inches above the flange of the casting for a standard two-piece casting, or 2 inches above the top of the base section of the casting for an adjustable three-piece casting.
- d. Use multiple seals, if necessary.
- e. Install compression bands (external chimney seal) or expansion bands (internal chimney seal) to lock the rubber sleeve or extension into place and to provide a positive watertight seal. Once tightened, lock the bands into place. Use only manufacturer recommended installation tools and sealants.

2. Molded Shield:

- a. Clean surface of structure cone section.
- b. Apply sealant to the top surface of the cone section. Use sufficient sealant to accommodate flaws in the surface of the cone section.
- c. Cut molded shield to height by adding the dimensions of the adjustment rings and casting height. Be sure not to interfere with seating of the lid into the casting frame.
- d. Seat the molded shield against the sealant on the cone section.
- e. Add adjustment rings and casting to meet final grade.

3. Heat Shrink Sleeve:

- a. Ensure all surfaces are clean, dry, and free of foreign objects and sharp edges.
- b. Warm the surface to drive off any moisture.
- c. Cut sleeve to required length per manufacturer's requirements.
- d. Apply primer to manhole and casting surface.
- e. Place sleeve according to manufacturer's requirements.
- f. Apply heat to the sleeve, smooth out wrinkles, and remove trapped air.
- g. Cut the sleeve at the casting gussets. Reheat to place the sleeve onto the casting.
- h. Trim off any excess material.

L. Backfill and Compaction:

1. Place suitable backfill material after concrete in structure has reached at least 3,000 psi compressive strength or 550 psi flexural strength. If concrete strength is not determined, place backfill at least 14 calendar days after initial concrete placement.
2. Place backfill material simultaneously on all sides of walls and structures so the fill is kept at approximately the same elevation at all times.
3. Compact the 3 feet closest to all walls using pneumatic or hand tampers only. Ensure proper and uniform compaction of backfill around structure.

3.02 ADDITIONAL REQUIREMENTS FOR CAST-IN-PLACE CONCRETE STRUCTURES**A. Forms:**

1. Comply with [Iowa DOT Article 2403.03, B.](#)
2. Form all cast-in-place manholes and intakes on both the inside and the outside face above the base. Do not form against excavated earthen surface.

**3.02 ADDITIONAL REQUIREMENTS FOR CAST-IN-PLACE CONCRETE STRUCTURES
(Continued)****B. Reinforcing Steel:**

1. Comply with [Iowa DOT Section 2404](#).
2. Lap bars a minimum of 36 diameters, unless otherwise specified in the contract documents.
3. Provide a minimum of 3 inches of clearance for structure bases and 2 inches of clearance for walls and tops.

C. Concrete Mixing:

1. Comply with [Iowa DOT Article 2403.02, D](#).
2. When using ready-mixed concrete, comply with ASTM C 94.

D. Concrete Placing:

1. Comply with [Iowa DOT Article 2403.03, C](#).
2. Do not place concrete when the air temperature is less than 40°F without the approval of the Engineer. When placement of concrete below 40°F is allowed, comply with [Iowa DOT Article 2403.03, F](#).
3. Place concrete continuously in each section until complete. Do not allow more than 30 minutes to elapse between depositing adjacent layers of concrete within each section.
4. Comply with [Iowa DOT Article 2403.03, D](#) for concrete vibration.
5. Form 1 1/2 inch by 3 inch keyed construction joints at locations shown in the contract documents.
6. Provide a broom finish on portions of structure that are to become part of exposed pavement.

E. Stripping and Cleaning:

1. Remove forms for manhole and intake walls and tops according to [Iowa DOT Article 2403.03, M](#). References to culverts include all sanitary and storm structures. When allowed by the Engineer, compressive strengths at six times the stated flexural strengths may be used in determining concrete strength of structure tops.
2. Finish surfaces according to [Iowa DOT Article 2403.03, P](#). Give exposed surfaces a Class 2 finish.

F. Curing:

1. Comply with [Iowa DOT Article 2403.03, E](#).
2. For surfaces visible to the public, use only curing compounds complying with ASTM C 309, Type 1-D or Type 2.

**3.02 ADDITIONAL REQUIREMENTS FOR CAST-IN-PLACE CONCRETE STRUCTURES
(Continued)****G. Exterior Loading:**

1. Restrict exterior loads on concrete according to [Iowa DOT Article 2403.03, N.](#)
2. When allowed by the Engineer, compressive strengths at six times the stated flexural strengths may be used.

H. Repairs: After visual inspection of the completed manhole or intake, repair honeycomb areas, visible leaks, tie holes, or other damaged areas. Remove concrete webs or protrusions.

I. Concrete Testing: The Engineer will conduct testing.

3.03 ADDITIONAL REQUIREMENTS FOR PRECAST CONCRETE STRUCTURES

A. Substitutions: If approved by the Engineer, precast structures may be substituted for designated cast-in-place structures. Comply with the requirements of Section 6010, 3.02 or [Iowa DOT Materials I.M. 445.](#)

B. Cast-in-place Base:

1. Comply with Section 6010, 3.02 for placement of concrete.
2. Ensure proper vertical and horizontal alignment of base riser section.

C. Precast Base or Base with Integral Riser Section: Place base or base with integral riser section and ensure proper vertical and horizontal alignment.

D. Additional Riser Sections: Install additional riser sections as required.

E. Lift Holes: Install rubber plug in lift holes. Cover plug and hole with non-shrink grout.

3.04 ADJUSTMENT OF EXISTING MANHOLE OR INTAKE**A. Casting Extension Rings:**

1. Install casting extension rings only when specified in the contract documents, and only in conjunction with pavement overlays.
2. Install according to the manufacturer's recommendation and adjust for proper alignment.

B. Minor Adjustment (Adding or Removing Adjustment Rings):

1. Remove casting.
2. Modify adjustment ring stack height by one of the following methods:
 - a. Add adjustment rings as necessary to adjust existing manhole or intake to finished pavement grade or finished topsoil grade, to a maximum ring stack height of 16 inches. Bed each concrete ring with bituminous jointing material. Bed each polyethylene ring with manufacturer's approved product.
 - b. Remove one or more adjustment rings, as appropriate, to reduce casting elevation.
3. Install new casting on modified adjustment ring stack. Existing casting may be reinstalled when specified in the contract documents.

3.04 ADJUSTMENT OF EXISTING MANHOLE OR INTAKE (Continued)

4. Replace infiltration barrier for sanitary sewer manhole using only new materials.
- C. Major Adjustment (Adding, Removing, or Modifying Riser or Cone Section):** When adjustment is greater than can be accomplished through adding or removing adjustment rings, a major adjustment will be required.
 1. Remove casting.
 2. Remove top.
 3. Remove and replace or modify existing riser section and/or top section according to the method approved by the Engineer.
 4. Install new frame and cover or grate. Existing casting may be reinstalled when specified in the contract documents.
 5. Replace infiltration barrier for sanitary sewer manhole using only new materials.

3.05 CONNECTION TO EXISTING MANHOLE OR INTAKE**A. General:**

1. Remove existing fillet as necessary to install pipe at required elevation and develop hydraulic channel.
2. Insert pipe into structure and trim end flush with inside wall of structure.
3. Install replacement fillet as necessary.
4. Place backfill material according to [Section 3010](#).

B. Concrete Collar:

1. For new pipes 12 inches or smaller, install two number 4 steel reinforcing hoops in collar around pipe. Pour concrete collar around pipe/structure junction to a minimum thickness and width of 6 inches, providing a minimum of 4 inches of concrete extending beyond the pipe opening.
2. For new pipes larger than 12 inches, install two number 4 steel reinforcing hoops in collar around pipe. Pour concrete collar around pipe/structure junction to minimum thickness and width of 9 inches, providing a minimum of 4 inches of concrete extending beyond the pipe opening.

C. Sanitary Sewer:**1. General:**

- a. Core new openings in existing manholes unless otherwise specified in the contract documents.
- b. Divert flow as necessary. Obtain approval of the diversion plan from the Engineer. Maintain sanitary sewer service at all times unless otherwise specified in the contract documents.

2. Cored Opening:

- a. Insert flexible watertight connector into new opening.
- b. Install and tighten internal expansion sleeve to hold flexible connector in place.
- c. Insert pipe through flexible connector and tighten external compression ring.
- d. Do not install grout or concrete collar for cored opening with flexible connector.

3.05 CONNECTION TO EXISTING MANHOLE OR INTAKE (Continued)

- 3. Cut and Chipped Opening (Knock-out):** Use only when specified or allowed.
 - a. Saw opening to approximate dimensions with a masonry saw. Saw to depth sufficient to sever reinforcing steel.
 - b. Remove concrete and expand opening to a diameter at least 6 inches larger than the outside diameter of the new pipe.
 - c. Cut off all reinforcing steel protruding from the structure wall.
 - d. Install waterstop around new pipe centered within structure wall.
 - e. Fill opening between structure and pipe with non-shrink grout.
 - f. Construct concrete collar around pipe and exterior manhole opening.
 - g. Provide pipe joint, non-shear coupling, or other approved flexible coupling within 2 feet of structure wall to allow for differential settlement between the new sewer and the structure.

D. Storm Sewer:

- 1. Cut and Chipped Opening:**
 - a. Use for pipe sizes 12 inches in diameter or larger.
 - b. Saw opening to approximate dimensions with a masonry saw. Saw to depth sufficient to sever reinforcing steel.
 - c. Remove concrete and expand opening to a diameter at no more than 4 inches larger than the outside diameter of the new pipe.
 - d. Leave a minimum of 6 inches of manhole or intake wall above and on the sides of the pipe.
 - e. Cut off all reinforcing steel protruding from the structure wall.
- 2. Cored Opening:**
 - a. Core new openings in existing manholes or intakes for all pipes less than 12 inches in diameter.
 - b. Opening to be no greater than 2 inches larger than the outside diameter of the pipe.
 - c. Leave a minimum of 6 inches of manhole or intake wall above and on the sides of the pipe.
- 3. Fill Opening:** Fill opening between manhole or intake wall and outside of pipe with non-shrink grout or construct a concrete collar around the pipe according to Section 6010, 3.05, B.

3.06 DROP CONNECTION TO SANITARY SEWER MANHOLE**A. Internal:**

1. Core opening in existing manhole wall and install flexible watertight connector.
2. Cut incoming pipe so a maximum of 2 inches extends into the manhole.
3. Allow 1 inch clearance between bottom of incoming pipe and top of the receiving bowl. Connect receiving bowl to manhole with stainless steel anchor bolts as recommended by the manufacturer.
4. Install flexible coupler connecting the receiving bowl and the drop pipe.
5. Mount drop pipe on the side of the manhole with stainless steel brackets spaced a maximum of 4 feet apart. Provide a minimum of two brackets per pipe segment.
6. Remove existing concrete fillet as required to accommodate bottom elbow.

3.06 DROP CONNECTION TO SANITARY SEWER MANHOLE (Continued)

7. Install elbow at bottom of drop pipe to match concrete fillet and create a smooth flow transition. Align elbow so discharge is directed at outlet pipe or at 45 degrees to manhole flow.
8. Repair fillet according to Section 6010, 3.01, G.
9. Comply with [Figure 6010.308](#).

B. External:

1. Core opening in existing manhole wall and install flexible watertight connector, if required.
2. Install ductile iron pipe and fittings according to [Section 5010, 3.01](#) and [3.02](#).
3. Place concrete from the base of the manhole to the top of the elbow.
4. Comply with [Section 3010, 3.05](#) for bedding and backfill of the external drop piping.
5. Comply with [Figure 6010.307](#).

3.07 REMOVAL OF MANHOLE OR INTAKE

- A. Unless otherwise specified, remove the entire structure to a minimum of 10 feet below top of subgrade in paved areas or 10 feet below finished grade in other areas.
- B. Pipes:
 1. Contact the Engineer to verify the sewer line is not in use.
 2. Construct sewer plug by completely filling the end of the pipe with concrete. Force concrete into the end of the pipe for a distance of 16 inches, or one-half the pipe diameter, whichever is greater.
 3. If specified in the contract documents, fill the line to be abandoned with flowable mortar or CLSM (comply with [Section 3010](#)) by gravity flow or pumping.
- C. Fill remaining structure using flowable mortar.
- D. Place compacted backfill over remaining structure as required for embankment or compacted backfill.

3.08 CLEANING, INSPECTION, AND TESTING

Clean, inspect, and test structures according to [Section 6030](#).

END OF SECTION