SECTION 02300
CAST-IN-PLACE CONCRETE MANHOLES

PART I: GENERAL

1.1 GENERAL REQUIREMENTS
- A. Cast-in-place concrete manholes for sanitary sewers and storm sewers, including box sewers.
- B. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.2 MEASUREMENT AND PAYMENT
- A. Unit Prices:
  1. Payment for manholes is on a unit price basis for each manhole installed.
  2. Payment for Type C manhole with BB inlet top is on a unit price basis for each.
  3. Payment for pile-supported concrete foundation used for unstable subgrade treatment for manhole base is on a unit price basis for each foundation installed.
  4. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
  1. If Contract is Stipulated Price Contract, payment for Work in this Section is included in Total Stipulated Price.

1.3 REFERENCES
- A. ASME – American Society of Mechanical Engineers.
  1. ASME B16.1 – Cast Iron Pipe Flanges and Flanged Fittings.
- B. ASTM – American Society for Testing and Materials.
  1. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
  2. ASTM C270 – Standard Specification for Mortar for Unit Masonry.
  3. ASTM C923 – Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
  4. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic – Cement Grout (Nonshrink).
  5. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3).
  6. ASTM D2665 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.
  7. ASTM D2996 – Standard Specification for Filament-wound Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
  8. ASTM D2997 – Standard Specification for Centrifugally Cast

Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

C. AWWA – American Water Works Association.
   1. AWWA C213 – Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines.

D. CFTS – City of Friendswood Technical Specifications.

1.4 SUBMITTALS

A. Conform to requirements of Section 01330 – Submittal Procedures.

B. Submit proposed design mix and test data for each type and strength of concrete.

C. Submit manufacturer's data and details of following items for approval:
   1. Frames, grates, rings and covers.
   2. Materials to be used in fabricating drop connections.
   3. Materials to be used for pipe connections at manhole walls.
   4. Materials to be used for stubs and stub plugs.
   5. Plugs to be used for sanitary sewer hydrostatic testing.
   6. Installation instructions for forms.

D. Seal submittal drawings by a Professional Engineer licensed by the State of Texas.

PART II: PRODUCTS

2.1 CONCRETE

A. Conform to requirements of Section 03300 – Structural Concrete.

B. Provide Class A concrete with minimum compressive strength of four thousand pounds per square inch (4000 psi) unless otherwise indicated on the Drawings.

2.2 REINFORCING STEEL

A. Conform to requirements of Section 03200 – Reinforcing Steel.

2.3 MORTAR

A. Conform to requirements of Section 03100 – Mortar.

2.4 MISCELLANEOUS METALS

A. Provide cast-iron frames, grates, rings and covers conforming to requirements of Section 02315 – Frames, Grates, Rings and Covers.

2.5 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on the Drawings.

2.6 PIPE CONNECTIONS

A. Sanitary Sewers.
   1. Provide resilient connectors conforming to requirements of

ASTM C923. Use the following materials for metallic mechanical devices as defined in ASTM C923:

a. External clamps: Type 304 stainless steel.
b. Internal, expandable clamps on standard manholes: Type 304 stainless steel, eleven (11) gauge minimum.
c. Internal, expandable clamps on corrosion-resistant manholes:
   1) Type 316 stainless steel, eleven (11) gauge minimum.
   2) Type 304 stainless steel, eleven (11) gauge minimum, coated with minimum sixteen (16) mil fusion bonded epoxy conforming to AWWA C213.

2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on the Drawings, provide polyethylene-isoprene waterstop meeting physical property requirements of ASTM C923, such as Pres-Seal WS Series or approved equal.

B. Storm Sewers.
1. Use non-shrink grout for storm sewer pipe connections to concrete manholes, unless otherwise shown on the Drawings. Pipe shall be flush with the inside wall of manhole. Grout pipe penetration in place on both inside and outside of manhole.

2.7 SEALANT MATERIALS
A. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, such as Adeka Ultraseal P201 or approved equal.
B. Provide external sealing material from Canusa Wrapid Seal manhole encapsulation system or approved equal.
C. Butyl Sealant: Provide Press-Seal EZ Stick or equal, for HDPE rings.

2.8 CORROSION-RESISTANT MANHOLE MATERIALS
A. Where corrosion-resistant manholes or PVC-lined manholes are indicated on the Drawings, provide the following:
1. PVC liner for precast cylindrical manhole section, base sections and cone sections.

2.9 BACKFILL MATERIALS
A. Conform to the requirements of Section 02125 – Excavation and Backfill for Utilities.

2.10 NON-SHRINK GROUT
A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based non-shrink grout requiring only addition of water.
B. Provide grout meeting requirements of ASTM C1107 and having minimum twenty-eight day (28 D) compressive strength of seven thousand pounds per square inch (7000 psi).

2.11 VENT PIPES

A. Provide external vent pipes for manholes where indicated on the Drawings.
B. Buried Vent Pipes: Provide three inch (3 In) or four inch (4 In) PVC Drain, Waste and Vent (DWV) pipe conforming to ASTM D2665. Alternatively, provide Fiberglas Reinforced Plastic (FRP) pipe as specified for vent outlet assembly.
C. Vent Outlet Assembly: Provide vent outlet assembly as shown on the Drawings, constructed of following specified materials:
    1. FRP Pipe: Provide filament-wound FRP conforming to ASTM D2996 or centrifugally cast FRP conforming to ASTM D2997. Seal cut ends in accordance with manufacturer's recommendations.
    2. Joints and Fittings: Provide epoxy- bodied fittings and join pipe to fittings with epoxy adhesive, according to pipe manufacturer's instructions.
    3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on the Drawings. Meet bolt pattern and dimensions for ASME B16.1, one hundred twenty-five pound (125 Lb) flanges. Use Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B flange bolts.
    4. Coating: Provide two (2) component, aliphatic polyurethane coating, using primer or tie coat recommended by manufacturer. Provide two (2) or more coats to yield dry film thickness of at least three (3) mils. Provide Amershield, Tnemec 74 or approved equal. The Project Manager selects color from manufacturer's standard colors.

PART III: EXECUTION

3.1 EXAMINATION

A. Verify lines and grades are correct.
B. Determine if subgrade, when scarified and recompacted, can be compacted to ninety-five percent (95%) of maximum Standard Proctor Density according to ASTM D698 prior to placement of foundation material and base section. When proper density cannot be reached, condition subgrade until that density is reached or treat as an unstable subgrade.
C. Do not build manholes in ditches, swales or drainage paths unless approved by the Project Manager.

3.2 MANHOLES

A. Construct manholes to dimensions shown on the Drawings. Commence construction as soon as possible after pipes are laid. On monolithic sewers, construct manholes at same time sewer is being constructed.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify the Project Manager for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for twenty-four inch (24 In) thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation under manhole base, as detailed on the Drawings.

C. Cast manhole foundations and walls monolithically. Use cold joint with approved waterstop when manhole flow line depth exceeds twelve feet (12 Ft). No other joints shall be allowed unless shown on the Drawings. Wrap cold joints with external sealing material, minimum six inch (6 In) width.

D. For concrete containing micro silica admixtures, place, finish and cure concrete for manholes following procedures in Section 03300 –Structural Concrete.

E. Top of manhole elevations shown on the Drawings are approximate, based on current pavement and natural ground conditions as determined from elevations measured on fifty foot (50 Ft) spacing. No additional payment shall be made if final elevation of manhole ring and cover is higher or lower due to requirements of finished grade or replaced pavement surface.

3.3 PIPE CONNECTIONS

A. Install approved resilient connectors at each pipe entering and exiting sanitary sewer manholes in accordance with manufacturer's instructions.

B. Grout storm sewer connections to manhole unless otherwise shown on the Drawings. Grout pipe penetrations both inside and outside of manhole. Pipes shall be flush with interior of the manhole.

C. Ensure no concrete, cement-stabilized sand, fill or other solid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on interior or exterior of manhole. When necessary, fill space with compressible material to ensure resilient connector shall maintain full flexibility where evidence of reduced flexibility is encountered.

D. Where new manhole is to be constructed on existing sewer, a rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe spring line using adhesive recommended and supplied by waterstop manufacturer.

1. Field verify the elevations of all manholes to be constructed on existing sewer before the start of any related work.
2. Failure to field verify existing conditions before start of work shall be the responsibility of the Contractor should the elevations not match and the work shall be completed with no additional cost to the City.

E. Do not construct joints on sanitary sewer pipe within wall sections of manholes. Use approved connection material.
F. Construct pipe stubs with resilient connectors for future connections at locations and with material indicated on the Drawings. Install approved stub plugs at interior of manhole.
G. Test connection for watertight seal before backfilling.

3.4 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:
   1. Slope of invert bench: one inch per foot (1 In/Ft) minimum; one and one-half inch per foot (1-1/2 In/Ft) maximum.
   2. Depth of bench to invert:
      a. Pipes smaller than fifteen inches (15 In): one-half (1/2) of largest pipe diameter.
      b. Pipes fifteen inches (15 In) to twenty-four inches (24 In): three-quarters (3/4) of largest pipe diameter.
      c. Pipes larger than twenty-four inches (24 In): equal to largest pipe diameter.
   3. Invert slope through manhole: one-tenth foot (0.1 Ft) drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on the Drawings.
B. Form invert channels with Class A concrete if not integral with manhole base. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.5 DROP CONNECTIONS FOR SANITARY SEWERS

A. Backfill drop assembly with crushed stone wrapped in filter fabric, cement-stabilized sand or Class A concrete to form solid mass. Extend cement-stabilized sand or concrete encasement minimum of four inches (4 In) outside bells.
B. Install connection when sewer line enters manhole higher than twenty-four inches (24 In) above invert of manhole.

3.6 STUBS FOR FUTURE CONNECTIONS

A. In manholes where future connections are indicated on the Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.7 ADJUSTMENT RINGS AND FRAME

A. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding

agent to precast concrete surfaces to be joined with non-shrink grout. Set cast iron frame on adjustment ring in a bed of approved sealant material. Install a sealant bed consisting of two (2) beads of sealant, each bead having minimum dimensions of one-half inch (1/2 In) and one-half inch (1/2 In) wide.

B. Wrap manhole frame and adjustment rings with external sealing material, minimum three inches (3 In) beyond joint between ring and frame and ring and precast section.

C. For manholes in unpaved areas, set top of frame a minimum of six inches (6 In) above existing ground line unless otherwise indicated on the Drawings. Encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.

D. For Manholes in paved areas, set manhole cover is flush with surrounding pavement. Form a six foot by six foot (6 Ft x 6 Ft) area, full depth to subgrade and parallel to the roadway centerline, centered on the manhole. Install expansion joint material on the perimeter of the form. Install reinforcing bar and concrete typical of road paving. Ensure that manhole is flush with surrounding pavement before applying final finish and curing compound.

3.8 BACKFILL

A. After concrete obtains adequate strength, place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02125 – Excavation and Backfill for Utilities. Use embedment zone backfill material for adjacent utilities, as shown in City of Friendswood Standard Details over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to spring line of pipe with Class A concrete or flowable fill.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of four inches (4 In) of topsoil conforming to requirements of Section 02905 – Topsoil. Seed in accordance with Section 02910 – Hydromulch Seeding or sod disturbed areas in accordance with Section 02915 – Sodding.

3.9 FIELD QUALITY CONTROL

A. Conduct leakage testing of Sanitary Sewer manholes in accordance with requirements of Section 02525 – Acceptance Testing of Gravity Sanitary Sewer Lines.

3.10 PROTECTION

A. Protect manholes from damage until subsequent Work has been accepted. Repair or replace damaged elements of manholes at no

additional cost to City.

B. Damaged manholes that have been repaired or replaced shall be retested at no additional cost to the City.

END OF SECTION