

SECTION 02560
MANHOLES

PART 1 - GENERAL

1.01 SCOPE

The work covered by this Section includes furnishing all labor, equipment and materials required to install cast-in-place, and/or precast concrete manholes, and concrete junction chambers as described herein and/or shown on the Drawings.

1.02 DESIGN CRITERIA

- A. Manholes shall be constructed of specified materials to the sizes, shapes, and dimensions and at the locations shown on the Drawings or as otherwise directed by the ENGINEER. The height or depth of the manhole will vary with the location, but unless shown otherwise on the Drawings shall be such that the top of the manhole frame will be at the finished grade of the pavement or ground surface and the invert will be at the designed elevations.
- B. Where the difference in the invert elevation of a sewer 18 inches in diameter or smaller and any other sewer intersecting in one manhole is 18 inches or more, a dropmanhole shall be constructed as shown on the Drawings. They shall be similar in construction to the standard manhole except that a drop connection of pipe and fittings of the proper size and material shall be constructed outside the manhole and be supported by Class B Concrete.

1.03 QUALITY ASSURANCE

- A. Prior to delivery all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory or, if approved by the ENGINEER, certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable. All materials which fail to conform to these specifications shall be rejected.
- B. After delivery to the site, any materials which have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site.

1.04 SHOP DRAWINGS AND ENGINEERING DATA

Complete shop drawings and engineering data on frames, covers, steps, and precast manhole sections shall be submitted to the ENGINEER in accordance with the requirements of the section entitled "Submittals" of these Specifications.

1.05 GUARANTEE

Provide a guarantee against defective materials and workmanship in accordance with the requirements of the Section entitled "Guarantees and Warranties" of these Specifications.

PART 2 - PRODUCTS

2.01 CONCRETE AND REINFORCEMENT

- A. Concrete used in manhole and junction chamber construction shall be Class A concrete conforming to the requirements of the Section entitled "Cast-In-Place Concrete" of these Specifications.
- B. Steel reinforcement shall conform to the requirements of the Section entitled "Cast-In-Place Concrete Reinforcement" of these Specifications.

2.02 MORTAR

- A. Mortar for manhole construction shall be sand cement mortar composed of one part Portland Cement to two parts clean sand conforming to ASTM C 144. Twenty pounds of hydrated lime per sack of cement may be added. No retempered mortar shall be used.
- B. Non-shrink mortar shall be pre-mixed, Master Builders "Masterflow 713", Sonneborn "Ferrolith G-D.S. Redi-Mixed", or equal.

2.03 PRECAST CONCRETE MANHOLES

- A. Precast concrete manholes shall consist of precast reinforced concrete sections, a conical or flat slab top section, and a base section conforming with the typical manhole details as shown on the Drawings.
- B. Precast manhole sections shall be manufactured, tested, and marked in accordance with the latest provision of ASTM C 478.
- C. The minimum compressive strength of the concrete for all sections shall be 4,000 psi.
- D. The maximum allowable absorption of the concrete shall not exceed eight (8%) percent of the dry weight.
- E. The circumferential reinforcement in the riser sections, conical top sections, and base wall sections shall consist of one line of steel and shall be not less than 0.12 square inches per lineal foot.
- F. The ends of each reinforced concrete manhole riser section and the bottom end of the manhole top section shall be so formed that when the manhole risers and the top are assembled, they will make a continuous and uniform manhole.

- G. Joints of the manhole sections shall be tongue and groove. Sections shall be joined using either an O-ring gasket or a mastic sealant consisting of bitumen and inert mineral fibers. The sealant shall be applied in accordance with the manhole manufacturer's requirements. A sufficient amount of sealant should be used to fill the annular joint space with some squeeze out.
- H. Each section of the precast manhole shall have not more than two (2) holes for the purpose of handling and laying. These holes shall be tapered and shall be plugged with rubber stoppers or mortar after installation.
- I. Cast iron or reinforced plastic manhole steps shall be installed in each section of the manhole in accordance with the details on the Drawings.

2.04 FRAMES, COVERS, AND STEPS

- A. Cast iron manhole steps, toe pockets, frames, and covers shall be cast iron conforming to the minimum requirements of Federal Specifications WW-1-652 or to ASTM A 48, "Gray Iron Castings," for Class 35B. All castings shall be made accurately to the required dimensions, fully interchangeable, sound, smooth, clean, and free from blisters and/or other defects. All regular manhole frames and covers shall be the City's Standard as manufactured by Acheson Foundry A2024-81C weight of 350 pounds as shown on the drawings.

Defective castings which have been plugged or otherwise treated shall not be used. All castings shall be thoroughly cleaned and painted or coated with a bituminous paint.

- B. Reinforced plastic manhole steps shall conform to the minimum requirements of ASTM 2146-68 under Type II, Grade 16906 and ASTM C-478, Paragraph 11. The reinforcing bar shall be a Grade 60, deformed 1/2-inch reinforcing bar conforming to all the requirements of ASTM A-615.
- C. All manhole frames and covers shall be of the size and weight shown on the Drawings. All regular manhole frames and covers shall be the City's Standard as manufactured by Acheson Foundry A2024-81C weight of 350 pounds as shown on the drawings.
- D. Watertight manhole covers shall be furnished with a rubber gasket, stainless steel tightening bolt, machined bearing surfaces, channel iron locking bar, and concealed watertight pick hole, and shall weigh not less than 590 pounds, and shall be of the size and dimensions shown on the Drawings. Watertight manhole covers shall be equivalent to A2624-71C as manufactured by Acheson Foundry of Chattanooga, Tennessee.

- E. The contact surfaces of all manhole covers and the corresponding supporting rings in the frames shall be machined to provide full perimeter contact.
- F. All sanitary sewer manhole covers shall have the words "CITY OF CHATTANOOGA" and "SEWER" as designated by the Engineer cast on the top in letters two (2) inches high or other as directed.
- G. An adjusting ring equal to R1979 as manufactured by Neenah Foundry Company of Neenah, Wisconsin, shall be provided for each manhole in a street. Adjusting rings shall provide a minimum inside clear opening of 24 inches and shall be made to be capable of being bolted to the manhole frame.

PART 3 - EXECUTION

3.01 GENERAL MANHOLE CONSTRUCTION

- A. All manhole bases, including curved manhole bases, and inverts shall be constructed of Class A concrete in accordance with details on the Drawings and inverts shall be smooth and accurately shaped and have the same cross section as the invert of the sewers which they connect.

The manhole base and invert shall be carefully formed to the required size and grade by gradual and even changes in sections, care being exercised to form the incoming and outgoing sewer pipes into the wall of the manhole at the required elevations. Changes in direction of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit.

- B. Pipe of all diameters shall be connected to manholes using an integrally cast A-lock elastomeric ring, a Kor-N-Seal rubber boot, or approved equal flexible connector and shall be installed as recommended by the manufacturer. Connections using mortar or other rigid materials will not be acceptable. Connections to existing manholes shall be cored. "Hammer taps" will not be acceptable.
- C. The manhole steps shall be inserted into the wall of the manhole at the proper locations and elevations and shall be securely embedded in the wall.
- D. Any adjustment necessary for manhole frame elevation shall be made with concrete "donut" sections. A maximum of three (3) sections shall be permitted.
- E. The cast iron frame for the manhole cover shall be set at the required elevation and properly anchored to the masonry. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted to conform to the exact slope, crown, and grade of the existing adjacent pavement.

- F. Masonry work shall be allowed to set for a period of not less than 24 hours. Outside forms, if any, shall then be removed and the manhole backfilled and compacted in the manner provided in the Section entitled "Earthwork" of these Specifications. All loose or waste material shall be removed from the interior of the manhole. The manhole cover then shall be placed and the surface in the vicinity of the work cleaned off and left in a neat and orderly condition.
- G. After backfilling has been completed, the excavated area if located in a street, alley, or sidewalk, shall be provided with a temporary surface, as directed by the ENGINEER.

3.02 CONSTRUCTION OF CAST-IN-PLACE CONCRETE MANHOLES

- A. Cast-in-place manholes, excluding curved manhole bases, shall be constructed in place with the base, barrel and conical section all monolithically cast using removable forms of a material and design approved by the ENGINEER
- B. The vertical forms, vertical and horizontal wall spacers steps and placing cone must be carefully positioned and firmly clamped in place before any placement is made. The wall spacers must be located 90 degrees from each other. The forms shall be firmly supported with bottom of forms at the proper elevation to permit the base to be deposited through the vertical forms.
- C. The manhole base shall be deposited down through the wall forms onto undisturbed earth or rock bearing. It shall be evenly distributed around the wall and vibrated both inside and outside the forms until there is a minimum slope of 60 degrees from the bottom of the forms to the bearing surface both inside and outside of the manhole. When this is complete and before additional concrete is added, the concrete must be carefully vibrated on each side of each sewer pipe.
- D. The base shall be concentric with the manhole and have a minimum diameter of 16 inches greater than the outside diameter of the manhole, and 10-inch minimum thickness under the lowest pipe. Minimum wall thickness shall be six (6) inches.
- E. Additional concrete must be deposited in evenly distributed layers of approximately 18 inches with each layer vibrated to bond it to the preceding layer. The wall spacers must be raised as the placements are made. The concrete in the area from which the spacer is withdrawn shall be carefully vibrated. Excessive vibration shall be avoided.
- F. Adjustment rings shall be provided between the conical section and the manhole frame. The rings shall be cast-in-place using building felt between pours to create a weakened joint or as directed by the ENGINEER. If adjustment of the lid elevation is called for, concrete "donut" sections shall be used.

- G. The invert and flow channel shall be constructed in accordance with the applicable requirements of Part 3.01 of this Section and shall be formed during or immediately after the placing of the concrete and brush-finished as soon as the concrete has sufficiently set.
- H. Form marks and offsets shall not exceed one (1) inch on the outside surface of the manhole. Form marks and offsets shall not exceed 1/2 inch inside of the manhole. All offsets on the inside surface of the manhole shall be smoothed and rubbed so there is no projection or irregularity capable of scratching a worker or catching and holding water or solid materials. Honeycombed areas shall be completely removed immediately upon removal of the forms and replaced with Class A concrete.
- I. Should circumstances make a cold joint necessary, a formed groove or reinforcing dowels shall be required in the top of the first placement for shear protection. Immediately before the second placement is made, the surface of the cold joint shall be thoroughly cleaned and wetted with a layer of mortar being deposited on the surface.
- J. Concrete setting time, backfilling, masonry work, setting frame and cover, temporary paving, etc., shall be in accordance with the applicable requirement of Part 3.01 of this Section.

3.03 CONSTRUCTION OF PRECAST CONCRETE MANHOLES

- A. The base and invert shall be constructed in accordance with the applicable requirements of Part 3.01 of this Section.
- B. After the base section has been allowed to set for a period of not less than 24 hours, the precast manhole sections shall be placed thereon, care being exercised to form the incoming and outgoing sewer pipes into the wall of the manhole at the required elevations.
- C. Manhole sections shall be set so that the manhole steps align vertically.
- D. Masonry work required to complete the precast concrete manhole shall be done in accordance with the provisions of Part 3.01 of this Section.
- E. Fill all joints, lifting holes, and other imperfections inside and outside with non-shrink mortar, overlapping the seam 2" on both sides, to form a neat, smooth finish. Manholes shall be completely waterproof.
- F. Concrete setting time, backfilling, setting frame and cover, temporary paving, etc., shall be in accordance with the applicable requirements of Part 3.01 of this section.

3.04 CONSTRUCTION OF PRECAST CONCRETE "TEE" MANHOLE BASES

- A. Precast concrete tee manhole bases and elbows shall conform to the requirements of the Section entitled "Concrete Pipe Sewers" of these Specifications. Class of pipe used shall be the same as that used in the line adjacent to the manhole and elbow. The tee section shall be carefully formed to the required size. The inside of the base shall be left smooth with no rough edges or protrusions.
- B. Elbows where required shall be fabricated to a true angle as shown on the drawings. Elbows shall be made smooth by hand troweling and the finished surface shall be equal to that in the rest of the pipe.
- C. All fabrication work on the manhole base and elbows shall be done by the manhole or pipe manufacturer at the plant. No field fabrication will be permitted without specific authorization of the ENGINEER.
- D. After the base section has been installed, the precast manhole sections shall be placed thereon.
- E. Masonry work required to complete the precast concrete manhole shall be done in accordance with the provisions in Part 3.01 of this Section.
- F. Concrete setting time, backfill, masonry work, setting frame and cover, temporary paving, etc., shall be in accordance with the applicable requirements of Part 3.01 of this Section.

3.05 CONSTRUCTION OF JUNCTION CHAMBERS

- A. Junction chamber toe pockets shall conform to the applicable requirements of Part 2.04 of this section and shall be placed as shown on the Drawings.
- B. The concrete shall be constructed in strict accordance with the Drawings and other applicable specifications and all lines inside the chamber shall be finished smooth with no protrusions to obstruct flow, all subject to the approval of the ENGINEER.
- C. During construction of the junction chambers, the existing sewage flow shall be maintained in a manner acceptable to the ENGINEER. Bypassing of sewage into streams or storm water drainage facilities will not be permitted. If the junction chamber is to be built on an existing sewer, the section of sewer within the junction chamber shall be removed before the base of the junction chamber is poured unless shown otherwise on the Drawings.
- D. All ground areas that are disturbed during construction of the junction chamber shall be prepared and grassed as called for elsewhere in these Specifications.

3.07 TESTING

Manholes installed in this contract shall be tested prior to backfilling for compliance with the infiltration limits specified for pipe used in this contract. The method shall be a vacuum test in which manholes are plugged, pumped to 5 psi vacuum, and held for a minimum of one (1) minute. The manhole shall be approved when it loses less than one (1) psi vacuum pressure during the 1 minute test period.

END OF SECTION