

ITEM 010160

Item 0101601 - TYPE I MANHOLE

Item 0101602 - TYPE II MANHOLE

DESCRIPTION

Type I and Type II manholes shall contain 14" X 10" forged aluminum steps, installed at 16" intervals. The work and materials required by this section of the Specifications consist of furnishing all materials and the construction of sanitary sewer manhole structure at the locations, to the grades, to the details indicated and/or as directed by the City, including pre-cast reinforced concrete manhole bases, frames, covers, risers, transition sections, tops and grade rings, brick masonry for manhole inverts, all jointing and jointing materials and appurtenant work for construction of the manhole structures, complete in place and accepted. The manhole shall contain a standard frame and cover, marked: STORM DRAIN or SEWER which shall be paid for under item 0101620.

REFERENCED ITEMS

Item 0101620, 0103501

REQUIRED SUBMITTALS

Shop Drawings:

Submit 5 copies of shop drawings for pre-cast units in accordance with the contract general requirements.

MATERIALS

1. Pre-cast reinforced concrete units shall conform to Metropolitan District Commission (MDC) requirements and/or to the following requirements:
 - a. Pre-cast reinforced concrete manhole bases, risers, tops and grade rings shall be of the types indicated or as directed; manhole bases, risers, transition section and tops shall conform to the requirements of ASTM Designation C-478-03, latest revision except as modified herein and/or on the drawings.
 - b. Each manhole base, riser, transition section, and top shall be constructed with bell-and-spigot or tongue-and-groove and grade rings shall be manufactured by the centrifugal, roller

suspension, or vertical cast process; construction methods shall be in accordance with the best practices of modern shops for this type of work.

- c. The height and diameter of manhole bases shall be as required to accommodate the size of sewer pipe used.
- d. The manhole risers shall be available in 2', 3', and 4' lengths; manhole tops of the eccentric cone type shall be 3', or 4' high with 24" inside diameter opening at the top; manhole tops of the flat-slab type, for use where shallow installations do not permit use of a cone-type or where directed, shall be not less than 6" thick, and shall have an opening having an inside diameter of 24".
- e. The transition sections shall be similar to the tops and used as reducers to join the larger bases with the 4' diameter risers. The transition sections shall be of the length required and have a 4' opening at the top.
- f. Aluminum manhole steps shall be provided in each manhole base, transition section, riser and cone-type top and shall be integrally cast in each of these items. Aluminum steps shall be as detailed and shall be of solid, forged aluminum alloy 6061, of the safety type. Manhole steps shall be arranged in the manhole bases, transition sections, risers and cones so as to provide a manhole step ladder approximately 12" on centers for the full height of installation.
- g. Wall thickness of manhole risers shall be not less than 5"; wall thickness of manhole transition sections and cone-type tops shall not be less than 5" at the base and shall taper to a thickness of not less than 8" at the top.
- h. The exterior surfaces of all manholes shall be shop coated with two coats of Super Service Black as manufactured by Koppers Company, Inc., or Heavy Duty Black 46-449 as manufactured by Tnemec or approved equal.

2. Openings in manhole bases and risers
 - a. Openings for pipes entering manhole bases and risers shall be provided at the locations and to the arrangements and dimensions shown on the approved shop drawings.
 - b. All openings in manhole bases and risers shall be provided with a pre-fabricated mechanical-type joint seal between manhole walls and entering pipes.
 - c. The joint seal shall be of a type to ensure watertight jointing between manhole and pipes under all conditions of installation; the type of joint seals to be used shall be subject to approval and shall be as shown on the approved shop drawings.
 - d. The types and details of manhole bases shall be as indicated.
3. Jointing of manhole bases, transition section, risers and tops
 - a. Ends of each length of manhole base, riser pipe, transition section and bottom end of manhole top or the cone-type shall be provided with bell-and-spigot or tongue-and-groove ends of concrete formed on machined rings to ensure accurate joint surfaces.
 - b. The joints shall be the type using an "O" ring type neoprene gasket for sealing the joints, or joints shall be of the type using a non-shrink type mortar for sealing the joints; all joints shall be provided so as to be watertight under all conditions of service.
 - c. The ends of bases, transition sections, risers and cones to be jointed using neoprene "O" ring type joints shall be designed to enclose the gasket on four surfaces when the joint is in its final position.
4. Gaskets for sealing joints
 - a. The "O" ring type gaskets shall be of neoprene of a special composition having a texture to assure a watertight and permanent seal.

- b. Each gasket shall be a continuous ring of round, solid, cross-section made of neoprene rubber, having smooth surfaces free from blisters, porosity and other imperfections.
- c. The neoprene joint sealing gasket shall be of a composition and texture which shall be resistant to sewage, industrial wastes including oils and ground waters, and which will endure permanently under the conditions likely to be imposed by this use.

5. Mortar and Grout

Sealing mortar type joints in pre-cast units shall be by using a non-shrink-type mortar or grout which shall be a factory-mixed, ready-to-use product containing a specially prepared metallic aggregate, cement and sand; and other components which shall produce a mortar or grout with properties to counteract shrinkage, increase density, withstand impact, improve workability, produce watertight joints, and which will be suitable for jointing the risers and tops.

6. Concrete

- a. The concrete used for pre-cast manhole bases, transition sections, risers and tops shall have an average strength of 5,000psi at 28 days.
- b. Strength shall be determined by tests on 6" X 12" vibrated test cylinders cured in the same manner as the manhole bases, transition sections, risers and tops, or by any other approved method.
- c. Not less than two (2) concrete strength tests shall be made for each 100 linear feet of manhole bases, transition sections, risers and tops; and the test results submitted to the City.
- d. Testing may be conducted at the manufacturer's plant or at an approved testing laboratory and shall be the responsibility of the Contractor, at no additional expense to the City.

7. Cement

Cement shall be moderate heat-of-hardening Portland cement conforming to ASTM designation C-150-04, latest revision, Type I for brickwork and Type II for pre-cast units.

8. Absorption

Absorption is to be determined by absorption test described in ASTM designation C-489, latest revision, and shall not exceed 8% of dry weight.

9. Brick

- a. Brick for manholes shall conform in all respects to ASTM Designation C-32-04, Grade SM, latest revision, size 2-1/2" X 3=3/4" X 8".
- b. Bricks that are broken, warped, cracked, or of improper size or quality or unduly chipped or otherwise defective shall not be used in the work and shall be removed from the site.

10. Mortar and Plaster

- a. Mortar and Plaster for brick work shall be composed of one-part Portland cement and two-part sand with only sufficient water added to make a staff plastic mortar of a consistency and texture satisfactory to the City.
- b. Mortar shall be used so that it will be in place before the initial setting of cement has taken place; re-tempering of mortar in which the cement has started to set will not be permitted.

11. Sand

- a. Sand for mortar shall be graded uniformly from fine to coarse and when dry shall pass through a screen having 8 meshes to the inch.
- b. Sand shall consist of an aggregate having clean, hard, durable, strong, un-coated grains and free from deleterious amounts of dust, lump, soft or flaky particles, shale, alkali, organic matter, loam or other deleterious substances.

- c. Sand shall be washed clean before loading on delivery trucks. Natural sand which shows a color darker than the standard color when tested in accordance with the Standard Method of Test for Organic Impurities of ASTM Designation C-40-04, latest revision, will be cause for rejection.
12. Water
- a. Mixing water for concrete and mortar shall be clean, drinkable, and obtained preferably from the municipal supply.
13. Manhole frame and cover.
- a. The work and materials shall be as described in Item 0101604: Manhole Frame and Cover of these specifications.

CONSTRUCTION METHODS

1. INSPECTION

Acceptance of pre-cast reinforced concrete manhole bases, transition sections, risers, and tops will be made on the basis of plant tests, material tests and inspection of the completed product, in accordance with ASTM Designation C-478-03, latest revision, with the following modifications:

- a. Manhole bases, transition sections, risers and tops shall not be shipped for at least five days after manufacture when cured by subjecting them to thoroughly saturated steam at a temperature of 100-150 degrees F for a period of not less than 8 hours, or when necessary for such additional time as may be required to enable the manhole bases, transition sections, risers and tops to meet the specification requirements.
- b. All manhole bases, transition sections, risers and tops will be inspected upon delivery; manhole bases, transition sections, risers and tops which do not conform to specification requirements will be rejected and shall be removed immediately from the site by the Contractor. The Contractor shall furnish all labor and facilities necessary to assist the inspector in inspecting the material.
- c. All manhole bases, transition sections, risers and tops which have been damaged after delivery and manhole bases, transition sections, risers and tops installed in the work which are found to be damaged

will be rejected and shall be removed material, at no additional expense to the City. At the time of inspection, the surfaces of bases, transition sections, risers and tops shall be dense and close-textured. Cores shall serve as a basis for rejection of manhole bases, transition sections, risers and tops if poor bond with reinforcement steel exists or reinforcement is exposed.

- d. The quality of all materials, process of manufacture, and the finished manhole bases, transition sections, risers and tops shall be subject to inspection and approval by the Owner. Such inspection may be made at the place of manufacture and/or on the site, and the manhole bases, transition sections, risers and tops shall be subject to rejection at anytime on account of failure to meet any of the specification requirements, even though sample manhole bases, transition sections, risers and tops may have been accepted as satisfactory.

2. **INSTALLATION**

- a. Each manhole base, transition section, riser and top shall be eased into its position in the trench only in such manner and by such means as recommended by the manufacturer of the manhole bases, transition sections, risers and tops, and as approved. The Contractor shall provide all necessary slings, straps and other devices for the safe and satisfactory handling and support of manhole bases, transition sections, risers and tops during lifting, installation and final positioning of the bases, transition sections, risers and tops. Lifting holes may be permitted provided for plugging and sealing the holes watertight with mortar, all as approved.
- b. Manhole bases, transition sections, risers and tops shall be installed using approved neoprene "O" ring type gaskets or non-shrink type mortar for sealing joints of manhole bases, transition sections, risers and tops. Jointing shall be performed in accordance with the manhole manufacturer's recommendations, and as approved. Manhole bases, transition sections, risers and tops shall be installed level and plumb. Water shall not be permitted to rise over newly made joints until after inspection and acceptance. All pointing shall be done in a manner to ensure watertight joints.
- c. Where directed, the cast-iron manhole frames shall be set on the manhole top in a full bed of mortar to the finished grade indicated or directed; and the outside of the frame shall be completely encased in cement-mortar.

- d. Openings shall be provided in the pre-cast manhole bases and risers to receive entering pipes, and these openings shall be made at the place of manufacture. The openings for all entering pipes shall be provided with the approved-type mechanical joint sealing device shown on the approved shop drawings and the installation of pipes entering the manholes and the installation of the mechanical joint sealing device made in strict conformance with the manhole manufacturer's printed recommendations so as to obtain watertight joints between manholes and pipe and in a satisfactory manner. Five copies of the manufacturer's printed recommendations shall be furnished to the City.
- e. Care shall be taken to assure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Mortar used in sealing spaces between entering pipes and openings in manhole walls shall be of the non-shrink type. Damaged bases and risers by jointing devices will be rejected and shall be replaced by the Contractor at no additional expense to the City.
- f. Manhole bases, transition sections, risers and tops shall be installed so the manhole steps are in alignment.
- g. All backfill material shall be compacted bank run gravel meeting the requirements of Item 0103501 for Bank Run Gravel. No additional payment shall be made for furnishing and placing the backfill material.

3. **MASONRY CONSTRUCTION**

- a. Brick masonry shall include brick masonry walls for extending manhole walls to grade, when directed; formed brick masonry for constructing manhole inverts and invert tables, cement-mortar plaster on exterior surfaces of masonry walls, mortar, building-in or manhole steps and pipes and appurtenant work.
- b. Brick masonry shall be provided to the details and dimensions indicated or as directed. All exterior surfaces of brick masonry manhole walls shall be plastered with a 1:2 Portland cement and sand mortar plaster to provide a minimum thickness of 1/2"; mortar plaster shall be applied with sufficient pressure to ensure a dense plaster completely filling all voids and thoroughly bonding to the brickwork.

- c. Inverts shall have a cross-section shaped to conform with connecting sewers; changes in size shall be made gradually and evenly.
- d. Brick masonry construction shall be done in a manner to ensure watertight construction and all leaks in brick masonry shall be sealed. Brick masonry shall be repaired or replaced so as to obtain watertight construction at no additional expense to the Owner.
- e. All workmanship shall conform to the best standard practice and all brick masonry shall be laid by skilled workmen. Brick masonry walls shall be constructed to the thickness indicated. All beds on which masonry is to be laid shall be cleaned and wetted properly. Brick shall be wetted as required and shall be damp but free of any surface water when placed in the mortar.
- f. Bed joints shall be formed of a thick layer of mortar which shall be smoothed or furrowed slightly. Head joints shall be formed by applying to the brick to be laid a full-coat of mortar on the entire end or on the entire sides as the case requires, and then firmly placing the mortar-covered end or side of the brick tightly against the bricks previously laid; the practice of butting at the corners of the brick and then throwing mortar or scraps into the empty joints will not be permitted.

Joints shall be uniform in thickness and shall be approximately 1/4" thick. Joints on the inside face of walls shall be tooled slightly concave with an approved jointer when the mortar is thumb print hard; the mortar shall be compressed with complete contact along the edges to seal the surface of the joints.
- g. Brickwork shall be constructed accurately to dimension and brickwork at top of manholes shall be to dimension of the flange of the cast-iron frames.
- h. No water shall be allowed to flow against brickwork or to rise on the masonry for 60 hours after it has been laid. Any brickwork damaged in this manner shall be replaced as directed at no additional expense to the City.
- i. Adequate precautions shall be taken in freezing weather to protect the masonry from frost damage.

- j. All pipes or castings to be embedded in the brickwork shall be accurately set and built-in as the work progresses. Pipe stubs shall be closed with suitable plugs in an approved manner.
- k. The outside face of all brickwork shall be plastered to the thickness and using the mortar specified herein; plaster shall be troweled to a smooth, hard, finish and no backfill shall be placed until the mortar has thoroughly hardened.

METHOD OF MEASUREMENT

Sanitary manholes will be measured for payment by the number of manholes completed and accepted. Excavation for manholes will not be measured for payment but is to be included under the appropriate pipe excavation item.

BASIS FOR PAYMENT

The item as measured above shall be paid for at the contract unit price per each "TYPE I MANHOLE" or "TYPE II MANHOLE", as listed in the bid, which price and payment shall constitute full-compensation for furnishing and constructing manhole bases, frames, covers, riser covers or slab tops and manhole drops including concrete encasement, complete with aluminum steps, manhole frames and covers, locking devices, brick masonry, new backfill material, disposal of unsuitable material, and appurtenant work, complete in-place and accepted by the Metropolitan District Commission; and for all labor, equipment, tools, materials, and all other costs and appurtenant work incidental and necessary to complete the items as specified, indicated, and directed.

<u>PAY ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
0101601	Type I Manhole	EA
0101602	Type II Manhole	EA