Designation: A 1019/A 1019M – 01

Standard Specification for Closed Rib Steel Pipe with Diameter of 36 in. [900 mm] or Less, Polymer Precoated for Sewers and Drains[1]

This standard is issued under the fixed designation A 1019/A 1019M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers polymer precoated, closed rib steel pipe, intended for use for storm water drainage, underdrains, 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.

1.2 The polymer precoating provides extra protection of the base metal against corrosion or abrasion, or both, in addition to that provided by the metallic coating. Severe environments are likely to cause corrosion problems to accessory items such as coupling band hardware that does not have a polymer coating unless supplemental protection is provided. Additional protection for polymer precoated steel pipe is available by use of coatings applied after fabrication of the pipe as described in Specification A 849.

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 with drainage products has shown that successful performance depends upon the proper selection of rib depth, sheet thickness, type of bedding and backfill, controlled manufacture in the plant, and care in installation. The installation procedure is described in Practice A 798/A 798M.

1.4 This specification is applicable to orders in either inch-pound units as A 1019, or in SI units as A 1019M. Inch-pound units and SI units are not necessarily equivalent. SI units are shown in brackets in the text for clarity, but they are the applicable values when the material is ordered to A 1019M.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

A 90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles With Zinc or Zinc-Alloy Coatings[2]

A 153/A153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware[2,3]

A 307 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength[3]

A 563 Specification for Carbon and Alloy Steel Nuts[3]

A 563M Specification for Carbon and Alloy Steel Nuts [Metric][3]

A 653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process[2]

A 742/A742M Specification for Steel Sheet, Metallic Coated, and Polymer Precoated for Corrugated Steel Pipe[2]

A 780 Practice for Repair of Damaged Hot-Dip Galvanized Coatings[2]

A 796/A796M Practice for Structural Design of Corrugated Steel Pipe, Pipe-Arches, and Arches for Storm and Sanitary Sewers and Other Buried Applications[2]

A 798/A798M Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications[2]

A 849 Specification for Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe[2]

A 902 Terminology Relating to Metallic Coated Steel Products[2]

A 924/A924M Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process[2]

B 633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel[3]

B 695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel[4]

C 443 Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets[5]

D 1005 Test Methods for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers[6]

D 1056 Specification for Flexible Cellular Materials,

[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] *Annual Book of ASTM Standards*, Vol 01.06.

[3] *Annual Book of ASTM Standards*, Vol 15.08.

[4] *Annual Book of ASTM Standards*, Vol 02.05.

[5] *Annual Book of ASTM Standards*, Vol 04.05.

[6] *Annual Book of ASTM Standards*, Vol 06.01.

Sponge or Expanded Rubber[7]
E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[8]
F 568 Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners[3]
2.2 *AASHTO Standard:*
T 249M Test for Helical Lock Seam Corrugated Pipe[9]

3. Terminology

3.1 *General Definitions*—For definitions of general terms used in this standard, refer to Terminology A 902.
3.2 *Definitions of Terms Specific to This Standard:*
3.2.1 *fabricator*—the producer of the pipe.
3.2.2 *manufacturer*—the producer of the sheet.
3.2.3 *purchaser*—the purchaser of the finished product.

4. Classification

4.1 The closed rib steel pipe covered by this specification is of the following type:
4.1.1 *Type ICR*—This pipe shall have a full circular cross section with a single thickness of smooth sheet, fabricated with closed helical ribs projecting outwardly.

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 closed rib steel pipe),
5.1.2 ASTM designation and year of issue, as A 1019 - XX for inch-pound units or as A 1019M - XX for SI units,
5.1.3 Diameter of circular pipe (Table 1),

TABLE 1 Pipe Sizes

Nominal Inside Diameter		Closed Rib Profile Sizes[A]		
in.	mm	¼ by 5-7/16 [6 by 138 mm]	⅜ by 5-7/16 [9.5 by 138 mm]	½ by 5-7/16 [13 by 138 mm]
6	150	x		
8	200	x		
10	250	x		
12	300	x	x	
15	375		x	
18	450		x	
21	500		x	
24	600			x
27	675			x
30	750			x
33	825			x
36	900			x

[A] An "x" indicates standard closed rib profile sizes for each nominal diameter of pipe.

5.1.4 Length, either total length or length of each piece and number of pieces,
5.1.5 Description of wall profile (7.2),
5.1.6 Sheet thickness (8.2),
5.1.7 Coupling bands, number, and type (9.1) if special type is required,
5.1.8 Gaskets for coupling bands, if required (9.2.5),
5.1.9 Certification, if required (14.1), and
5.1.10 Special requirements.

6. Materials and Manufacture

6.1 *Steel Sheet for Pipe*—All pipe fabricated under this specification shall be formed from polymer precoated sheet conforming to Annex A1 of this specification.
6.1.1 The polymer coating shall be applied to steel sheet having a metallic coating of zinc.
6.2 *Steel Sheet for Coupling Bands*—The sheet used in fabricating coupling bands shall be the same as that specified for fabrication of the pipe furnished under the order, with the same polymer coating and same metallic coating.
6.3 *Hardware for Coupling Bands*—Bolts and nuts for coupling bands shall conform to the following requirements:

	Bolts	Nuts
For A 1019 pipe	A 307	A 563, Grade A
[For A 1019M pipe]	[F 568, Class 4.6]	[A 563M, Class 5]

6.3.1 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 Specification A 153; electroplating process as provided in Specification B 633, Class Fe/Zn 8; or mechanical process as provided in Specification B 695, 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 A 153; electroplating process as provided in Specification B 633, Class Fe/Zn 25; or mechanical process as provided in Specification B 695, Class 25.
6.4 *Gaskets*—If gaskets are used in couplings, they shall be a band of expanded rubber that meets the requirements of Specification D 1056 for the "RE" closed cell grades, O-rings meeting the requirements of Specification C 443, or other material approved by the purchaser.

7. Fabrication

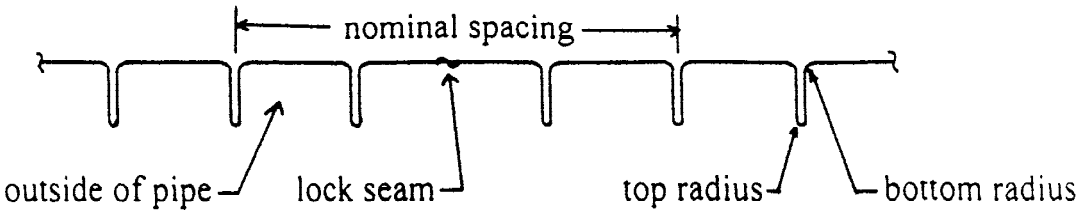
7.1 *General Requirements*—Pipe shall be fabricated in full circular cross section.
7.1.1 The pipe shall be fabricated with essentially closed helical ribs projecting outward, with a continuous lock seam extending from end to end of each length of pipe.
7.2 *Wall Profile*—The dimensions and spacing of the ribs shall be in accordance with Table 2 for the nominal size indicated on the order. The ribs shall be spaced such that, after every third rib, a wider spacing is provided to accommodate the lock seam.
7.2.1 The maximum spacing of the lock seam, measured perpendicular to the lock seam, shall be 5-¾ in. [146 mm].

NOTE 1—The nominal dimensions and properties for pipe wall profiles are given in Practice A 796/A 796M.

7.3 *Helical Lock Seams*—The lock seam shall be formed in the flat zone of the pipe wall midway between each pair of ribs having the wider spacing described in 7.2.
7.3.1 The edges of the sheets within the cross section of the lock seam shall lap at least 5/32 in. [4.0 mm] with an occasional

[7] *Annual Book of ASTM Standards*, Vol 09.02.
[8] *Annual Book of ASTM Standards*, Vol 14.02.
[9] Available from American Association of State Highway and Transportation Officials, 444 N. Capital, Washington, DC 20001.

TABLE 2 Rib Requirements



Nominal Size[A]	Rib Width,[B] max	Rib Depth,[C] min	Rib Spacing,[D] max	Bottom Outside Radius, min	Bottom Outside Radius,[E] max avg	Top Outside Radius, min	Top Outside Radius, max
			A1019, in.				
¼ × 5-7⁄16	0.12	0.24	1.25	0.06	0.15	0.04	0.06
⅜ × 5-7⁄16	0.12	0.36	1.25	0.06	0.15	0.04	0.06
½ × 5-7⁄16	0.12	0.48	1.25	0.06	0.15	0.04	0.06
			A1019M, mm				
6 × 138	3.0	6.1	32	1.5	3.8	1.0	1.5
9.5 × 138	3.0	9.1	32	1.5	3.8	1.0	1.5
13 × 138	3.0	12.2	32	1.5	3.8	1.0	1.5

[A] Nominal size is the nominal rib depth times the repetitive spacing of three-rib clusters. Spacing of individual ribs varies.
[B] Width is measured on the outside of the pipe (outside of the rib).
[C] Depth is an average of the three ribs within one sheet width measured from the outside by placing a straight edge across adjacent ribs and measuring to the flat between ribs, adjacent to a rib.
[D] Spacing is an average of two adjacent rib spacings, exclusive of the spacing that includes the lock seam. For the spacing that includes the lock seam, the maximum spacing shall be 3-⅛ in. [79 mm], and the lock seam shall be approximately at the midwidth of this spacing.
[E] The average of the two bottom radii shall be within the minimum and maximum tolerances. The term "outside" refers to the outside surface of the pipe.

tolerance of -10 % of lap width allowable. The lapped surfaces shall be in tight contact. The profile of the sheet shall include a retaining offset adjacent to the 180° fold (as described in AASHTO T 249) of one sheet thickness on one side of the lock seam, or one-half sheet thickness on both sides of the lock seam, at the fabricator's option. There shall be no visible cracks in the metal, loss of metal-to-metal contact, or excessive angularity on the interior of the 180° fold of metal at the completion of forming the lock seam. Damage to the polymer coating or the underlying metallic coating is subject to repair in conformance with Section 11.

7.3.2 Specimens cut from production pipe normal to and across the lock seam shall develop the tensile strength listed in Table 3, when tested in accordance with AASHTO T 249M.

8. Pipe Requirements

8.1 *Pipe Dimensions*—The nominal diameter of the pipe shall be as stated in the order, selected from the sizes listed in Table 1. The size of closed rib profiles that are standard for each size of pipe are also shown in Table 1. The average inside diameter of circular pipe, when measured on the inside of the pipe, shall not be less than the nominal diameter and shall not exceed the nominal diameter by more than 3⁄16 in. [5 mm].

8.2 *Sheet Thickness*—Sheet thickness shall be as specified by the purchaser from the specified sheet thicknesses listed in Annex A1.

TABLE 3 Lock Seam Strength

Specified Sheet Thickness		Lock Seam Tensile Strength per Unit Width, min	
in.	mm	lbf/in.	kN/m
0.022	0.56	95	17
0.028	0.71	120	21

9. Coupling Bands

9.1 *Types of Coupling Bands*—Field joints for each type of closed rib pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installation. Coupling bands shall be of the following types: smooth, internal sleeve-type coupling with optional supplemental external coupling; and bands of special design. The type of coupling furnished shall be the option of the fabricator unless the type is specified in the order.

NOTE 2—Pipe joints are classified in accordance with their ability to resist shear, moment, and tensile forces as described in Practice A 798/A 798M and identified as "stab joints," "standard joints," and "special joints." Classification shall be determined by analysis or test.

9.2 *Requirements*—Coupling bands shall be fabricated to lap on an equal portion of each of the pipe sections to be connected. The coupling band sheet thickness shall be no less than the sheet thickness of the pipe to be connected.

9.2.1 Smooth internal sleeve-type couplings shall be close-fitting to hold the pipe firmly in alignment and shall contain a device so that it will lap equally on the two pipes being joined. Annular deformations ⅜ in. [9.5 mm] deep shall be permitted in the coupling band for seating gaskets as described in 9.2.2 and 9.2.5. The overall coupling width (dimension measured along the axis of the pipe) shall be a minimum of 6 in. [150 mm] for pipe diameters of 24 in. or greater, and shall be a minimum of 4 in. [100 mm] for smaller diameters.

9.2.2 Where infiltration or exfiltration is a concern, the use of supplemental external couplings with gaskets shall be considered. Supplemental external couplings shall be of steel having the same nominal thickness as the pipe being joined. The ends of the bands shall lap or be fabricated to form a tightly closed joint after installation. The overall width of the coupler shall be a minimum of 8 in. [200 mm] for pipe diameters of 24 in. or greater, and shall be a minimum of 7 in.

[175 mm] for smaller diameters. The bands shall be connected in a manner approved by the purchaser with suitable galvanized devices such as: angles, or integrally or separately formed and attached flanges, connected with bolts; bars and straps; wedge lock and straps; or lugs. Coupling bands shall be fastened with the following size of bolts:

9.2.3 Pipe diameters 18 in. [450 mm] and less, ⅜-in. [Metric M 10] diameter.

9.2.4 Pipe diameters 21 in. [525 mm] and greater, ½-in. [Metric M 12] diameter.

9.2.5 *Gaskets*—Gasket materials shall be as specified in 6.4. Closed-cell expanded rubber gaskets shall be a continuous band, with a width approximately equal to the width of the coupling band, and a thickness adequate to seal the joint. Rubber O-ring gaskets shall be of a diameter adequate to seal the joint. Other types of gaskets shall be permitted when approved by the purchaser.

9.3 Other types of coupling bands or fastening devices that are equally effective as those described, and which comply with the joint performance criteria of Practice A 798/A 798M, shall be permitted when approved by the purchaser.

10. Workmanship, Finish and Appearance

10.1 The completed pipe shall show carefully, finished workmanship in all particulars. Pipe that has been damaged, either during fabrication or in shipping, shall be subject to rejection unless repairs are made which are satisfactory to the purchaser. Among others, the following defects shall be considered as constituting poor workmanship, if of a magnitude likely to affect the integrity of the pipe:

10.1.1 Variation from a straight centerline.

10.1.2 Elliptical shape in pipe intended to be round.

10.1.3 Dents or bends in the metal.

10.1.4 Polymer coating or metallic coating that has been broken, disbonded, or otherwise damaged.

10.1.5 Lack of rigidity.

10.1.6 Illegible markings on the steel sheet.

10.1.7 Ragged or diagonal sheared edges.

10.1.8 Loosely formed lock seams.

11. Repair of Damaged Coatings

11.1 Pipe on which either the polymer coating or the underlying metallic coating has been damaged in fabricating or handling shall be repaired. Damage to the metallic coating shall be repaired as described in 11.2-11.4. Damage to the polymer coating shall be repaired as described in 11.5. The repair shall be done so that the completed pipe shall show carefully finished workmanship in all particulars. Pipe that, in the opinion of the purchaser, has not been cleaned or coated satisfactorily shall be subject to rejection. If the purchaser so elects, the repair shall be done in his or her presence.

11.2 Damage to the metallic coating shall be repaired as provided in Practice A 780, except as described herein. The damaged area shall be cleaned to bright metal by blast cleaning, power disk sanding, or wire brushing. The cleaned area shall extend at least ½ in. [13 mm] into the undamaged section of the coating. The cleaned area shall be coated within 24 h and before any rusting or soiling.

11.3 *Paints Containing Zinc Dust*—Paints containing zinc dust as described in the Materials section of Practice A 780 shall be applied to a dry film thickness of at least 0.005 in. [0.13 mm] over the damaged section and surrounding cleared area.

11.4 *Metallizing Coating*—The damaged area shall be cleaned as described in 11.2, except it shall be cleaned to the near-white condition. The repair coating applied to the cleaned section shall have a thickness of not less than 0.005 in. [0.13 mm] over the damaged section and shall taper off to zero thickness at the edges of the cleaned undamaged section.

11.4.1 Where the zinc coating is to be metallized, it shall be done with zinc wire containing not less than 99.98 % zinc.

11.5 *Polymer Coating*—Areas of damaged polymer coating shall be repaired with a polymer coating similar and compatible with respect to durability, adhesion, and appearance of the original polymer coating. The coating material and method of application used for the repair must be approved by the manufacturer of the original polymer precoat material.

11.5.1 Polymer coating damaged during shipping or installation shall be repaired using materials as described in 11.5 or by the application of a protective coating material conforming to Specification A 849.

12. Inspection

12.1 The purchaser or representative shall have free access to the fabricating plant for inspection, and every facility shall be extended for this purpose. This inspection shall include an examination of the pipe for the items in 10.1 and the specific requirements of this specification applicable to the type of pipe.

12.2 On a random basis, samples shall be permitted to be taken for chemical analysis and metallic and polymer coating measurements for check purposes. These samples will be secured from fabricated pipe or from sheets or coils of the material used in fabrication of the pipe. The weight [mass] of metallic coating shall be determined in accordance with Test Method A 90/A 90M. The thickness of polymer coating shall be measured in accordance with Test Method D 1005.

13. Rejection

13.1 Pipe failing to conform to the specific requirements of this specification, or that shows poor workmanship, shall be subject to rejection. This requirement applies not only to the individual pipe, but to any shipment as a whole where a substantial number of pipe are defective. If the average deficiency in length of any shipment of pipe is greater than 1 %, the shipment shall be subject to rejection.

14. Certification

14.1 When specified in the purchase order or contract, a manufacturer's or fabricator's certification, or both, shall be furnished to the purchaser stating that samples representing each lot have been tested and inspected in accordance with this specification and have been found to meet the requirements for the material described in the order. When specified in the order, a report of the test results shall be furnished.

15. Keywords

15.1 closed-rib steel pipe; drainage pipe; metallic-coated steel pipe; polymer-precoated steel pipe; sewer pipe

ANNEX

(Mandatory Information)

A1. MATERIAL REQUIREMENTS

A1.1 Scope

A1.1.1 This annex covers requirements for the material for fabrication of closed rib steel pipe under this specification.

A1.2 Polymer Precoated Sheet

A1.2.1 The material shall be precoated polymer sheet that conforms to the requirements of Specification A 742/A 742M except as modified in A1.2.2 and A1.3.

A1.2.2 The polymer coating grade shall be as follows:

	Coating Thickness	
Grade	in.	µm
6/6 [150/150]	0.006/0.006	150/150

The thicknesses indicated are minimum values at any point not less than ⅜ in. [10 mm] from an edge.

A1.2.3 *Alternate Marking*—An alternate method and frequency of marking coils or finished pipe that provides the same information described in A 742/A 742M shall be permitted when approved by the purchaser.

A1.3 Metallic-Coated Substrate

A1.3.1 The metallic-coated substrate shall conform to all applicable requirements of Specification A 653/A 653M for a zinc coating.

A1.3.2 The specified thickness of the metallic coated substrate sheet, not including the thickness of the polymer coating, shall be selected from the following:

Specified Thickness, in. [mm]	Minimum Thickness, in. [mm]
0.022 [0.56]	0.020 [0.51]
0.028 [0.71]	0.026 [0.66]

A1.3.3 The metallic coating weight [mass] shall conform to the requirements for a G90 [Z275] coating listed in Table A1.1.

A1.3.4 Adhesion of the coating shall be such that no peeling or flaking occurs while forming during pipe fabrication.

TABLE A1.1 Coating Weight [Mass] Requirements

	Coating Weight [Mass], Total Both Sides[A]		Equivalent Coating Thickness, Total Both Sides[B]	
Type	Triple Spot Average, min oz/ft^2[g/m^2]	Single Spot, min oz/ft^2[g/m^2]	Triple Spot Average, min in. [µm]	Single Spot, min in. [µm]
Zn	0.90 [275]	0.80 [235]	0.0015 [38]	0.0014 [36]

[A] In case of dispute when sampling for coating weight [mass], the weigh-strip-weigh procedures of Test Method A 90 [A 90M] shall apply.

[B] Coating thicknesses are approximate, for information only. Conversions are based on the following relationship: 1 oz/ft^2= 0.0017 in., 1 g/m^2= 0.1401 µm.

TABLE A1.2 Chemical Composition

	Heat Analysis	Product Analysis
Sulfur, max, %	0.05	0.06
Sum of carbon, manganese, phosphorus, sulfur, and silicon, max, %	0.70	0.74

TABLE A1.3 Mechanical Requirements (Properties of Flat Sheet Prior to Fabrication)[A]

Tensile strength, min,[B] ksi [MPa]	45.0 [310]
Yield strength, min,[B] ksi [MPa]	33.0 [230]
Elongation in 2 in. [50 mm], min, %	20

[A] To determine conformance with this specification, round each value for tensile strength and yield strength to the nearest 0.1 ksi [1 MPa] and each value for elongation to the nearest 1 %, both in accordance with the rounding method of Practice E 29.

[B] Yield strength and tensile strength are based on the thickness of the base metal. If tests are made after coating, determine the base metal thickness after stripping the coating from the ends of the specimen contacting the grips of the tensile testing machine prior to tensile testing.

A1.3.5 *Base Metal Analysis*—The base metal heat or product analysis shall conform to the chemical requirements of Table A1.2.

A1.3.6 *Coating Bath Composition*:

A1.3.6.1 *Zinc Coating*—The coating bath metal shall contain not less than 99 % zinc.

A1.3.7 *Mechanical Properties*—The metallic coated sheet shall conform to the mechanical requirements listed in Table A1.3.

A1.3.7.1 Two tension tests shall be made on random samples of finished material (flat unformed sheet) from said heat. One test is sufficient when the finished material from said heat is less than 50 tons [45 Mg]. The samples shall be prepared and tested in accordance with the method specified in A 924 [A 924M].

A1.3.8 *Other Tests*—The manufacturer shall make such tests and measures as deemed necessary to ensure that the coated sheet produced complies with this specification.

A1.3.9 *Retention of Test Results*—The test results, including chemical composition, mechanical properties, coating type, and coating weight [mass] for each heat and coating lot, shall be maintained by the manufacturer for seven years. The test results shall be made available to the fabricator and purchaser upon request.