



CITY OF BUCKEYE
Engineering Department

Case Number: 18-14

Date: 07-31-19

To: MAG Specifications and Details Committee

From: Craig Sharp

RE: POLYMER CONCRETE MANHOLE SPECIFICATION

Purpose: To create a specification section for corrosion resistant precast polymer concrete manholes utilized in corrosive environments and wastewater systems. Utilized the specification sections for precast concrete manholes as a baseline and modified it for a polymer based concrete (resin, sand, aggregate)

Revisions: revising the reinforcement section 744.5 due to information provided to me by one of the manufacturers:

- Revised the reinforcement section (744.5) to specifically state fiber glass reinforcing **bar** instead of fiberglass reinforcement. Manufacturers pointed out using a fiber mesh instead of a fiberglass reinforcing bar does not have the same structural strength.
- Minor punctuation and sentence revisions.

Updated 07-31-19

SECTION 744
PRECAST POLYMER CONCRETE MANHOLE
REVISED 07-31-19
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744.1 GENERAL:

This specification covers requirements for precast polymer concrete manhole structures. Loading criteria for the precast polymer concrete manholes shall meet or exceed the AASHTO M-306 H20 design loads. All precast manhole bases shall be cast to ensure they are watertight and have a certified structural design. This shall include a manhole base with multi-section cast manhole barrels, cones, and flat lids, which also shall have a certified structural design, sealed and stamped by a Professional Engineer. Precast concrete sections with corrosion protective coatings or polymer concrete barrel sections, flat lids, and cones, can also be used on top of concrete cast-in-place bases that are poured in the field.

744.2 MATERIALS:

744.2.1 Polymer Concrete Materials: Polymer concrete materials shall not contain less than 7% resin content of the weight of the sample in accordance with ASTM D6783 for polymer concrete mix design. All aggregates and sand shall be non-reactive and meet the requirements of ASTM C33. Chemical resistance testing shall comply with the latest revision of ASTM C267, D543, F1216 or ASTM C580. This testing is used to determine the physical properties of material specimens used in sewers after exposure to chemical solutions.

All materials shall be tested above 9,000 psi in compression strength according to ASTM C579, and have a tensile strength of not less than 1,500 psi. The modulus of elasticity shall be a minimum of 1,000 psi in accordance with ASTM C78. The density of the material shall not be below 130-155 pounds per cubic foot (PCF) and the water absorption shall not exceed 0.01%. This shall be certified by the manufacturer and provided in the submittal package. No Portland cement shall be permitted in the concrete mix, and all aggregates shall have a minimum acid insoluble content of 95%.

744.2.2 Precast Sections: The dimensional tolerances and related components of precast polymer concrete manhole sections and precast base sections, shall conform to ASTM C478. The material and manufacturing is allowed compositional and dimensional differences required by a polymer concrete product including the reinforcement. The manufacturer shall incorporate steel or fiberglass bar reinforcement in all polymer manhole components. The reinforcement shall be completely encapsulated in the polymer matrix composition, and a professional engineer shall certify the design of the reinforcement as it is related to the structure. The wall thickness design shall meet or exceed the minimum loading requirements as required by AASHTO M199. The design shall be in accordance with AASHTO M199 using traffic load A-16 (HS20-44) or greater. Polymer manholes shall be designed based upon live and dead load criteria found in ASTM C857 and ACI 350-05. A unit soil weight of 120 PCF shall be used for calculating the soil density around the structure, which includes the cone and barrel sections. All structures shall be designed to withstand 63 PCF liquid density for an internal liquid pressure. This shall be certified by the manufacturer.

744.2.3 Joints and Connections: Details of proposed joints and connections shall be submitted to the engineer for approval and shall conform to ASTM [C990](#) as applicable. With polymer manhole construction, the preferred joint connection shall be per the manufacturer's requirements. In cases where field conditions change and a cast-in-place concrete base is required, the polymer manufacturer shall provide a joint transition mechanism to allow for an interlocking joint system with the cast-in-place concrete base. This transition can be cast with the base or by utilizing transition sections between the materials. This revised joint connection shall only be allowed with the approval of the contracting agency. Water tightness and vacuum testing requirements shall be per contracting agency requirements. Joints shall be sealed in accordance with the manufacturer.

744.3 MANHOLE PENETRATIONS:

The location of penetrations shall be determined by the plans and specifications. Manhole penetrations may be formed or cut out. Cut outs of the precast sections shall be done using a mechanical hole saw. For polymer sections with steel reinforcement, after the core is removed from the polymer section, the manufacturer shall coat all exposed steel reinforcement with a corrosion resistant mortar compound suitable for end use application. The thickness of the compound shall be per the compound manufacturer's recommendation.

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744.4 PIPE CONNECTIONS:

A flexible pipe to manhole connector shall be used whenever a pipe connects into a precast polymer concrete manhole or structure. The design of the connector shall provide a flexible, watertight seal between the pipe and the structure. The connector shall ensure that a seal is made between the structure wall and the pipe by:

- Casting the connector integrally with the structure wall during the manufacturing process in a manner that shall not pull out during pipe coupling.
- Compressing the connector against the inside circumference of the structure by means of wedge or toggle style connection, expansion ring, or other means approved by the engineer.

The connector shall be made from materials that conform to the physical and chemical requirements in ASTM [C923](#) or [C425](#), as applicable. The connector shall be sized specifically for the type of pipe being used, and shall be installed in accordance with the recommendations of the manufacturer.

The connection hardware shall be constructed of type 316 stainless steel meeting ASTM [A480](#). The hardware shall ensure a watertight connection between the polymer concrete and the pipe material, and shall withstand the negative air pressure test per ASTM [C1244](#).

Designs are to be submitted to and approved by contracting agency, and certified by the manufacturer.

744.5 REINFORCING:

Fiberglass bar or steel reinforcement shall be required in flat lids, manhole bases, risers, and cones as required by the manufacturer in accordance with the design sealed by a professional engineer. All reinforcement shall be fiberglass or steel bar type reinforcement per ACI 440. Fiberglass rebar shall conform to ASTM D7205, steel shall conform to ASTM A706.

744.6 LIFTING POINTS:

Lifting points shall be designed and evaluated by a professional engineer. There shall be a minimum of two lifting points on every precast manhole base. After base installation, the lifting holes shall be thoroughly packed with a pre-packaged corrosion resistant compound. Bent reinforcing steel bars shall not be used as lifting devices. Through lifting holes will not be allowed.

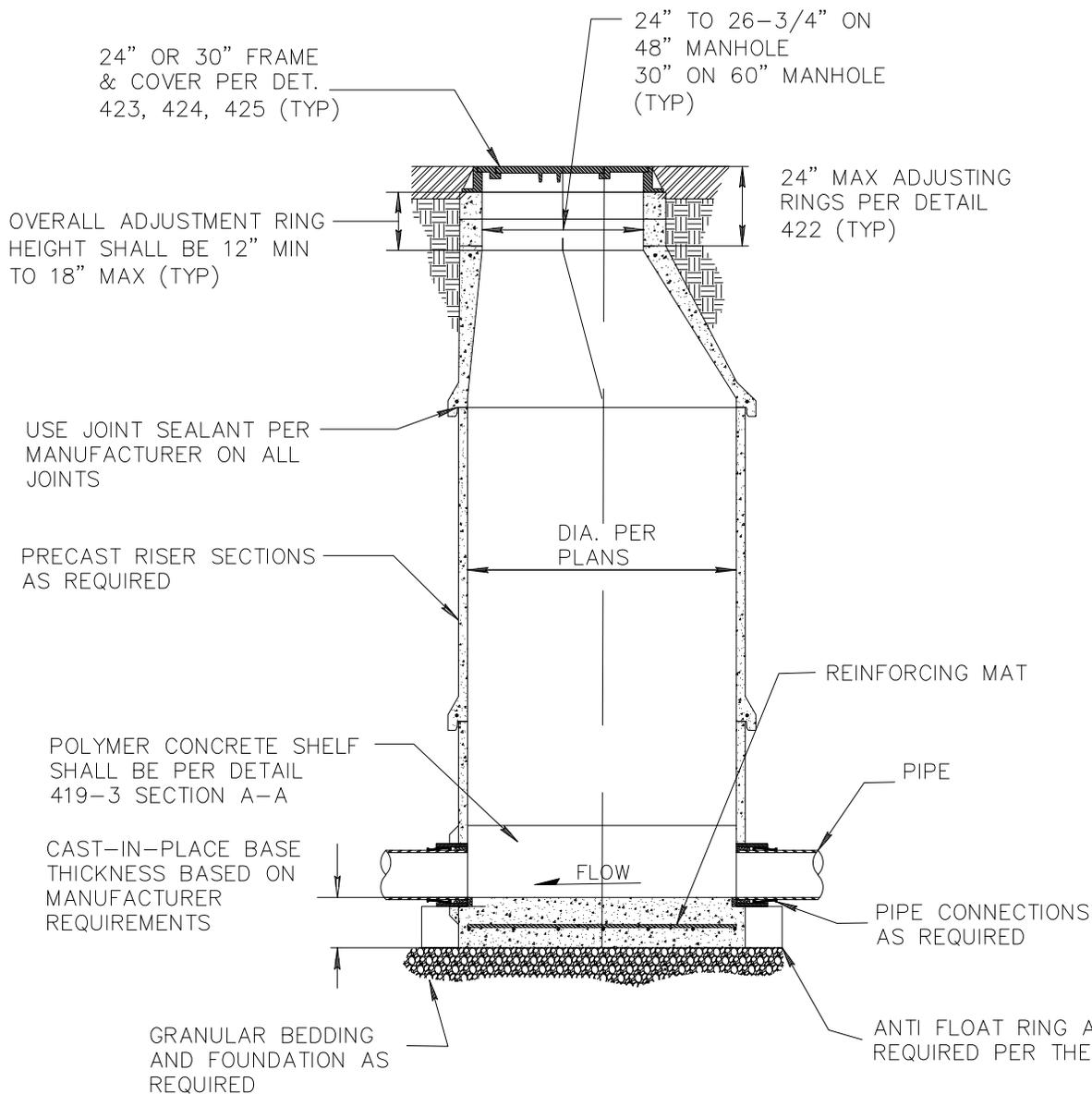
744.7 IMPERFECTIONS:

Any imperfections, which in the opinion of the contracting agency's engineer may adversely affect the performance of the precast section, shall be cause for rejection. The manufacturer is to specify acceptable repair procedures, and identify imperfections that may be acceptable during the manufacturing process.

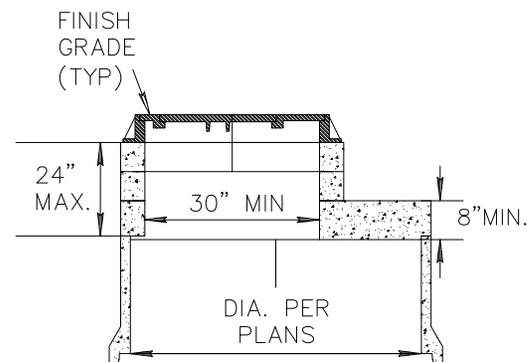
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TYPE 'A' TOP

(POLYMER CONCRETE ECCENTRIC CONICAL TOP MANHOLE)



(POLYMER CONCRETE FLAT TOP M.H.)



NOTES:

1. PRECAST REINFORCED POLYMER CONCRETE MANHOLE SECTIONS SHALL BE MANUFACTURED IN ACCORDANCE WITH MAG SECTION 744.
2. SEE DETAIL 422 FOR FINAL ADJUSTMENT TO GRADE.
3. ALL MANHOLES SHALL REQUIRE ENGINEER (STRUCTURAL) CALCS.
4. THE MANHOLE ACCESS POINT SHALL BE ORIENTED IN SUCH A WAY THAT THE OPENING IS DIRECTLY ABOVE THE LOWEST INVERT, OR AS OTHERWISE DIRECTED BY THE PLANS OR ENGINEER.
5. FOR PRECAST BASE SEE DETAIL 419-2.
6. FLAT TOPS SHALL ONLY BE USED WITH APPROVAL FROM THE ENGINEER.

DETAIL NO.
419-1

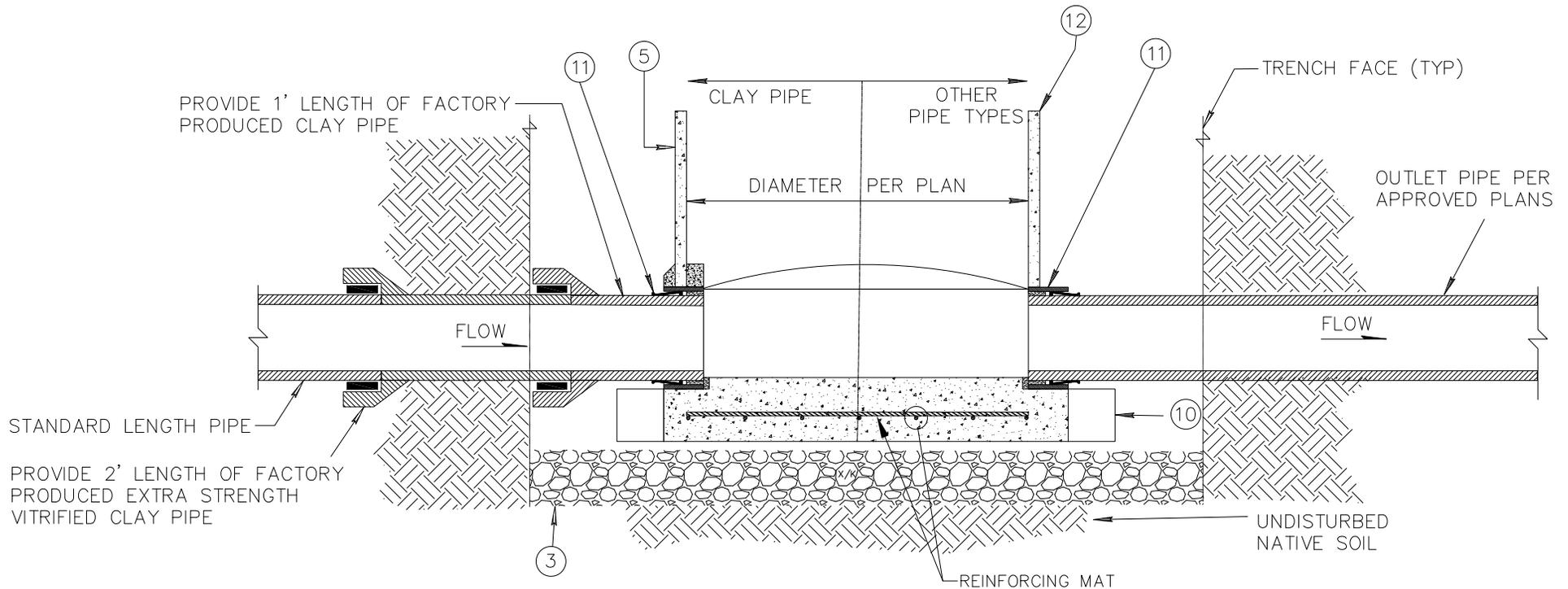


STANDARD DETAIL
ENGLISH

POLYMER CONCRETE SEWER MANHOLE

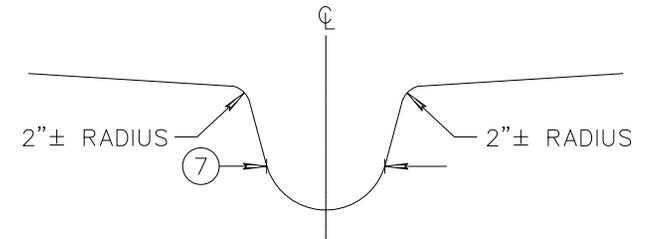
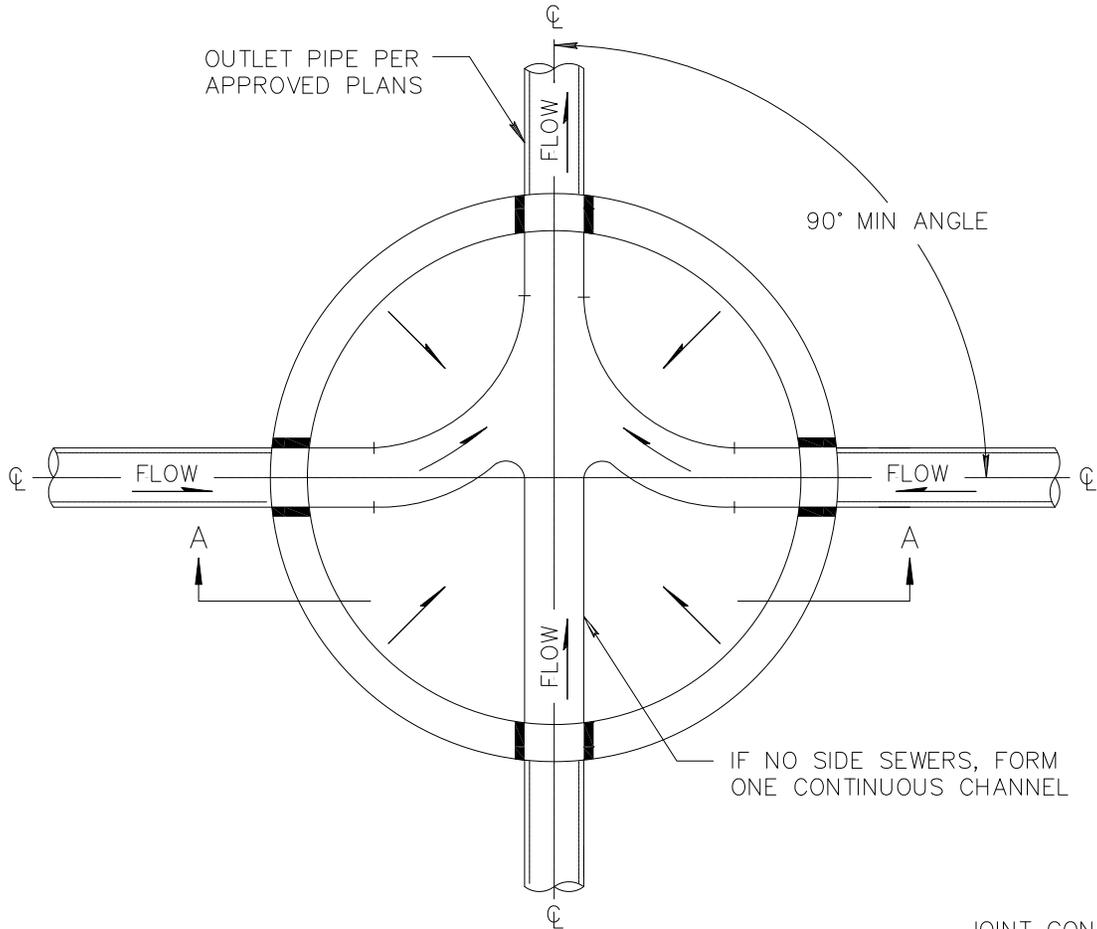
REVISED
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DETAIL NO.
419-1



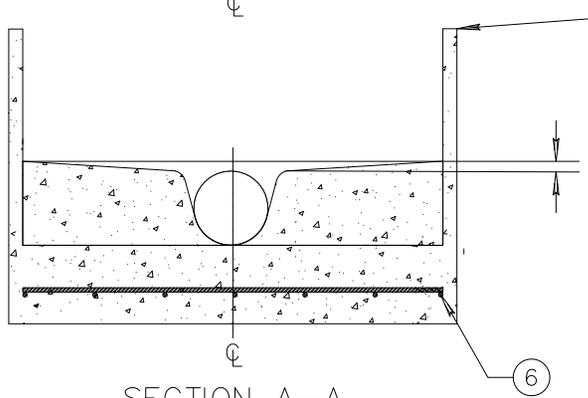
NOTES:

- ① MANHOLE CONSTRUCTION SHALL BE PER SECTION 744.
- ② JOINTS SHALL BE COMPATIBLE WITH CAST-IN-PLACE MANHOLE CONSTRUCTION.
- ③ ALL POLYMER PRECAST MANHOLE BASES SHALL BE PLACED ON 8" MINIMUM OF ABC PER SECTION 702 COMPACTED TO 100% MAXIMUM DENSITY.
- ④ ALL MODIFICATIONS SHALL BE APPROVED BY THE ENGINEER.
- ⑤ WALL THICKNESS SHALL BE 2" MINIMUM BASED ON MANUFACTURER REQUIREMENTS.
- ⑥ REINFORCEMENT SHALL BE REQUIRED PER THE MANUFACTURER RECOMMENDATIONS AND CERTIFIED BY A REGISTERED PROFESSIONAL ENGINEER.
- ⑦ CHANNEL TRANSITION SHALL BE CONSTANT FROM INLET TO OUTLET OF MANHOLE TO FACILITATE SMOOTH TRANSITIONS AND ACCOMMODATE CORRESPONDING MANDREL.
- ⑧ THERE SHALL BE NO HARD CONNECTIONS (GROUTED) INTO THE MANHOLE BASE UNLESS APPROVED BY THE ENGINEER.
- ⑨ ALL SEWER SERVICE CONNECTIONS SHALL HAVE THE SAME CONNECTION TYPES IN THE PRECAST MANHOLE BASE.
- ⑩ EXTENDED BOTTOM SLAB WILL BE A DESIGN OPTION BASED UPON ENGINEERING AND FIELD REQUIREMENTS.
- ⑪ ALL PIPE CONNECTIONS SHALL BE IN COMPLIANCE WITH ASTM F477 OR ASTM C425. AN EXTRA STRENGTH VCP BELL WITH A POLYURETHANE JOINT THAT MEETS ASTM C425 MAY BE USED WITH VCP.
- ⑫ JOINT CONNECTION DESIGN WILL BE BASED ON THE MANUFACTURER'S RECOMMENDATIONS.



CHANNEL TRANSITION SHALL BE CONSISTENT FROM INLET TO OUTLET OF MANHOLE TO FACILITATE SMOOTH TRANSITIONS AND ACCOMMODATE CORRESPONDING MANDREL.

TYPICAL CHANNEL



JOINT CONNECTION DESIGN WILL BE BASED ON MANUFACTURERS RECOMMENDATIONS

TOP OF SHELF TO TOP OF PIPE (MIN 2% SLOPE) NOT TO EXCEED 3"

SEE DETAIL 419-2 FOR NOTES

DETAIL NO.
419-3



STANDARD DETAIL
ENGLISH

POLYMER CONCRETE MANHOLE BASE

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DETAIL NO.
419-3