



Designation: A1105 – 17 (Reapproved 2022)

Standard Specification for Corrugated Steel Manhole Assemblies¹

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1. Scope

1.1 This specification covers the manufacture and purchase requirements of products used for assembly and construction of circular reinforced corrugated steel manholes used in sewer and water works. Products covered by this specification are not normally used for the conveyance of sanitary or industrial wastes. The steel sheet used in fabrication of the manhole structures has a protective metallic coating of zinc (galvanizing), aluminum, 55 % aluminum-zinc alloy, or zinc-5 % aluminum-mischmetal alloy, or a polymer pre-coating.

1.2 Part I, Sections 1 through 11, of this specification presents general requirements and requirements that are common to each corrugated steel product in the sections outlined in 1.3.

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

Product	Section
Grade Rings	12
Manhole Structures	13
Base Section	14
Steps and Ladders	15

1.4 Steel sheet with zinc, aluminized or polymeric coating may be specified for the fabrication of the manhole structures. Manhole structures made from sheets with composite coatings are always furnished with an approved coating.

NOTE 1—Pipe fabricated with polymeric coated sheet may be used for sanitary sewers and industrial applications.

NOTE 2—This specification is a manufacturing specification and purchase specification only and does not include requirements for backfill, or the relationship between field load conditions.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This specification is under the jurisdiction of ASTM Committee A05 on Metallic-Coated Iron and Steel Products and is the direct responsibility of Subcommittee A05.17 on Corrugated Steel Pipe Specifications.

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2. Referenced Documents

2.1 ASTM Standards:

- A153/A153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- A563 Specification for Carbon and Alloy Steel Nuts (Metric) A0563_A0563M
- A615/A615M Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- A742/A742M Specification for Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe
- A760/A760M Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
- A762/A762M Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
- A885/A885M Specification for Steel Sheet, Zinc and Aramid Fiber Composite Coated for Corrugated Steel Sewer, Culvert, and Underdrain Pipe (Withdrawn 2006)²
- A929/A929M Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
- B633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel
- B695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
- C33/C33M Specification for Concrete Aggregates
- C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens
- C150/C150M Specification for Portland Cement
- C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- C497 Test Methods for Concrete Pipe, Concrete Box Sections, Manhole Sections, or Tile
- C595/C595M Specification for Blended Hydraulic Cements
- C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- C1619 Specification for Elastomeric Seals for Joining Concrete Structures
- D1056 Specification for Flexible Cellular Materials—Sponge or Expanded Rubber

² The last approved version of this historical standard is referenced on www.astm.org.

2.2 AASHTO Standards:³

T241 Test for Helical Continuous Welded Seam Corrugated Steel Pipe

T249 Test for Helical Lock Seam Corrugated Pipe

3. Terminology

3.1 *Definitions*: For definitions of terms relating to pre-fabricated steel reinforced manholes, see Terminology **A760/A760M**.

4. Materials and Manufacture

4.1 *Steel Sheet for Manhole Structure(s) Pipe*—All pipe fabricated under this specification shall be formed from zinc-coated sheet, aluminum-coated sheet, 55 % aluminum-zinc alloy-coated sheet, zinc-5 % aluminum-mischmetal alloy-coated sheet all conforming to Specification **A929/A929M**, zinc-coated sheet conforming to Specification **A885/A885M**, or polymer precoated sheet meeting **A762/A762M**. If the type of metallic coating is not stated in the order, zinc-coated sheet conforming to Specification **A929/A929M** shall be used. All pipe furnished on the order shall have the same metallic coating, unless otherwise specified.

4.2 *Steel Sheet for Coupling Bands*—The sheets used in fabricating coupling bands shall have the same coating and shall conform to the same specification listed in 4.1 as that used for fabrication of the manhole assembly(s) pipe furnished under the order.

4.3 *Rivets*—The rivets used in riveted pipe shall be of the same material as the base metal specified for the corrugated sheets. They shall be thoroughly galvanized. If bolts and nuts are substituted for rivets (see 4.4.1), they shall meet the following requirements:

	Bolts	Nuts
For A760 pipe	A449	A563 , Grade C
[For A760M SI pipe]	[F568M, Class 8.8]	[A563M, Class 12]

The bolts and nuts shall be hot-dip galvanized in conformance with Specification **A153/A153M**, or be mechanically galvanized in conformance with Specification **B695**, Class 40.

4.4 *Hardware for Joining Systems*—Bolts and nuts for coupling bands shall conform to the following requirements:

	Bolts	Nuts
For A760 pipe	A307	A563 , Grade A
[For A760M pipe]	[F568M, Class 4.6]	[A563M, Class 5]

4.4.1 Bolts, nuts, and other threaded items used with joining systems shall be zinc coated by one of the following processes: hot-dip process as provided in Specification **A153/A153M**; electroplating process as provided in Specification **B633**, Class Fe/Zn 8; or mechanical process as provided in Specification **B695**, Class 8. Other hardware items used with coupling bands shall be zinc coated by one of the following processes: hot-dip process as provided in Specification **A153/A153M**; electroplating process as provided in Specification **B633**, Class Fe/Zn 25; or mechanical process as provided in Specification **B695**, Class 25.

³ Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, <http://www.transportation.org>.

4.5 *Gaskets*—If gaskets are used in joining systems, they shall be a band of expanded rubber meeting the requirements of Specification **D1056** for the “RE” closed-cell grades, or O-rings meeting the requirements of Specification **C1619**.

4.6 *Metallic-Coated Steel Inserts*—Metallic-coated steel inserts for Type IS and Type IIS pipe shall be of the same material specified for the pipe in 4.1 and shall have a metallic coating of the same type and coating weight. In addition to these requirements, when specified in the order, the metallic-coated steel insert shall be fabricated from polymer precoated sheet conforming to Specification **A742/A742M**.

4.7 *Steel Reinforced Concrete*—Reinforced concrete shall consist of cementitious materials, mineral aggregates, and water, in which steel reinforcement has been embedded or contained in such a manner so that the steel and reinforcement act together.

4.7.1 *Cement*—Cement shall conform to the requirements for Portland cement Specifications **C150/C150M**, or shall be Portland blast-furnace slag cement or portland-pozzolan cement conforming to Specifications **C595/C595M**, except that the pozzolan constituent of the Type IP portland-pozzolan cement shall be fly ash and shall not exceed 25% by weight.

4.7.1.1 *Fly Ash*—Fly Ash shall conform to the requirements of Class F or Class C of Specifications **C618**.

4.7.2 *Allowable Combinations of Cementitious Materials*—The combination of cementitious materials used in the concrete shall be one of the following.

4.7.2.1 Portland cement only,

4.7.2.2 Portland blast-furnace slag cement only,

4.7.2.3 Portland pozzolan cement only, or

4.7.2.4 A combination of portland cement and fly ash is between 5 and 25 % by weight of total cementitious materials (Portland cement plus fly ash).

4.7.3 *Aggregates*—Aggregates shall conform to Specifications **C33/C33M**, except that the requirements of gradation shall not apply.

4.7.4 *Admixtures and Blends*—Admixtures or blends shall not be used unless approved by the owner.

4.7.5 *Steel Reinforcement*—Reinforcement shall consist of bars of Grade 40 steel conforming to Specifications **A615/A615M**.

4.7.6 *Other Materials*—Other materials required for a product and not covered in Section 4 will be covered in Part II section for that 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 composite corrugated steel/concrete manhole products covered by this specification shall be 4000 psi unless specified otherwise in Part II of the specification.

5.2 Modified or Special Design:

5.2.1 Manufactures 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 be

tests and performance requirements specified by the owner in accordance with the appropriate sections of manufactures and physical requirements.

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 base.

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 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 pipe openings are provided in the product.

6.4 *Welded Steel Reinforcement 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 bar and cold-drawn wire.

6.4.2 When splices are welded and are not lapped to the minimum requirements in 6.4.1 pull tests of representative specimens shall develop at least 50% of the minimum specified tensile strength of steel, and there shall be a minimum lap of 2 in. For butt welded splices in bars, permitted only with helically wound cages, pull tests of representative specimens shall develop at least 75% of the minimum specified tensile strength of the steel.

7. Cast-in-Place Concrete Manufacture

7.1 *Mixture*—The aggregate 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-to-cement ratio not exceeding 0.53 by weight. Cementitious materials shall be as specified in 4.7.1 and shall be added to the mix in a proportion of not less than 470 lb/yd³, unless mix designs with 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 prescribed in 7.2.1 – 7.2.3 or to any other methods or combination of methods approved by the owner that will give satisfactory results.

7.2.1 *Water Curing*—Concrete products are water-cured by covering with water-saturated, or by any other approved method that will keep products moist during the curing period.

7.2.2 *Sealing Membrane*—A sealing membrane conforming to the requirements of Specifications C309 is applied and shall be left intact until the required concrete strength requirements are met. The concrete at the time of the application of the membrane shall be within 10 °F of the atmospheric tempera-

ture. All concrete surfaces shall be kept moist prior to the application of the membrane is applied.

7.2.3 The manufacturer is not prohibited from combining the methods prescribed in 7.2.1 and 7.2.2 provided the required concrete compressive strength is attained.

8. Acceptance

8.1 *Acceptance Procedures:*

8.1.1 Unless otherwise designated by the owner at the time of, or before, placing an order, acceptance procedures for cast-in-place reinforced concrete manhole products shall not be as specified in the Part II section for a particular product, and shall not be prohibited from consisting of one or more of the following:

8.1.1.1 Acceptance of a product on the basis of tests of materials includes concrete compressive strength.

8.1.1.2 Acceptance of a product on the basis of inspection of the finished product, including amount and placement of reinforcement to determine conformance with the design prescribed under this specification, and freedom from defects.

8.2 *Test Methods:*

8.2.1 *Concrete Compressive Strength Test:*

8.2.1.1 *Type of Specimen*—Compression tests for satisfying the minimum specified concrete strength requirements shall be made on either concrete cylinders or at the option of the manufacturer from the concrete manhole product.

8.2.1.2 *Compression Testing of Cylinders*—Cylinders shall be made in accordance with the Test Methods C497, and shall be tested in accordance with C39/C39M. For manhole products, an owner shall not be prohibited from requiring concrete compressive tests on cylinder specimens numbering in the amount of 5% of the total order of a manhole product, but not to exceed two cylinders for each day's production. The average compressive strength of all cylinders tested shall be equal to or greater than the specified strength of the concrete. Not more than 10% of the cylinders tested shall fall below the specified strength of the concrete. In no case shall any cylinder tested fall below 80% of the specified strength.

8.2.1.3 *Compressive Testing of Cores*—Cores shall be cut from the concrete manhole product and tested in accordance with the Test Methods C497, except that the requirements for moisture conditioning shall not apply. One core shall be taken from a manhole product selected at random from each day's production run of a single concrete strength. When the concrete compressive strength of the core is equal to or greater than 80% of the specified strength of the concrete, the concrete strength of the production run is acceptable. If the core does not meet the preceding concrete strength requirement, another core from the preceding product shall be taken and tested.

8.2.1.4 If the concrete compressive strength of the recore is equal to or greater than 80% of the specified strength of the concrete, the concrete strength of the production run is acceptable. If the recore does not meet the preceding concrete strength requirement, that manhole product shall be rejected. Two manhole products from the remainder of the day's production run shall be selected at random and one core taken from each manhole product and tested. When the average concrete strength of the two cores is equal to or greater than