



Standard Specification  
for



# Corrugated Steel Pipe, Polymer Precoated, for Sewers and Drains

AASHTO DESIGNATION: M 245M-91 (1995)  
(ASTM DESIGNATION: A 762/A 762M-95a)

## 1. SCOPE

**1.1** This specification covers polymer precoated corrugated steel pipe intended for use for storm water drainage, under-drains, the construction of culverts, and similar uses. Pipe covered by this specification is not normally used for the conveyance of sanitary or industrial wastes. The steel sheet used in fabrication of the pipe has a polymer protective coating over a metallic coating of zinc (galvanizing), 55 aluminum-zinc alloy, or zinc-5 percent aluminum-Mischmetal alloy.

**1.2** The polymer coating provides a degree of extra protection for the pipe against abrasion and corrosion as compared to metallic-coated pipe without polymer coating. Some severe environments may cause corrosion problems to accessory items such as rivets or coupling band hardware that does not have a polymer coating. Additional protection for polymer precoated corrugated steel pipe can be provided by use of coatings applied after fabrication of the pipe as described in M 190M.

**1.3** This specification does not include requirements for bedding, backfill, or the relationship between earth cover load and sheet thickness of the pipe. Experience has shown that the successful performance of this product depends upon the proper selection of sheet thickness, type of bedding and backfill, controlled manufacture in the plant, and care in the installation. The installation procedure is described in AASHTO *Standard Specifications for Highway Bridges*, Division II, Section 26.

## 2. REFERENCED DOCUMENTS

### 2.1 AASHTO Standards:

#### 2.1.1 M 190M Bituminous Coated

Corrugated Metal Culvert Pipe and Pipe Arches

M 198 Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

M 218M Steel Sheet, Zinc-Coated (Galvanized) for Corrugated Steel Pipe

M 232M/M 232 Zinc Coating (Hot-Dip) on Iron and Steel Hardware

M 243M Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches

M 246M Steel Sheet, Metallic-Coated and Polymer Precoated, for Corrugated Steel Pipe

M 289M Aluminum-Zinc Alloy Coated Steel Sheet for Corrugated Steel Pipe

M 291M Carbon and Alloy Steel Nuts (Metric)

M 298 Coatings of Zinc Mechanically Deposited on Iron and Steel

T 65M/ T 65 Mass [Weight] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

T 249M Helical Lock Seam Corrugated Pipe

2.1.2 *Standard Specifications for Highway Bridges*

### 2.2 ASTM Standards:

A 493 Stainless and Heat-Resisting Steel for Cold

Heading and Cold Forging Bar and Wire  
A 780 Repair of Damaged Hot-Dip-Galvanized Coatings  
A 796 Structural Design of Corrugated Steel Pipe, Pipe-Arches, and Arches for Storm and Sanitary Sewers  
A 916M Sheet Steel, Zinc-5% Aluminum-Mischmetal Alloy-Coated by the Hot-Dip Process for Storm Sewer and Drainage Pipe  
B 633 Electrodeposited Coatings of Zinc on Iron and Steel  
D 1005 Measurement of Dry Film Thickness of Organic Coatings Using Micrometers  
D 1056 Flexible Cellular Materials—Sponge or Expanded Rubber  
F 568 Carbon and Alloy Steel Externally Threaded Metric Fasteners

## 3. DESCRIPTIONS OF TERMS SPECIFIC TO THIS STANDARD

**3.1 fabricator**—in this specification, the producer of the pipe.

**3.2 manufacturer**—in this specification, the producer of the sheet.

**3.3 purchaser**—in this specification, the purchaser of the finished product.

## 4. CLASSIFICATION

4.1 The corrugated steel pipe covered by this specification is classified as follows:

4.1.1 *Type I*—This pipe shall have a full circular cross-section, with a single thickness of corrugated sheet, fabricated with annular (circumferential) or helical corrugations.

4.1.2 *Type IA*—This pipe shall have a full circular cross-section with an outer shell of corrugated sheet fabricated with helical corrugations and an inner liner of smooth (uncorrugated) sheet attached to the shell at helical lock seams.

4.1.3 *Type IR*—This pipe shall have a full circular cross-section, with a single thickness of smooth sheet, fabricated with helical ribs projecting outwardly.

4.1.4 *Type II*—This pipe shall be a Type I pipe which has been reformed into a pipe-arch, having an approximately flat bottom.

4.1.5 *Type IIA*—This pipe shall be a Type IA pipe which has been reformed into a pipe-arch, having an approximately flat bottom.

4.1.6 *Type IIR*—This pipe shall be a Type IR pipe which has been reformed into a pipe-arch having an approximately flat bottom.

4.1.7 *Type III*—This pipe, intended for use as underdrains or for underground disposal of water, shall be a Type I pipe which has been perforated to permit the in-flow or out-flow of water.

4.1.8 *Type IIIA*—This pipe, intended for use as underdrains, shall consist of a semi-circular cross-section, having a smooth (uncorrugated) bottom with a corrugated top shield.

4.2 Perforations in Type III pipe are included in two classes as described in Section 8.3.2.

## 5. ORDERING INFORMATION

5.1 Orders for material to this specification shall include the following information as necessary, to adequately describe the desired product:

5.1.1 Name of material (polymer-coated corrugated steel pipe);

5.1.2 Grade of polymer coating indicating thickness on inside and outside (Section 6.1.1);

5.1.3 Type of metallic coating (zinc or aluminum-zinc alloy) (Section 6.1.2);

5.1.4 AASHTO designation and date of issue;

5.1.5 Type of pipe (Section 4.1);

5.1.6 Diameter of circular pipe (Table 6), or span and rise of pipe-arch section (Tables 8, 9, or 10);

5.1.7 Length, either total length or length of each piece and number of pieces;

5.1.8 Description of corrugations (Section 7.2);

5.1.9 Sheet thickness (Section 8.1.2);

5.1.10 For Type I and Type II pipe, the pipe fabrication method, whether with annular corrugations or helical corrugations (Section 7.1.1) (Note 1);

5.1.11 Coupling bands, number, and type (Section 9.1) if special type is required;

5.1.12 Gaskets for coupling bands, if required (Section 9.3);

5.1.13 For Type III pipe, class of perforations, if other than Class I (Section 8.3.2);

5.1.14 Certification, if required (Section 14.1); and

5.1.15 Special requirements.

**NOTE 1**—Pipe manufactured with annular corrugations may have an element of weakness in the longitudinal seams as compared to pipe with helical corrugations. Therefore, consideration of the method of fabrication is important when pipe is installed under certain conditions of loading.

## 6. MATERIALS

6.1 *Steel Sheet for Pipe*—All pipe fabricated under this specification shall

| Grades  |                      |                                 |
|---------|----------------------|---------------------------------|
| Grade   | Previous Designation | Coating Thickness $\mu\text{m}$ |
| 250/0   | Type A               | 250/0                           |
| 250/75  | Type B               | 250/75                          |
| 250/250 |                      | 250/250                         |

| Bolts and Nuts        |                |                |
|-----------------------|----------------|----------------|
|                       | Bolts          | Nuts           |
| For pipe fabrication: |                |                |
| For M 245M pipe       | F 568, Cl. 8.8 | M 291M, Cl. 12 |
| For coupling bands:   |                |                |
| For M 245M pipe       | F 568, Cl. 4.6 | M 291M, Cl. 5  |

be formed from polymer precoated sheet conforming to M 246M.

6.1.1 The grade of coating shall be stated in the order, and the polymer coating thickness on both inside and outside of the pipe. The polymer coating is classified by grade corresponding to the thickness in micrometers on each side in SI units. The following grades are usually available (see table entitled "Grades").

6.1.1.1 Any combination of polymer coating thicknesses or other than shown above is subject to agreement between the manufacturer and purchaser or fabricator.

6.1.2 The polymer coating is applied to steel sheet having a metallic coating of zinc or aluminum-zinc alloy, as described in M 218M, M 289M, or ASTM A 916M, respectively. The type of metallic coating should be stated in the order, consistent with thickness availability as shown in Table 7. If the type of metallic coating is not stated, zinc-coated sheet conforming to M 218M shall be used. All pipe furnished on the order shall have the same metallic coating unless otherwise specified.

6.2 *Steel Sheet for Coupling Bands*—The sheet used in fabricating coupling bands shall conform to M 246M with the same polymer coating grade as that used for fabrication of the pipe furnished under the order, and having the same metallic coating.

6.2.1 As an alternate, the steel sheet for coupling bands shall conform to M 218M, M 289M, or ASTM A 916M (with the same metallic coating as the pipe), with the sheet having a bituminous coating according to M 190M, except the thickness requirement shall not apply.

6.2.2 When specifically permitted by the purchaser, coupling bands shall be made of steel sheet conforming to the specification listed in Section 6.2.1 having the same metallic coating as the pipe, but without bituminous coating.

6.3 *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 or sherardized. If bolts and nuts are substituted for rivets (see Section 7.3.1), they shall meet the following requirements (see table entitled "Bolts and Nuts").

The bolts and nuts shall be hot-dip

galvanized in conformance with M 232M/ M 232, or be mechanically galvanized in conformance with M 298 Class 40.

**6.3.1** When specified in the order, rivets used in riveted pipe to be installed in severely corrosive environments shall be made of stainless steel conforming to any of the S3xxx designations in ASTM A 493. Stainless steel rivets may be substituted for those described in Section 6.3 at the fabricator's option.

**NOTE 2**—Some polymer precoated pipe in a severe environment is reported to have failed due to corrosion of rivets conforming to Section 6.3, while the sheet was essentially unaffected. The use of stainless steel rivets is recommended to overcome such problems.

**6.4 Hardware for Coupling Bands**—Bolts and nuts for coupling bands shall conform to the following requirements (see table entitled "Bolts and Nuts"). Bolts, nuts, and other threaded items used with coupling bands shall be zinc coated by one of the following processes: hot-dip process as provided in AASHTO M 232M/ M 232; electroplating process as provided in ASTM B 633, Class Fe/Zn 8; or mechanical process as provided in M 298, 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 M 232M/ M 232; electroplating process as provided in ASTM B 633, Class Fe/Zn 25; or mechanical process as provided in AASHTO M 298, Class 25.

**6.5 Gaskets**—If gaskets are used in couplings, they shall be a band of expanded rubber meeting the requirements of ASTM D 1056 for the "RE" closed

cell grades, or O-rings meeting the requirements of M 198.

## 7. FABRICATION

**7.1 General Requirements**—Pipe shall be fabricated in full circular cross section except for Type IIIA which is described in Section 8.4.

**7.1.1** Type I pipe shall have annular corrugations with lap joints fastened with rivets or shall have helical corrugations with a continuous lock seam extending from end to end of each length of pipe. The type of fabrication used shall be the option of the fabricator unless otherwise specified.

**7.1.2** Type IA pipe shall be fabricated with a smooth liner and helically corrugated shell integrally attached at helical lock seams extending from end to end of each length of pipe. The shell shall have corrugations of nominal 68 or 75 mm pitch.

**7.1.3** Type IR pipe shall be fabricated with helical ribs projecting outward with a continuous lock seam extending from end to end of each length of pipe.

**7.2 Corrugations**—The corrugations shall be either annular or helical as provided in Section 7.1. The direction of the crests and valleys of helical corrugations shall not be less than 60 degrees from the axis of the pipe for pipe diameters larger than 500 mm and not less than 45 degrees from the axis for pipe diameters of 500 mm and smaller.

**7.2.1** For Type I and IA pipe, corrugations shall form smooth continuous curves and tangents. The dimensions of

the corrugations shall be in accordance with Table 1 for the size indicated in the order, except if the depth measurement of one or more corrugations is less than the minimum depth in Table 1, the depth of all corrugations between adjacent seams shall be measured and the values of Table 2 for minimum average depth and minimum corrugation depth shall apply.

**NOTE 3**—Inspection frequently consists of measurement of the depth of one or a few corrugations. If such measurement indicates insufficient depth, application of the requirements in Table 2 provides for acceptance where greater depth of some corrugations compensates for lack of depth of others. These measurements would normally be made at one location between seams on a length of pipe.

**7.2.2** For Type IR pipe, the corrugations shall be essentially rectangular ribs projecting outward from the pipe wall. The dimensions and spacing of the ribs shall be in accordance with Table 3 for the size indicated on the order. For the 292 mm rib spacing, if the sheet between the ribs does not include a lock seam, a stiffener shall be included midway between the ribs. This stiffener shall have a nominal radius of 6.4 mm and a minimum height of 5.1 mm toward the outside of the pipe.

**NOTE 4**—The nominal dimensions and properties for smooth corrugations and for ribs are given in AASHTO *Standard Specifications for Highway Bridges*, Division I, Section 12, and in ASTM A 796.

**7.3 Riveted Seams**—The longitudinal seams shall be staggered to the extent that no more than three thicknesses of sheet are fastened by any rivet. Pipe to be reformed into pipe-arch shape shall have seams meeting the longitudinal seam requirement of Section 8.2.2.

**NOTE 5**—Fabrication of pipe without longitudinal seams in 120 degrees of arc, so that the pipe may be installed without longitudinal seams in the invert, is subject to negotiation between the purchaser and fabricator.

**7.3.1** The size of rivets, number per corrugation, and width of lap at the longitudinal seam shall be as stated in Table 4, depending on sheet thickness, corrugation size, and diameter of pipe. For pipe with 25 mm deep corrugations, M 12

TABLE 1 Corrugation Requirements for Type I, IA, II, IIA, and III Pipe

| Nominal Size                     | Maximum Pitch <sup>A</sup> | Minimum Depth <sup>B</sup> | Inside Radius <sup>C</sup> |         |
|----------------------------------|----------------------------|----------------------------|----------------------------|---------|
|                                  |                            |                            | Nominal                    | Minimum |
| <i>All values in millimeters</i> |                            |                            |                            |         |
| 38 by 6.5 <sup>D</sup>           | 48                         | 6.0                        | 7                          | 6.5     |
| 68 by 13                         | 73                         | 12                         | 17                         | 12      |
| 75 by 25                         | 83                         | 24                         | 14                         | 12      |
| 125 by 25                        | 135                        | 24                         | 40                         | 36      |

<sup>A</sup> Pitch is measured from crest to crest of corrugations, at 90 degrees to the direction of the corrugations.

<sup>B</sup> Depth is measured as the vertical distance from a straightedge resting on the corrugation crests parallel to the axis of the pipe to the bottom of the intervening valley. If the depth measurement of one or more corrugations is less than the value indicated herein, the depth of all corrugations between seams shall be measured, and the requirements of Table 2 shall be applied. (See Section 7.2.1.)

<sup>C</sup> Minimum inside radius requirement does not apply to a corrugation containing a helical lock seam.

<sup>D</sup> The corrugation size of 38 by 6.5 mm is available only in helically corrugated pipe.