
Standard Specification for Precast Reinforced Concrete Manhole Sections

AASHTO Designation: M 199M/M 199-24¹

Technically Revised: 2024

Technical Subcommittee: 4a, Concrete Drainage Structures

ASTM Designation: C478/C478M-22



**American Association of State Highway and Transportation Officials
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AASHTO

PART I—GENERAL

1. SCOPE
- 1.1.

This specification covers the manufacture and purchase requirements of products used for the assembly and construction of circular vertical precast reinforced concrete manholes and structures used in sewer, drainage, and water works.
- 1.2.

Part I (Sections 1 through 11) of this specification presents general requirements and requirements that are common to each precast concrete product covered by this specification.
- 1.3.

Part II of this specification presents specific requirements for each manhole product in the following sections:

Product	Section
Grade rings	12
Flat slab tops	13
Risers and conical tops	14
Base sections	15
Steps and ladders	16

Note 1—Future products will be included in Part II in a future revision of this specification.

- 1.4.

This specification is applicable for orders in either SI units (M 199M) or in inch-pound units (M 199). SI units and inch-pound units are not necessarily equivalent. Inch-pound units are shown in brackets in the text for clarity, but they are the applicable values when the material is ordered to M 199.
- Note 2**—This specification is a manufacturing and purchase specification only, and does not include requirements for backfill, or the relationship between field load conditions and the strength requirements of the manhole products and appurtenances. Experience has shown, however, that the successful performance of this product depends on the proper selection of the product strength, type of foundation and backfill, and care in the field installation of the manhole products and connecting pipes. The owner of the project for which these products are specified herein is cautioned to require inspection at the construction site.

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards:*

- M 6, Fine Aggregate for Hydraulic Cement Concrete
- M 31M/M 31, Deformed and Plain Carbon and Low-Alloy Steel Bars for Concrete Reinforcement
- M 80, Coarse Aggregate for Hydraulic Cement Concrete
- M 85, Portland Cement
- M 154M/M 154, Air-Entraining Admixtures for Concrete
- M 157, Ready-Mixed Concrete
- M 194M/M 194, Chemical Admixtures for Concrete
- M 240M/M 240, Blended Hydraulic Cement
- M 262, Concrete Pipe and Related Products
- M 295, Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- M 302, Slag Cement for Use in Concrete and Mortars
- M 336M/M 336, Steel Wire and Welded Wire, Plain and Deformed, for Concrete Reinforcement
- M 339M/M 339, Thermometers Used in the Testing of Construction Materials
- T 22M/T 22, Compressive Strength of Cylindrical Concrete Specimens
- T 280M/T 280, Concrete Pipe, Manhole Sections, or Tile

2.2. *ASTM Standards:*

- A706/A706M, Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
- C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete (withdrawn 2022; use latest historical version)
- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- E230/E230M, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
- E2877, Standard Guide for Digital Contact Thermometers

2.3. *International Electrotechnical Commission Standard:*

- IEC 60584-1:2013, Thermocouples - Part 1: EMF Specifications and Tolerances

2.4. *Other Standard:*

- ACI 318, Building Code, Requirements for Reinforced Concrete

3. TERMINOLOGY

3.1. *Definitions*—For definitions of terms relating to concrete manholes, see M 262.

4. MATERIALS AND MANUFACTURE

- 4.1. General material requirements for precast reinforced concrete manhole products are presented in Sections 4.1.1 through 4.1.8. Other materials or additional requirements for a product, if any, are covered in the Part II section for that specific product.
- 4.1.1. *Reinforced Concrete*—The reinforced concrete shall consist of cementitious materials, mineral aggregates, and water, in which steel reinforcement has been embedded in such a manner so that the steel reinforcement and concrete act together.
- 4.1.2. *Cementitious Materials:*
- 4.1.2.1. *Cement*—Cement shall conform to the requirements for portland cement of M 85, or shall be portland blast-furnace slag cement, portland-limestone cement, or portland-pozzolan cement conforming to the requirements of M 240M/M 240, except that the pozzolan constituent in the Type IP portland-pozzolan cement shall be fly ash.
- 4.1.2.2. *Fly Ash*—Fly ash shall conform to the requirements of Class F or Class C of M 295.
- 4.1.2.3. *Slag Cement*—Slag cement shall conform to the requirements of Grade 100 or 120 of M 302.
- 4.1.3. *Allowable Combinations of Cementitious Materials*—The combination of cementitious materials used in the concrete shall be one of the following:
- 4.1.3.1. Portland cement only,
- 4.1.3.2. Portland blast-furnace slag cement only,
- 4.1.3.3. Portland-pozzolan cement only,
- 4.1.3.4. Portland-limestone cement only,
- 4.1.3.5. A combination of portland cement or portland-limestone cement and slag cement,
- 4.1.3.6. A combination of portland cement or portland-limestone cement and fly ash,
- 4.1.3.7. A combination of portland cement or portland-limestone cement, slag cement, and fly ash, or
- 4.1.3.8. A combination of portland-pozzolan cement and fly ash.
- 4.1.4. *Aggregates*—Aggregates shall conform to M 6 and M 80, except that the requirement for gradation shall not apply.
- 4.1.5. *Admixtures and Blends*—Admixtures and blends shall only be used with the approval of the owner.
- 4.1.5.1. Air-entraining admixture conforming to M 154M/M 154;
- 4.1.5.2. Chemical admixture conforming to M 194M/M 194;
- 4.1.5.3. Chemical admixture for use in producing flowing concrete conforming to ASTM C1017/C1017M;
- 4.1.5.4. Chemical admixture or blend approved by the owner.

- 4.1.6. *Steel Reinforcement*—Reinforcement shall consist of wire or wire reinforcement conforming to M 336M/M 336 or of bars of Grade 300 [40] steel conforming to M 31M/M 31, or bars conforming to ASTM A706/A706M.
- 4.1.7. *Secondary Synthetic Fiber*—Collated fibrillated polypropylene virgin fibers shall not be prohibited when used in steel reinforced concrete manholes as a nonstructural manufacturing enhancement. Only fibers designed and manufactured specifically for use in concrete and so certified by the manufacturer shall be accepted.
- 4.1.8. *Water*—Mix water shall conform with M 157, Section 4.1.4, with a maximum limit of 0.15 percent chloride.
- 4.1.9. *Other Materials*—Other materials required for a product and not covered in Section 4 will be covered in the Part II section for that specific product.

5. DESIGN

- 5.1. Design requirements for a product are prescribed in the specific Part II section for that product.
- 5.1.1. The minimum compressive strength of concrete manhole products covered by this specification shall be 27.6 MPa [4000 psi] unless specified otherwise in Part II of this specification.
- 5.2. *Modified or Special Design:*
- 5.2.1. Manufacturers are not prohibited from submitting to the owner, for approval prior to manufacture, designs other than those prescribed in the specific section for a product. If such approval is obtained, then the product shall meet all the tests and performance requirements specified by the owner in accordance with the appropriate sections on manufacture and physical requirements.
- 5.2.1.1. If a modified or special design consists of requirements other than reinforcement that is specified for the manhole components within this standard, the written submittal shall include installed and handling structural analysis, past product testing and recommended testing, and production quality control processes to provide assurances that the modified or special design assumptions proposed are fully incorporated in the furnished product.
- 5.2.2. If permitted by the owner, the manufacturer is not prohibited from requesting approval of designs of special sections, such as reducers, tees, and bases.

6. REINFORCEMENT

- 6.1. This section presents requirements for reinforcement cover, continuity, laps, welds, and splices. Other reinforcement requirements are presented in Section 4, and any additional requirements are given in the Part II section for a specific product.
- 6.2. *Cover*—The exposure of the ends of reinforcement, stirrups, or spacers used to position the reinforcement during placement of the concrete shall not be cause for rejection.
- 6.3. *Continuity*—The continuity of the circumferential reinforcement shall not be destroyed during the manufacture of the product, except when lift holes or pipe openings are provided in the product.

- 6.4. *Welded Steel Cage Laps, Welds, and Splices:*
- 6.4.1. If splices are not welded, the reinforcement shall be lapped not less than 20 diameters for deformed bars, and 40 diameters for plain bars and cold-worked wire. In addition, where lapped cages of welded wire reinforcement are used without welding, the lap shall contain a longitudinal wire.
- 6.4.2. When splices are welded and are not lapped to the minimum requirements in Section 6.4.1, pull tests of representative specimens shall develop at least 50 percent of the minimum specified ultimate tensile strength of the steel, and there shall be a minimum lap of 50 mm [2 in.]. For butt welded splices in bars or wire, permitted only with helically wound cages, pull tests of representative specimens shall develop at least 75 percent of the minimum specified ultimate tensile strength of the steel.
- 6.5. *Steel Hoop Splices*—A representative sample steel hoop with welded splices shall develop at least 50 percent of the minimum specified ultimate tensile strength of the steel, and there shall be a minimum lap of 50 mm [2 in.]. For butt welded splices, the representative steel hoop sample shall develop at least 75 percent of the minimum specified ultimate tensile strength of the steel.

7. PRECAST CONCRETE MANUFACTURE

- 7.1. *Mixture*—The aggregates shall be sized, graded, proportioned, and mixed with such proportions of cementitious materials and water as will produce a homogeneous concrete mixture of such quality that the products will conform to the test and design requirements of this specification. All concrete shall have a water-cementitious ratio not exceeding 0.53 by weight. Cementitious materials shall be as specified in Section 4.1.2 and shall be added to the mix in a proportion not less than 280 kg/m³ [470 lb/yd³], unless mix designs with a lower cementitious materials content demonstrate that the quality and performance of the product meet the requirements of this specification.
- 7.2. *Curing*—Concrete products shall be subjected to any one of the methods of curing prescribed in Sections 7.2.1 through 7.2.4 or to any other method or combination of methods approved by the owner that will give satisfactory results.
- 7.2.1. *Steam Curing*—Concrete products are placed in a curing chamber, free of outside drafts, and cured in a moist atmosphere maintained by the injection of steam for such time and such temperatures as needed to enable the products to meet the strength requirements. The curing chamber shall be so constructed as to allow full circulation of the steam around the entire product.
- 7.2.2. *Water Curing*—Concrete products are water cured by covering with water-saturated material, or by a system of perforated pipes, mechanical sprinklers, porous hose, or by any other approved method that will keep the products moist during the curing period.
- 7.2.3. *Sealing Membrane*—A sealing membrane conforming to the requirements of ASTM C309 is applied and shall be left intact until the required concrete strength requirements are met. The concrete at the time of application of the membrane shall be within 6°C [10°F] of the atmospheric temperature. All concrete surfaces shall be kept moist prior to the application of the membrane and shall be damp when the membrane is applied. The thermometer for measuring ambient temperature shall meet the requirements of M 339M/M 339, with a temperature range of at least 32 to 110°F and an accuracy of ±2.5°F (see Note 3).
- Note 3**—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E2877 digital metal stem thermometer; ASTM E230/E230M thermocouple thermometer, Type T, any Class or Types J or K, Special Class; IEC 60584 thermocouple thermometer, Type T, any Class or Types J or K, Class 1; or dial gauge metal stem (bimetal) thermometer.