ITEM NO. 852
SANITARY SEWER MANHOLES

852.1 DESCRIPTION: This item shall govern the construction of standard sanitary sewer manholes complete in place and the materials therein, including manhole rings and covers. All material and construction work shall be in accordance with current Texas Commission on Environmental Quality (TCEQ) rules to include: Design Criteria for Sewage Systems (30 TCEQ § 217), or any revision thereto as applicable. All constructed manholes shall be watertight and equipped with pre-tested and approved low leakage frames and lids, as specified herein. Sewer manhole ring and cover castings shall meet the current requirements of the American Association of State Highway and Transportation Officials (AASHTO) Designation M306-10.

852.2 REFERENCED STANDARDS: The following standards are referenced herein or otherwise related to the project work and shall be the current edition:

1. AASHTO – American Association of State Highway and Transportation Officials:

2. ASTM – American Society for Testing and Materials:

3. COSA – City of San Antonio:

4. TCEQ – Texas Commission on Environmental Quality:
SUBMITTALS: Contractor shall submit manufacturer’s product data, instructions, recommendations, shop drawings, and certifications. All submittals shall be in accordance with Owner’s requirements and submittals shall be approved by the Owner prior to delivery.

MATERIALS:

1. Concrete Manhole Components: For new concrete manholes, all concrete manhole components (cast-in-place or precast manhole base, precast risers, precast cone sections, cast-in-place or precast flat tops, and concrete “throat rings” as applicable) for new manholes shall conform to the applicable requirements of ASTM Designation C478, except as modified below.

   a. Concrete Grout: All concrete grout used for patching or other similar fill-in work shall be of non-shrink type made with the Komponent® admixture specified above, or approved alternate, in accordance with the manufacturer’s recommended formulation with Portland cement, fine aggregate, water, and water reducer to produce a compressive strengths of approximately 4,800 psi within 7 days and 7,250 psi within 28 days at a 70 °F baseline temperature.

2. Manhole Ring and Cover: The manhole ring and cover shall be of ductile iron or gray cast iron construction. The cover shall be solid with no vent or pick holes; hinged with underlying special hinge area leakage protection; the cover secured with four (4) stainless steel bolts; and shall have a recessed “pick bar” for cover opening. Cam lock type covers shall not be allowed. Approved manufacturers, as listed below, have previously completed required inflow leakage shop testing and have met a maximum allowable leakage rate criterion of 1 gallon per minute (gpm) at 12 inches of water submergence above the manhole cover. Rings and covers shall be furnished from either of the following two manufacturers with the specified features:
   a. Approved Manufacturers:
      (1) Neenah Foundry, Division of Neenah Enterprises, Inc.
         a) 24-inch Clear Opening Cover: “Lift Mate” Model R-1650-LM. Refer to drawing DD-852-07, Sheet 4 of 5.
         b) 30-inch Clear Opening Cover: “Lift Mate” Model R-1743-LM. Refer to drawing DD-852-07, Sheet 5 of 5.
         c) Hinge Area Leakage Protection (both cover sizes): Insertion plug beneath hinge shall be neoprene, pre-installed by the manufacturer. The plug shall be self-
sealing and held firmly in place by direct contact of the hinge upon closure and bolting down of the cover.

(2) East Jordan (EJ)
   a) 24-inch Clear Opening Cover: Product Number 41418105L01. Refer to drawings DD-852-07, Sheets 1 and 2 of 5.
   b) 30-inch Clear Opening Cover: Product Number 41421084L01. Refer to drawing DD-852-07, Sheet 3 of 5.
   c) Hinge Area Leakage Protection, 24-in Clear Opening Cover: Flat neoprene sheet gasket pre-installed by the manufacturer to the underside of the single hinge pocket with quick-set epoxy glue.
   d) Hinge Area Leakage Protection, 30-in Clear Opening Cover: Insertion plug beneath each hinge shall be low density polyethylene (LDPE), pre-installed by the manufacturer with silicone sealant. The plug shall be held firmly in place by direct contact of the hinge upon closure and bolting down of the cover.

b. Cover Gasket. The underside of the cover shall be equipped with a continuous (one piece) vulcanized “T-shaped” gasket for perimeter leakage sealing. The gasket shall either be of nitrile, neoprene, or EPDM construction and pre-inserted into the perimeter retainer slot by the manufacturer as shown by the above referenced drawings. If the gasket is damaged in any way through shipping or through on-site storage or handling by the Contractor, a completely new manhole cover must be provided. Field repairs of a damaged gasket shall not be attempted or allowed.

c. Machined Metal Surfaces: Prior to gasket insertion, the underside of the metal mating surfaces on the underside of the cover and the inner frame ledge supporting the cover shall have been machined smooth to allow uniform seating of the cover gasket.

d. Cover Labeling: All covers shall have the words “SAN ANTONIO WATER SYSTEM Sanitary Sewer” cast thereon. Ring and cover shall have the specified foundry’s name, part number, country of origin preceded by “Made in” (example: MADE IN USA) in compliance with the country of origin law of 1984, and production date (example: mm/dd/yy) for tracking purposes. Each casting must be marked with DI (ductile iron) and ASTM A536 or A536 80-55-06 or CI (cast iron) and ASTM A-48, Class 35B to verify the materials used. Castings without proper markings shall be rejected.
Cover Bolts. Four (4) bolts of 1/2-IN diameter x 13 thread pitch shall be used to secure the cover. Bolts shall be of stainless steel, grade 304 or better. The top of the cover shall have a recessed area around each bolt assembly to accommodate the washer diameter and thickness and bolt head height so that the bolting assembly does not exceed the top of the manhole cover. Where cover bolts directly thread into the underlying cast iron frame, the bolt threads shall be thoroughly coated with Nikal Jet Lube product, as manufactured by CSW Industrials Company or approved alternate before insertion to avoid subsequent “seize up” from dissimilar metals. If such bolts are removed for any purpose, the threads must be recoated. Stainless steel bolts that are threaded into stainless steel nuts within recessed slots in the underlying frame optionally do not require an anti-seize coating of the bolt threads.

3. “Throat Rings”: “Throat rings” shall be made of reinforced concrete and have a maximum thickness of 2 inches. The internal diameter shall match that of the ring and cover’s opening. Concrete shall conform to the provisions of Item No. 300 "Concrete (Natural Aggregate)." Concrete “throat rings” are to be used in conjunction with a UV stabilized internal polyethylene liner for the purpose of providing an infiltration/inflow (I/I) barrier. The I/I Barrier shall be as manufactured by Strike Tool Products of Cannon Falls, MN and must meet the following ASTM standards: ASTM D790 for flexural properties; ASTM D1505 for density; ASTM D1238 for Melt Flow Index; ASTM D638 for tensile strength at yield (50mm/mm); ASTM D790 for flexural modulus; ASTM D648 for heat deflection temperature at IGEPAL; and ASTM D693 for EsCR, 100% IGEPAL/10% IGEPAL.

Note of Clarification: A minimum of two and a maximum of six “throat rings” may be used at each adjusted manhole. “Throat rings” are limited to a minimum of two and a maximum of four rings for new manhole construction.

4. Bitumastic Joint Sealant. To be applied between cones, risers, adjustment rings, flat tops, and between the ductile or gray cast iron ring (frame) and the uppermost adjustment ring or flat top: RAM-NEK, as manufactured by Henry, Inc.; Kent Seal, as manufactured by Hamilton-Kent, Inc.; Encapseal, as manufactured by Miller Pipeline Corporation; or approved alternate.

5. Interior Coating: The interior of all new and rehabilitated manholes shall be rendered watertight, chemically resistant, and abrasion resistant
6. **Note of Clarification:** Existing manholes being adjusted only as per Item 851 will not require a coating system.

For new and rehabilitated manholes, apply a combination of both products with the cementitious coating first, followed by the epoxy coating. Kerneos SewperCoat 2000 HS and PG, applied at the required one inch thick application, is the only product approved which does not require a subsequent epoxy coating. Other approved materials are as follows:

a. Cementitious coating: With required one inch thick application:
   1. Permaform CR-5000;
   2. Strong - Seal MS-2C;
   4. Quadex Aluminaliner;
   5. ConShield Biotech Armor.

b. Epoxy coating: With specified thickness application:
   1. Carboline “Plasite 4500” System: Min required thickness – 125 mils
   2. Carboline Reactamine ET: Min required thickness – 125 mils

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**852.5 CONSTRUCTION:**

1. Manholes shall be constructed of materials and workmanship as prescribed by these specifications, at such places shown in the contract documents or as designated by the Engineer, and in conformity with the typical details and sketches shown.

2. Unless otherwise shown in the contract documents or approved by the Engineer, standard sanitary sewer manholes shall be constructed with influent and effluent piping less than or equal to 24 inches in diameter with precast reinforced concrete manhole sections. A standard sanitary sewer manhole shall be a single entrance cylindrical structure, having a minimum internal diameter of 4 feet between the cone and base sections. The base of the structure shall include the load bearing portion beneath and exterior of the structure, invert channels and the fill or bench portions adjacent to the lower sewer pipes within the structure. The maximum vertical height of the diameter adjustment section or cone shall be 36 inches. Adjustment or throat rings may be used for final elevation adjustment of the manhole ring and cover. Concrete encasement of the manhole’s ring shall be as shown in the DD-852 Standard Drawing Series. Specifically, they shall attach the ring and cover to the diameter adjustment section or cone. Manholes which differ from the above description shall be governed by Item No. 850, "Sanitary

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manhole’s ring shall be as shown in the DD-852 Standard Drawing Series. Specifically, they shall attach the ring and cover to the diameter adjustment section or cone. Manholes which differ from the above description shall be governed by Item No. 850, "Sanitary Sewer Structures."

An internal drop manhole shall be required, when sewer lines enter a manhole more than 24 inches above the manhole invert, while an external drop manhole shall be provided for a sewer entering a manhole more than 30 inches above the invert. Both conditions will require prior approval by the Engineer.

a. Footings or bases of manholes shall be a minimum of 6 inches in depth below the bottom of the pipe.

b. All invert channels shall be constructed and shaped accurately so as to be smooth, uniform and cause minimum resistance to flow. The bench shall be finished smooth with a slope of ½ inch per foot from the manhole walls to the edges of the invert. The top half of all sewer pipes within the invert channel or bench zone shall be removed flush to the inside manhole walls.

c. Joints on sewer pipes shall not be cast or constructed within the wall sections of manholes.

d. Concrete cradles shall be required for new pre-cast manholes. Concrete cradles shall extend beyond the outside walls of the manhole a minimum of 36 inches.

e. Voids between exterior pipe walls and manhole walls at all pipe connections in manholes shall be filled with a non-shrink grout, as specified above, or as approved by the Engineer, or as shown in the contract documents and inspected prior to backfilling.

f. Where connections to existing manholes are required, the adjacent pipe bedding shall be prepared to proper grade, the existing manhole neatly cut and the new pipe inserted so that the end is projecting 2 inches from the inside wall. The invert shall then be reshaped to properly channel new flows. Debris of any kind shall be kept out of new or existing manholes or mains.

g. Joints between cones, risers, adjustment rings, flat tops, and between the ductile cast iron ring and the uppermost adjustment ring or flat top, as applicable, shall be thoroughly sealed in accordance with manufacturer’s recommendations with strongly adhesive bitumastic
products as specified above. Where precast concrete risers are used, any gaps in the outer joint surfaces shall be additionally coated with non-shrink grout to a minimum thickness of \(\frac{1}{4}\) inch.

h. After adjustment ring joints have been sealed as specified above and prior to the placement of final backfill and pavement, the Contractor shall apply the specified heat shrink wrap around the outer perimeter of the adjustment “throat rings”. All receiving surfaces shall first be thoroughly cleaned to allow proper adhesion of the heat shrink wrap. Installation of the wrap shall be in strict accordance with manufacturer’s instructions and using the proper hot air equipment under suitable temperature and dry weather conditions. Provide sufficient vertical overlaps of the wrap around the base of the manhole ductile cast iron ring and the top of the manhole cone as applicable to the finished manhole geometry. Final backfill and pavement work must be conducted in a careful manner to avoid damaging the plastic wrap, as further specified below.

i. No more than 4 throat rings may be used on any new manhole or no more than 21 inches from the top of the cone to the top of the ring and cover.

j. Manhole Ring Encasement: All manhole rings shall be encased with 4,000 psi reinforced concrete as shown in the contract documents or as approved by the Engineer.

(1) Concrete manhole ring encasement shall extend 6 inches below the top of the cone and have a minimum width when measured at the manhole ring of 1 foot. The surface of the encasement shall be flush with the top of the manhole ring.

(2) Where manholes are constructed in existing streets and where directed by the Engineer or shown in the contract documents, the exterior exposed surfaces of the ring, mortar; throat rings and manhole surface shall be coated with a \(\frac{1}{8}\) inch minimum thickness of heat shrink wrap plastic prior to placement of concrete.

852.6 TESTING: The Contractor shall notify Inspector and Engineer 48 hours prior to beginning of manhole testing. The Contractor shall perform the testing for all sanitary sewer manholes in accordance with the following:

1. Leakage Testing: All manholes must pass a leakage test. The contractor shall test each manhole (after assembly and backfilling) for leakage, separate and independent of all other sanitary sewer piping, by means of either a hydrostatic test, vacuum test, or other methods approved by the
Engineer. The Contractor is hereby instructed to conduct either of the two identified tests in the following manner:

a. Hydrostatic Testing: Hydrostatic testing shall be conducted by utilizing approved plugs to seal all influent and effluent pipes in the manhole and filling the manhole to the top of the cone with water. Additional water may be added over a 24-hour period to compensate for absorption and evaporation losses. At the conclusion of the 24-hour saturation period, the manhole shall be filled to the top and observed. Any measureable loss within a 30 minute period shall be considered an unsuccessful test and thus require the Contractor to assess the needed repairs, perform such repairs (subject to the approval of the Engineer), and notify the Inspector when the retest will be performed. All effort, materials, or other costs shall be solely at the Contractor’s expense.

b. Vacuum Testing:
   (1) General: Manholes shall be tested after construction/ installation and backfilling with all connections (existing and/or proposed) in place. Drop-connections and gas sealing connections shall be installed prior to testing.
   
   (2) Test Procedure: The lines entering the manhole shall be temporarily plugged with the plugs braced to prevent them from being drawn into the manhole. The plugs shall be installed in the lines beyond drop connections, gas sealing connections, etc. Prior to performing the test, the Contractor shall plug all lift holes and exterior joints with a non-shrink grout and plug all pipes entering the manhole. No grout shall be placed in horizontal joints prior to testing. Contractor shall use a minimum 60 inch-lb. torque wrench to tighten the external clamps that secure the test cover to the top of the manhole. The test head shall be inflated in accordance with the manufacturer's recommendations. A vacuum of 10 inches of mercury shall be drawn, and the vacuum pump will be turned off. With the valve closed, the level vacuum shall be read after the required test time. If the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury), the manhole will have passed the vacuum test. The required test time is 2 minutes.

   (3) Acceptance: Manholes will be accepted with relation to vacuum test requirements, if they meet the criteria above. Any manhole which fails the initial test must be repaired with a non-shrink grout or other suitable material based on the material of which the manhole is constructed. The manhole shall be retested as described above until a successful test is
attained. After a successful test, the temporary plugs will be removed. To ensure that the plugs have been removed, Contractor shall only do so in the presence of the Inspector. 

(4) Repairs to Existing Manholes: Any existing manhole which fails to pass the hydrostatic/vacuum test shall be closely examined by the Inspector and the Contractor to determine if the manhole can be repaired. Thereafter, the Contractor shall either repair or remove and replace the manhole as directed. The manhole shall then be retested and coated with a SAWS-approved sewer coating as stated above. The Owner may elect to simply remove and replace the existing manhole with a new one. Any manhole excavated for repairs or excavated for tie in, shall be backfilled with flowable fill up to 1 foot below the top of the cone. The Contractor also has the option of backfilling with approved secondary materials, subject to the provisions of Item No. 804, “Excavation, Trenching and Backfill.”

2. Holiday Testing: Inspect each sanitary sewer manhole using high-voltage holiday detection equipment. All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper, or other hand tooling method. After abrading and cleaning, additional protective coating material shall be applied to the repair area. All touch-up repair procedures shall follow the protective coating manufacturer’s recommendations.

3. If a sanitary manhole fails to pass one of the above tests, it shall be repaired in accordance with the manufacturer’s recommendations and re-tested. It shall not be accepted until it passes all tests. All repairs and re-testing shall be at no additional cost to SAWS.

852.6 MEASUREMENT:

1. All manholes zero feet to 6 feet deep and designated in the contract documents will be measured as the total number of such manholes constructed, including those exceeding 6 feet in depth from the lowest invert elevation to the top of the ring.

2. Manholes deeper than 6 feet shall be measured by the number of vertical feet in excess of 6 feet.

852.7 PAYMENT:

1. All manholes shall be paid at the contract unit price bid for each such
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manhole, which price shall be full compensation for all precast sections or throat rings, UV stabilized polyethylene liner, cones, bases, rings and covers, manhole ring, approved sewer coating, encasement, concrete, flowable fill, mortar, drop pipes, saws cutting of surfaces, and fittings, labor, tools, equipment, all testing, tees, wyes, and incidentals necessary to complete the work.

2. Extra depth manholes shall be paid for at the contract unit price bid per vertical foot as measured above.

3. Concrete cradles for pipes shall be measured and paid for at the contract unit price bid as provided for in Item No. 858, "Concrete Encasement, Cradles, Saddles and Collars."

4. Gravel subgrade filler for manholes shall not be measured separately for payment.

5. Hydrostatic Testing and Vacuum testing of new and/or existing structures will not be a pay item. The cost of this work will be included in the bid price for the new and/or existing manholes.

- End of Specification -