Designation: A762/A762M – 15

Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains[1]

This standard is issued under the fixed designation A762/A762M; 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 corrugated 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, 55 % aluminum-zinc alloy, or zinc-5 % aluminum-mischmetal alloy.

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. 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 Specification A849.

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 Practice A798/A798M.

1.4 This specification is applicable to orders in either inch-pound units as A762, or in SI units as A762M. 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 A762M.

[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:*[2]

A90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

A153/A153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A307 Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

A449 Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use

A493 Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging

A563 Specification for Carbon and Alloy Steel Nuts

A563M Specification for Carbon and Alloy Steel Nuts (Metric)

A742/A742M Specification for Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe

A780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

A796/A796M Practice for Structural Design of Corrugated Steel Pipe, Pipe-Arches, and Arches for Storm and Sanitary Sewers and Other Buried Applications

A798/A798M Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications

A849 Specification for Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe

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

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

C443 Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
D1056 Specification for Flexible Cellular Materials—Sponge or Expanded Rubber
F568M Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners (Metric) (Withdrawn 2012)[3]

2.2 *AASHTO Standard:*
T 249 Test for Helical Lock Seam Corrugated Pipe[4]

2.3 *AISI Standard:*[5]
AISI 100 North American Specification for the Design of Cold-Formed Steel Structural Members

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *fabricator, n*—the producer of the pipe.

3.1.2 *manufacturer, n*—the producer of the sheet.

3.1.3 *minimized coating structure, n*—a coating characterized by a finer metallurgical coating structure obtained by a treatment designed to restrict the formation of the normal coarse grain structure formed during solidification of the Zn-5 Al-MM alloy coating.

3.1.4 *purchaser, n*—the purchaser of the finished product.

3.1.5 *regular coating structure, n*—the normal coating structure resulting from unrestricted grain growth during normal solidification of the Zn-5 Al-MM alloy coating.

3.2 *Abbreviations:*

3.2.1 55 Al-Zn—55 % aluminum-zinc.

3.2.2 Zn-5 Al-MM—zinc-5 % aluminum-mischmetal.

3.2.3 MM—mischmetal.

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 and an inner liner of smooth (uncorrugated) sheet, fabricated with helical corrugations and 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 HR*—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 semicircular 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 8.3.2.

4.3 Zn-5 Al-MM alloy coated material is available in two coating classes, or structures, as follows:

4.3.1 *Class A*—Minimized coating structure, and

4.3.2 *Class B*—Regular coating structure.

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 (6.1),

5.1.3 Type of metallic coating (zinc, aluminum, 55 Al-Zn alloy, or Zn-5 Al-MM alloy) (6.1),

5.1.4 ASTM designation and year of issue, as A762-__ for inch-pound units or as A762M–__ for SI units,

5.1.5 Type of pipe (4.1),

5.1.6 Diameter of circular pipe, Table 1, or span and rise of pipe-arch section, Table 2 [Table 3] or Table 4 [Table 5],

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

5.1.8 Description of corrugations (7.2),

5.1.9 Sheet thickness (8.1.2),

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

NOTE 1—Pipe with annular corrugations with spot welded or riveted seams is designed by different criteria compared to pipe with helical corrugations. Pipe with annular corrugations must consider seam strength. Therefore, consideration of the method of fabrication is important when pipe is installed under certain conditions of loading.

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

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

5.1.13 For Type III pipe, class of perforations, if other than Class 1 (8.3.2),

5.1.14 Certification, if required (14.1), and

5.1.15 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 Specification A742/A742M.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] 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.

[5] Available from American Iron and Steel Institute (AISI), 25 Massachusetts Ave., NW, Suite 800, Washington, DC 20001, http://www.steel.org.

TABLE 1 Pipe Sizes

Nominal Inside Diameter		Corrugation Sizes[A]			Ribbed Pipe				Minimum Outside Circumference[B]	
in.	mm	1½ by ¼ in. [38 by 6.5 mm]	2⅔ by ½ in. [68 by 13 mm]	3 by 1 in. [75 by 25 mm]	5 by 1 in. [125 by 25 mm]	¾ by ¾ by 7½ in. [19 by 19 by 190 mm]	¾ by 1 by 11½ in. [19 by 25 by 292 mm]	¾ by 1 by 8½ in. [19 by 25 by 216 mm]	in.	mm
4	100	X							11.4	264
6	150	X							17.7	441
8	200	X							24.0	598
10	250	X							30.2	755
12	300	X	X						36.5	912
15	375	X	X						46.0	1148
18	450	X	X			X	X	X	55.4	1383
21	500		X			X	X	X	64.8	1620
24	600		X			X	X	X	74.2	1854
27	675		X			X	X	X	83.6	2091
30	750		X			X	X	X	93.1	2483
33	825		X			X	X	X	102.5	2561
36	900		X	X	X	X	X	X	111.9	2797
42	1050		X	X	X	X	X	X	130.8	3269
48	1200		X	X	X	X	X	X	149.6	3739
54	1350		X	X	X	X	X	X	168.4	4209
60	1500		X	X	X	X	X	X	187.0	4675
66	1650		X	X	X	X	X	X	205.7	5142
72	1800		X	X	X	X	X	X	224.3	5609
78	1950		X	X	X	X	X	X	243.0	6075
84	2100		X	X	X	X	X	X	261.7	6542
90	2250			X	X	X	X	X	280.3	7008
96	2400			X	X	X	X	X	299.0	7475
102	2550			X	X		X	X	317.6	7941
108	2700			X	X		X	X	336.3	8408
114	2850			X	X			X	355.0	8874
120	3000			X	X			X	373.6	9341
126	3150			X	X			X	392.3	9807
132	3300			X	X			X	410.9	10274
138	3450			X	X			X	429.6	10740
144	3600			X	X			X	448.3	11207

[A] An "X" indicates standard corrugation sizes for each nominal diameter of pipe.
[B] Measured in valley of annular corrugations. Not applicable to helically corrugated pipe.

TABLE 2 Pipe Arch Requirements 2⅔ by ½-in. Corrugations (A762)

Pipe Arch Size, in.	Equivalent Diameter, in.	Span,[A] in.	Rise,[A] in.	Minimum Corner Radius, in.	Maximum, B,[B] in.
17 by 13	15	17	13	3	5¼
21 by 15	18	21	15	3	6
24 by 18	21	24	18	3	7¼
28 by 20	24	28	20	3	8
35 by 24	30	35	24	3	9½
42 by 29	36	42	29	3½	10½
49 by 33	42	49	33	4	11½
57 by 38	48	57	38	5	13½
64 by 43	54	64	43	6	15
71 by 47	60	71	47	7	16½
77 by 52	66	77	52	8	18
83 by 57	72	83	57	9	20

[A] A tolerance of ±1 in. or 2 % of equivalent diameter, whichever is greater, is permissible in span and rise.
[B] B is defined as the vertical dimension from a horizontal line across the widest portion of the arch to the lowest portion of the base.

TABLE 3 Pipe Arch Requirements 68 by 13-mm Corrugations (A762M)

Pipe Arch Size, mm	Equivalent Diameter, mm	Span,[A] mm	Rise,[A] mm	Minimum Corner Radius, mm	Maximum B,[B] mm
430 by 330	375	430	330	75	135
530 by 380	450	530	380	75	155
610 by 460	525	610	460	75	185
710 by 510	600	710	510	75	205
780 by 560	675	780	560	75	225
885 by 610	750	870	630	75	240
970 by 690	825	970	690	75	255
1060 by 740	900	1060	740	90	265
1240 by 840	1050	1240	840	100	290
1440 by 970	1200	1440	970	130	345
1620 by 1100	1350	1620	1100	155	380
1800 by 1200	1500	1800	1200	180	420
1950 by 1320	1650	1950	1320	205	460
2100 by 1450	1800	2100	1450	230	510

[A] A tolerance of 25 mm or 2 % of equivalent diameter, whichever is greater, will be permissible in span and rise.
[B] B is defined as the vertical dimension from a horizontal line across the widest portion of the arch to the lowest portion of the base.

6.1.1 The grade of coating shall be stated in the order, and the polymer thickness on both inside and outside of the pipe. The polymer coating is classified by grade corresponding to the thickness in mils (thousandths inch) on each side in inch-pound units, and the thickness in micrometres on each side in SI units.

Grade	Coating Thickness	
	in.	µm
10/10 [250/250]	0.010/0.010	250/250

TABLE 4 Pipe Arch Requirements 3 by 1-in. or 5 by 1-in. Corrugations (A762)

Pipe Arch Size, in.	Equivalent Diameter, in.	Span,[A] in.	Rise,[A] in.	Minimum Corner Radius, in.
40 by 31	36	40 – 1.8	31 + 1.8	5
46 by 36	42	46 – 2.1	36 + 2.1	6
53 by 41	48	53 – 2.4	41 + 2.4	7
60 by 46	54	60 – 2.7	46 + 2.7	8
66 by 51	60	66 – 3.0	51 + 3.0	9
73 by 55	66	73 – 3.3	55 + 3.3	12
81 by 59	72	81 – 3.6	59 + 3.6	14
87 by 63	78	87 – 4.4	63 + 4.4	14
95 by 67	84	95 – 4.8	67 + 4.8	16
103 by 71	90	103 – 5.2	71 + 5.2	16
112 by 75	96	112 – 5.6	75 + 5.6	18
117 by 79	102	117 – 5.9	79 + 5.9	18
128 by 83	108	128 – 6.4	83 + 6.4	18
137 by 87	114	137 – 6.9	87 + 6.9	18
142 by 91	120	142 – 7.1	91 + 7.1	18

[A]Negative and positive numbers listed with span and rise dimensions are negative and positive tolerances, no tolerance in opposite direction.

TABLE 5 Pipe Arch Requirements 75 by 25-mm or 125 by 25-mm Corrugations (A762M)

Pipe Arch Size, mm	Equivalent Diameter, mm	Span,[A] mm	Rise,[A] mm	Minimum Corner Radius, mm
1010 by 790	900	1010 – 45	790 + 45	130
1160 by 920	1050	1160 – 55	920 + 55	155
1340 by 1050	1200	1340 – 60	1050 + 60	180
1520 by 1170	1350	1520 – 70	1170 + 70	205
1670 by 1300	1500	1670 – 75	1300 + 75	230
1850 by 1400	1650	1850 – 85	1400 + 85	305
2050 by 1500	1800	2050 – 95	1500 + 95	355
2200 by 1620	1950	2200 – 110	1620 + 110	355
2400 by 1720	2100	2400 – 120	1720 + 120	410
2600 by 1820	2250	2600 – 130	1820 + 130	410
2840 by 1920	2400	2640 – 145	1920 + 145	460
2970 by 2020	2550	2970 – 150	2020 + 150	460
3240 by 2120	2700	3240 – 165	2120 + 165	460
3470 by 2220	2850	3470 – 175	2220 + 175	460
3600 by 2320	3000	3600 – 180	2320 + 180	460

[A]Negative and positive numbers listed with span and rise dimensions are negative and positive tolerances, no tolerance in opposite direction.

6.1.1.1 Any combination of polymer coating thickness other than shown in 6.1.1 is subject to agreement between the manufacturer and the purchaser or fabricator.

6.1.2 The polymer coating is applied to steel sheet having a metallic coating of zinc, 55 % aluminum-zinc alloy, or zinc-5 % aluminum-mischmetal alloy, as described in Specifications A929/A929M. The type of metallic coating should be stated in the order, consistent with thickness availability as shown in Table 6. If the type of metallic coating is not stated, 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.

6.2 *Steel Sheet for Coupling Bands*—The sheet used in fabricating coupling bands shall conform to Specification A742/A742M 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 alternative, the steel sheet used in fabricating coupling bands shall conform to Specification A929/A929M with the same metallic coating as that used for the fabrication of the pipe, with the sheet having a bituminous coating according to Specification A849, except the requirement for the thickness of bituminous coating shall not apply.

TABLE 6 Thickness of Metallic Coated Steel Sheet[A]

Specified Thickness		Metallic Coating Type		
in.	mm	Zinc Coated	55 Al-Zn Alloy Coated	Zn-5 Al-MM Alloy Coated
0.040	1.02	X	X	X
0.052	1.32	X	X	X
0.064	1.63	X	X	X
0.079	2.01	X	X	X
0.109	2.77	X	X	X
0.138	3.51	X	X	X
0.168	4.27	X		X

[A]An "X" indicates sheet thicknesses for the different metallic coating types included in Specification A742/A742M. The specified thickness is the thickness of the metallic-coated sheet and does not include the thickness of the polymer coating.

6.2.2 When specifically permitted by the purchaser, coupling bands shall be made of steel sheet conforming to Specification A929/A929M with the same metallic coating as that used for the fabrication of the pipe, 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 7.3.1), they shall meet the following requirements:

	Bolts	Nuts
For A762 pipe	A449	A563, Grade C
[For A762M 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.

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 S3xxxx designations in Specification A493. Stainless steel rivets may be substituted for those described in 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 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:

	Bolts	Nuts
For A762 pipe	A307	A563, Grade A
[For A762M pipe]	[F568M, Class 4.6]	[A563M, Class 5]

6.4.1 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 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.

6.5 *Gaskets*—If gaskets are used in couplings, 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 C443.

7. Fabrication

7.1 *General Requirements*—Pipe shall be fabricated in full circular cross section except for Type IIIA pipe which is described in 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 2⅔, 3, or 5-in. [68, 75, or 125-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 7.1. The direction of the crests and valleys of helical corrugations shall not be less than 60° from the axis of the pipe for pipe diameters larger than 21 in. [525 mm], and not less than 45° from the axis for pipe diameters of 21 in. [525 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 7 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 7. Then the depth of all corrugations between adjacent seams shall be measured and the values of Table 8 for minimum average depth and minimum corrugation depth shall apply.

TABLE 7 Corrugation Requirements for Types I, IA, II, IIA, and III Pipe

Nominal Size	Maximum Pitch[A]	Minimum Depth[B]	Inside Radius[C]	
			Nominal	Minimum
		A762, in.		
1½ by ¼ [D]	1⅞	0.24	9/32	0.25
2⅔ by ½	2⅞	0.48	11/16	0.5
3 by 1	3¼	0.95	9/16	0.5
5 by 1	5 5/16	0.95	1.57	1.4
		A762M, mm		
38 by 6.5[D]	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

[A]Pitch is measured from crest to crest of corrugations, at 90° to the direction of the corrugations.
[B]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 7.2.1).
[C]Minimum inside radius requirement does not apply to a corrugation containing a helical lock seam.
[D]The corrugation size of 1½ by ¼ in. [38 by 6.5 mm] is available only in helically corrugated pipe.

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 8 provide 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 9 for the size indicated on the order. For the 11.5 in. [292 mm] rib spacing, if the sheet between the ribs does not include a lock seam, a stiffener shall be included midway between ribs. This stiffener shall have a nominal radius of 0.25 in. [6.4 mm] and a minimum height of 0.20 in. [5.1 mm] toward the outside of the pipe.

NOTE 4—When requested by the purchaser, the pipe manufacturer shall provide independent verification that the nominal dimensions of the profile supplied meets or exceeds the sectional properties published in Practice A796/A796M. Such effective sectional properties shall be determined in accordance with AISI S100, North American Specification for the Design of Cold-Formed Steel Structural Members.

NOTE 5—The nominal dimensions and properties for smooth corrugations and for ribs are given in Practice A796/A796M.

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 8.2.2.

NOTE 6—Fabrication of pipe without longitudinal seams in 120° of arc, so that the pipe may be installed without longitudinal seams in the invert, is subject to negotiation between the purchaser and the 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 10, depending on sheet thickness, corrugation size, and diameter of pipe. For pipe with 1-in. [25-mm] deep corrugations, ½-in. [Metric M12] diameter bolts and nuts may be used in place of rivets on a one-for-one replacement ratio. Circumferential seams shall be riveted using rivets of the same size as for longitudinal seams and shall have a maximum rivet spacing of 6 in. [150 mm], measured on centers, except that six rivets will be sufficient in 12-in. [300-mm] diameter pipe.

TABLE 8 Referee Requirements for Corrugation Depth[A]

Nominal Size	Diameter	Minimum Average Depth	Minimum Corrugation Depth
		Inches	
1½ by ¼	all	0.24	0.20
2⅔ by ½	12 through 21	0.48	0.40
2⅔ by ½	over 21	0.49	0.44
3 by 1	all	0.98	0.92
5 by 1	all	0.98	0.92
		Millimetres	
38 by 6.5	all	6.1	5
68 by 13	300 through 525	12.1	10
68 by 13	over 525	12.4	11
75 by 25	all	24.9	23
125 by 25	all	24.9	23

[A]See 7.2.1 for application of Table 2.

TABLE 9 Rib Requirements for Types IR and IIR Pipe

Nominal Size Rib	Rib			Bottom Outside Radius, min	Bottom[A] Outside Radius, max avg.	Top Outside Radius, min	Top[A] Outside Radius, max avg.
	Width[B], min	Depth[C], min	Spacing[D], max				
			A762, in.				
¾ by ¾ by 7½	0.68	0.73	7¾	0.10	0.50	0.10+*t*	0.50+*t*
¾ by 1 by 8½	0.68	0.95	8¾	0.10	0.50	0.10+*t*	0.50+*t*
¾ by 1 by 11½	0.68	0.95	11¾	0.10	0.50	0.10+*t*	0.50+*t*
			A762M, mm				
19 by 19 by 180	17	19	197	2.5	12.0	2.5+*t*	12.0+*t*
19 by 25 by 216	17	24	222	2.5	12.0	2.5+*t*	12.0+*t*
19 by 25 by 292	17	24	298	2.5	12.0	2.5+*t*	12.0+*t*

[A]The average of the two top rib radii and of the two bottom rib radii shall be within the minimum and maximum tolerances. The term "outside" refers to the outside surface of the pipe.
[B]Width is a dimension of the inside of the rib but is measured on the outside of the pipe (outside of the rib) and shall meet or exceed the specified minimum width plus two times the wall thickness (that is, 2*t* + 0.68 in. [2*t* + 17 mm]). Rib width measurements shall be taken at the top and bottom of the rib. The maximum allowable difference between the top and bottom rib width measurements is 0.1875 in. [4.8 mm].
[C]Depth is an average of ribs within one sheet width measured from the inside by placing a straightedge across the open rib and measuring to the bottom of the rib.
[D]Spacing is an average of three adjacent ribs spacings for ¾ by ¾ by 7½ pipe and two adjacent rib spacings for the ¾ by 1 by 11½ pipe and ¾ by 1 by 8½ pipe measured center-to-center of the ribs, at 90° to the direction of the ribs.

TABLE 10 Riveted Longitudinal Seams

Specified Sheet Thickness		Nominal Corrugation Size					
		2⅔ by ½ in. [68 by 13 mm][A,B]		3 by 1 in. [75 by 25 mm][C,D]		5 by 1 in. [125 by 25 mm][D,E]	
in.	mm	Rivet diameters, min					
		in.	mm	in.	mm	in.	mm
0.052	1.32	5/16	8.0	. . .	. . .	. . .	. . .
0.064	1.63	5/16	8.0	3/8	9.5	3/8	9.5
0.079	2.01	5/16	8.0	3/8	9.5	3/8	9.5
0.109	2.77	3/8	9.5	7/16	11.0	7/16	11.0
0.138	3.51	3/8	9.5	7/16	11.0	7/16	11.0
0.168	4.27	3/8	9.5	7/16	11.0	7/16	11.0

[A]One rivet each valley for pipe diameters 36 in. [900 mm] and smaller. Two rivets each valley for pipe diameters 42 in. [1050 mm] and larger.
[B]Minimum width of lap is 1½ in. [38 mm] for pipe diameters 36 in. [900 mm] and smaller, and 3 in. [75 mm] for pipe diameters 42 in. [1050 mm] and larger.
[C]Two rivets each valley for all pipe diameters.
[D]Minimum width of lap is 3 in. [75 mm] for pipe of all diameters.
[E]Two rivets each crest and valley for all pipe diameters.

7.3.2 All rivets shall be driven cold in such a manner that the sheets shall be drawn tightly together throughout the entire lap. The center of a rivet shall be no closer than twice its diameter from the edge of the sheet. All rivets shall have neat, workmanlike, and full hemispherical heads or heads of a form acceptable to the purchaser, shall be driven without bending, and shall completely fill the hole.

7.4 *Helical Lock Seams*—The lock seam for Type I pipe shall be formed in the tangent element of the corrugation profile with its center near the neutral axis of the corrugation profile. The lock seam for Type IA pipe shall be in the valley of the corrugation, shall be spaced not more than 30 in. [760 mm] apart, and shall be formed from both the liner and the shell in the same general manner as Type I helical lock seam pipe. The lock seam for Type IR pipe shall be formed in the flat zone of the pipe wall, midway between two ribs.

7.4.1 The edges of the sheets within the cross section of the lock seam shall lap at least 5/32 in. [4.0 mm] for pipe 10 in. [250 mm] or less in diameter and at least 5/16 in. [7.9 mm] for pipe greater than 10 in. [250 mm] in diameter, with an occasional 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.

7.4.2 Specimens cut from production pipe normal to and across the lock seam shall develop the tensile strength as provided in Table 11, when tested according to AASHTO T 249. For Type IA pipe, the lock seam strength shall be as tabulated based on the thickness of the corrugated shell.

7.4.3 When the ends of helically corrugated lock seam pipe have been rerolled to form annular corrugations, either with or without a flanged end finish, the lock seam in the rerolled end shall not contain any visible cracks in the base metal and the tensile strength of the lock seam shall be not less than 60 % of that required in 7.4.2.

7.5 *End Finish:*

7.5.1 To facilitate field jointing, the ends of individual pipe sections with helical corrugations may be rerolled to form annular corrugations extending at least two corrugations from the pipe end or to form an upturned flange meeting the requirements in 7.5.2, or both. The diameter of ends shall not exceed that of the pipe barrel by more than the depth of the corrugation. All types of pipe ends, whether rerolled or not, shall be matched in a joint such that the maximum difference in the diameter of abutting pipe ends is ½ in. [13 mm].

TABLE 11 Lock Seam Tensile Strength

Specified Sheet Thickness[A]		Lock Seam Tensile Strength, per Unit Width, min	
in.	mm	lbf/in.	kN/m
0.040	1.02	175	30
0.052	1.32	240	42
0.064	1.63	340	60
0.079	2.01	520	91
0.109	2.77	700	122
0.138	3.50	880	154
0.168	4.27	1200	210

[A]For Type 1A pipe, the thickness shall be that of the corrugated shell.

7.5.1.1 When pipe with any size helical corrugation (except 1-½ by ¼ in. [38 by 6.5 mm]) or rib is rerolled to form annular corrugations in the ends, the usual size of the annular corrugation is 2-⅔ by ½ in. [68 by 13 mm].

7.5.2 If a flanged finish is used on the ends of individual pipe sections to facilitate field jointing, the flange shall be uniform in width, be not less than ½ in. [13 mm] wide, and shall be square to the longitudinal axis of the pipe.

7.5.3 The ends of all pipe which will form the inlet and outlet of culverts, fabricated of sheets having nominal thicknesses of 0.079 in. [2.01 mm] and less, shall be reinforced in a manner approved by the purchaser, when specified.

8. Pipe Requirements

8.1 *Type I, Type IA, and Type IR Pipe:*

8.1.1 *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 corrugations which are standard for each size of pipe are also shown in Table 1. The average inside diameter of circular pipe and pipe to be reformed into pipe arches shall not vary more than 1 % or ½ in. [13 mm], whichever is greater, from the nominal diameter when measured on the inside crest of the corrugations. Alternatively, for pipe having annular corrugations, conformance with the inside diameter requirement may be determined by measuring the outside circumference, for which minimum values are given in Table 1.

NOTE 7—The outside circumference of helically corrugated pipe is influenced by the corrugation size and the angle of the corrugations, affecting the number of corrugations crossed, therefore no minimum circumferential measurement can be specified.

8.1.2 *Sheet Thickness*—Sheet thickness shall be as specified by the purchaser from the specified sheet thicknesses listed in Table 6 (Note 8 and Note 9). For Type IA pipe, the thickness of both the shell and the liner shall be given; the thickness of the corrugated shell shall be not less than 60 % of the equivalent Type I pipe; the liner shall have a nominal thickness of at least 0.040 in. [1.02 mm]; and the sum of the specified thicknesses of shell and liner shall equal or exceed the specified thickness of an equivalent pipe of identical corrugations as the shell according to the design criteria in Practice A796/A796M.

NOTE 8—The sheet thicknesses indicated in Table 6 are the thicknesses listed as available in Specification A742/A742M. The specified thickness is based on the thickness of the metallic-coated sheet, not including the thickness of polymer coating.

NOTE 9—The purchaser should determine the required thickness for Types I, IA or IR pipe, or Types I, IA or IR pipe to be reformed into Types II, IIA, or IIR pipe according to the design criteria in Practice A796/A796M or other appropriate guidelines.

8.1.3 When specified by the purchaser, the finished pipe shall be factory elongated to the extent specified. The elongation shall be accomplished by the use of a mechanical apparatus which will produce a uniform deformation throughout the length of the section.

8.2 *Type II, IIA and IIR Pipe:*

8.2.1 *Pipe-Arch Dimensions*—Pipe furnished as Type II, IIA, or IIR shall be made from Type I, IA, or IR pipe, respectively, and shall be reformed to provide a pipe-arch shape. All applicable requirements for Types I, IA, and IR pipe shall be met by finished Types II, IIA, and IIR pipe respectively. Pipe arches shall conform to the dimensional requirements of Table 2 [Table 3], Table 4 [Table 5], or Table 12 [Table 13]. All dimensions shall be measured from the inside crests of corrugations for Type II pipe or from the inside liner or surface for Types IIA or IIR pipe, respectively.

8.2.2 *Longitudinal Seams*—Longitudinal seams of riveted pipe-arches shall not be placed in the corner radius.

8.2.3 Reforming Type IR into Type IIR pipe shall be done in such a manner as to avoid damage to the external ribs.

8.3 *Type III Pipe:*

8.3.1 Type III pipe shall have a full circular cross section and shall conform to the requirements for Type I pipe, and in addition shall contain perforations conforming to one of the classes described in 8.3.2.

8.3.2 *Perforations*—The perforations shall conform to the requirements for Class 1, unless otherwise specified in the order. Class 1 perforations are for pipe intended to be used for subsurface drainage. Class 2 perforations are for pipe intended to be used for subsurface disposal of water, but pipe containing Class 2 perforations may also be used for subsurface drainage.

8.3.2.1 *Class 1 Perforations*—The perforations shall be approximately circular and cleanly cut; shall have nominal diameters of not less than 3⁄16 in. [4.8 mm] nor greater than ⅜ in. [9.5 mm]; and shall be arranged in rows parallel to the axis of the pipe. The perforations shall be located on the inside crests or along the neutral axis of the corrugations, with one perforation in each row for each corrugation. Pipe connected by couplings or bands may be unperforated within 4 in. [100 mm] of each end of each length of pipe. The rows of perforations shall be arranged in two equal groups placed symmetrically on either side of a lower unperforated segment corresponding to the flow line of the pipe. The spacing of the rows shall be uniform. The distance between the center lines of rows shall be not less than 1 in. [25 mm]. The minimum number of longitudinal rows of perforations, the maximum heights of the centerlines of the uppermost rows above the bottom of the invert, and the inside chord lengths of the unperforated segments illustrated in Fig. 1 shall be as specified in Table 14.

NOTE 10—Pipe with Class 1 perforations is generally available in diameters from 4 to 21 in. [100 to 525 mm] inclusive, although perforated

TABLE 12 Pipe Arch Requirements—¾ by ¾ by 7½-in. or ¾ by 1 by 11½-in. Rib Corrugations

Pipe Arch Size, in.	Equivalent Diameter, in.	Span.[A] in.	Rise,[A] in.	Minimum Corner Radius, in.
20 by 16	18	20–1.0	16 + 1.0	5
23 by 19	21	23–1.0	19 + 1.0	5
27 by 21	24	27–1.5	21 + 1.5	5
33 by 26	30	33–1.5	26 + 1.5	5
40 by 31	36	40–1.8	31 + 1.8	5
46 by 36	42	46–2.1	36 + 2.1	6
53 by 41	48	53–2.4	41 + 2.4	7
60 by 46	54	60–2.7	46 + 2.7	8
66 by 51	60	66–3.0	51 + 3.0	9

[A]Negative and positive numbers listed with span and rise dimensions are negative and positive tolerances, no tolerance in opposite direction.

TABLE 13 Pipe Arch Requirements—19 by 19 by 190-mm or 19 by 25 by 292-mm Rib Corrugations

Pipe Arch Size, mm	Equivalent Diameter, mm	Span,[A] mm	Rise,[A] mm	Minimum Corner Radius, mm
500 by 400	450	500-25	400 + 25	125
550 by 450	500	550-25	450 + 25	125
680 by 530	600	680-40	530 + 40	125
770 by 630	700	770-40	630 + 40	126
880 by 690	800	880-40	690 + 40	125
1000 by 770	900	1000-50	770 + 50	125
1100 by 850	1000	1100-50	850 + 50	150
1330 by 1030	1200	1330-50	1030 + 50	175
1550 by 1200	1400	1550-70	1200 + 70	200
1780 by 1360	1600	1780-85	1360 + 85	300

[A]Negative and positive numbers listed with span and rise dimensions are negative and positive tolerances, no tolerance in opposite direction.

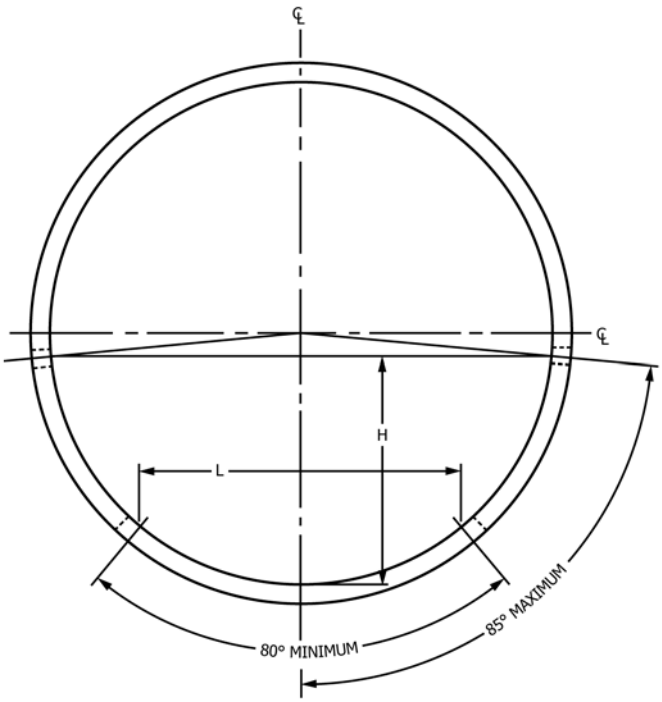

FIG. 1 Requirements for Perforations

TABLE 14 Rows of Perforations, Height *H* of the Centerline of the Uppermost Rows Above the Invert, and Chord Length *L* of Unperforated Segment, for Class 1 Perforations

Internal Diameter of Pipe		Rows of Perforations[A]	*H*, max[B]		*L*, min[B]	
in.	mm		in.	mm	in.	mm
4	100	2	1.8	46	2.6	64
6	150	4	2.8	69	3.8	96
8	200	4	3.7	92	5.1	128
10	250	4	4.6	115	6.4	160
12	300	6[C]	5.5	138	7.7	192
15	375	6[C]	6.9	172	9.6	240
18	450	6[C]	8.3	207	11.5	288
21	525	6	9.7	241	13.4	336
24 and larger	600 and larger	8	[D]	[D]	[D]	[D]

[A]Minimum number of rows. A greater number of rows for increased inlet area shall be subject to agreement between the purchaser and the fabricator. Note that the number of unit length in each row (and inlet area) is dependent on the corrugation pitch.
[B]See Fig. 1 for location of dimensions *H* and *L*.
[C]Minimum of 4 rows permitted in pipe with 1½ by ¼-in. [38 by 6.5-mm] corrugations.
[D]*H*(max) = 0.46*D*; *L*(min) = 0.64*D*, where *D* = internal diameter of pipe, inches or millimetres as appropriate.

pipe in larger sizes may be obtained.

8.3.2.2 *Class 2 Perforations*—The perforations shall be circular holes with nominal diameters of 5⁄16 to 3⁄8 in. [8.0 to 9.5 mm], or slots with nominal width of 3⁄16 to 5⁄16 in. [4.8 to 8.0 mm] and not to exceed ½ in. [13 mm] in length. The perforations shall be uniformly spaced around the full periphery of the pipe. The perforations shall provide an opening area of not less than 3.3 in.^{2}/ft^2 [230 cm^2/m^2] of pipe surface based on nominal diameter and length of pipe.

NOTE 11—Thirty perforations, 3⁄8-in. diameter, per square foot [323 perforations, 9.5-mm diameter, per square metre] satisfies this requirement.

8.4 *Type IIIA Pipe*—Type IIIA pipe shall be fabricated of an unperforated semicircular bottom section with a top shield of corrugated steel, both of nominal 0.052 in. [1.32 mm] thickness or greater. The smooth semicircular bottom section shall be approximately 4⅝ in. [120 mm] in diameter and shall have a continuous lip extending outward along each side; the corrugated top shield shall be approximately 6⅜ in. [160 mm] wide including a ¾-in. [19-mm] sloping overhang on each side and shall be secured to the lip of the bottom section by integral tabs spaced at about 3½ in. [90 mm] center to center. The top shield shall have corrugations approximately ⅞ in. [22 mm] center to center and approximately 5⁄16-in. [8.0-mm] depth.

9. Coupling Bands

9.1 *Types of Coupling Bands*—Field joints for each type of corrugated steel pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installation. Coupling bands may be of the following types: bands with annular corrugations; bands with helical corrugations; bands with projections (dimples); channel bands for upturned flanges, with or without annular corrugations; flat bands; and smooth sleeve-type couplers. Except as provided in 9.1.1 through 9.1.4, the type of coupling furnished shall be the option of the fabricator unless the type is specified in the order.

NOTE 12—Bands are classified according to their ability to resist shear, moment, and tensile forces as described in Practice A798/A798M and identified as "standard joints" and "special joints." The first four types of bands listed in 9.1, and meeting the requirements of 9.2, are expected to meet the requirements for "standard joints." Some may also be able to meet the requirements for "special joints," but such capability should be determined by analysis or test.

9.1.1 *Annular Corrugations*—Coupling bands with annular corrugations shall be used only with pipe with annular corrugations, or helical pipe in which the ends have been rerolled to form annular corrugations. The corrugations in the band shall have the same dimensions as the corrugations in the pipe end, or may be of a special design to engage either the first or second corrugation from the end of each pipe. The band may also include a U-shaped channel to accommodate upturned flanges on the pipe.

9.1.2 *Helical Corrugations*—Coupling bands with helical corrugations shall be used only with pipe with helically corrugated ends. The corrugations in the bands shall be designed to properly mesh with the corrugations in the pipe.

9.1.3 *Projections*—Coupling bands with projections (dimples) may be used with pipe with either annular or helical corrugations. The bands shall be formed with the projections in annular rows with one projection for each corrugation of helical pipe. Bands 10½ or 12 in. [265 or 300 mm] wide shall have two annular rows of projections, and bands 16¼ or 22 in. [415 or 560 mm] wide shall have four annular rows of projections.

9.1.4 *Channel Bands*—Channel bands may be used only with pipe having upturned flanges on the pipe ends.

9.1.5 *Smooth Sleeve-Type*—Smooth sleeve-type couplers and flat bands may be used with Types III and IIIA pipe of 12-in. [300-mm] diameter or smaller.

9.1.6 *Flat Bands*—When specified by the purchaser, flat bands may be used on pipe with helically corrugated ends, annular corrugated pipe, or helical pipe on which the ends have been rerolled to form annular corrugations.

9.2 *Requirements*—Coupling bands shall be fabricated to lap on an equal portion of each of the pipe sections to be connected. The ends of the bands shall lap or be fabricated to form a tightly closed joint upon installation. Coupling band thickness shall conform to the requirements in Table 15 based on the sheet thickness of the pipe to be connected, except as provided in 9.2.4 and 9.2.5. The band width shall be not less than as shown in Table 16. 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, bolted with galvanized or cadmium-plated bolts; bars and straps; wedge lock and straps; or lugs. Coupling bands shall be fastened with the following size of bolts:

9.2.1 Pipe diameters 18 in. [450 mm] and less, ⅜-in. [Metric M10] diameter.

9.2.2 Pipe diameters 21 in. [525 mm] and greater, ½-in. [Metric M12] diameter.

9.2.3 Type IIIA pipe, 5⁄16-in. [Metric M8] diameter.

9.2.4 If flanges are provided on the pipe ends, the coupling may also be made by interlocking the flanges with a preformed channel band or other band incorporating a locking channel not less than ¾ in. [19 mm] in width. The depth of the channel shall be not less than ½ in. [13 mm]. The channel band shall have a minimum nominal thickness of 0.079 in. [2.01 mm].

9.2.5 Smooth sleeve-type couplings and flat bands shall be steel having a nominal thickness of not less than 0.040 in. [1.02 mm], or as an option, may be a plastic sleeve to provide equivalent strength. The coupling shall be close-fitting, to hold the pipe firmly in alignment without the use of sealing compounds or gaskets. The coupling or flat band shall contain a device so that the band or coupling will lap equally on the two pipes being joined. The overall length of the coupling shall be equal to or greater than the nominal diameter of the pipe.

TABLE 15 Coupling Band Thickness

Nominal Pipe Thickness		Nominal Coupling Band Thickness, Minimum	
in.	mm	in.	mm
0.109 and thinner	2.77 and thinner	0.052	1.32
0.138	3.51	0.064	1.63
0.168	4.27	0.079	2.01

TABLE 16 Coupling Band Width Requirements

Nominal Corrugation Size[A]	Nominal Pipe Inside Diameter[B]	Coupling Band Width, min		
		Annular Corrugated Bands	Helically Corrugated Bands	Bands With Projections
Specification A762, in.				
1½ by ¼	4 to 18	10½	7	10½
2⅔ by ½	12 to 36	7	12	10½
	42 to 72	10½	12	10½
	78 to 84[C]	10½	12	16¼
3 by 1	36 to 72	12	14	10½
	78 to 120	12	14	16¼
5 by 1	36 to 72	20	22	12
	78 to 120	20	22	22
Specification A762M, mm				
38 by 6.5	100 to 450	265	180	265
68 by 13	300 to 900	180	300	265
	1050 to 1800	265	300	265
	1950 to 2100[C]	265	300	415
75 by 25	900 to 1800	300	350	265
	1950 to 3600	300	350	415
125 by 25	900 to 1800	500	560	300
	1950 to 3600	500	560	560

[A]For helically corrugated pipe with rerolled ends, the nominal corrugation size refers to the dimensions of the end corrugations in the pipe. When pipe with helical corrugations 2⅔ by ½, 3 by 1, or 5 by 1 in. (68 by 13, 75 by 25, or 125 by 25 mm) are rolled to form annular corrugations in the ends, the usual size of the annular corrugations is 2⅔ by ½ in. (68 by 13 mm).
[B]Equivalent diameter for Type II pipe.
[C]Diameters through 144 in. (3600 mm) for annular corrugated bands used on rerolled ends of helically corrugated pipe.

9.3 *Gaskets*—Where infiltration or exfiltration is a concern, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band, approximately 7 in. [180 mm] wide and approximately ⅜ in. [9.5 mm] thick. Rubber O-ring gaskets shall be 13⁄16-in. [20-mm] diameter for pipe diameters of 36 in. [900 mm] or smaller, and ⅞-in. [22-mm] diameter for large pipe diameters, having ½-in. [13-mm] deep end corrugations. Rubber O-ring gaskets shall be 1⅜ in. [35 mm] in diameter for pipe having 1-in. [25-mm] deep end corrugations.

NOTE 13—Riveted pipe is not watertight, having small openings at the intersection of longitudinal and circumferential seams. Therefore this type of fabrication should not be used where watertightness is a concern unless the pipe is bituminous coated or lined prior to installation.

9.4 Other types of coupling bands or fastening devices which are equally effective as those described, and which comply with the joint performance criteria of Practice A798/A798M may be used when approved by the purchaser.

10. Workmanship, Finish, and Appearance

10.1 The completed pipe shall show careful, finished workmanship in all particulars. Pipe which has been damaged, either during fabrication or in shipping, may be rejected unless repairs are made which are satisfactory to the purchaser. Among others, the following defects shall be considered as constituting poor workmanship:

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 which has been bruised, 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 Uneven laps in riveted pipe.
10.1.9 Loose, unevenly lined, or unevenly spaced rivets.
10.1.10 Loosely formed lockseams.

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 through 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 careful finished workmanship in all particulars. Pipe which, in the opinion of the purchaser, has not been cleaned or coated satisfactorily may be rejected. If the purchaser so elects, the repair shall be done in his presence.

11.2 Damage to the metallic coating shall be repaired as provided in Practice A780 (Note 14), 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.

NOTE 14—While Practice A780 specifically refers to repair of damaged zinc coatings, the same procedures are applicable to repair of 55 Al-Zn alloy and Zn-5 Al-MM alloy coatings except as described in this section.

11.3 *Paints Containing Zinc Dust*—Paints containing zinc dust as described in the Materials section of Practice A780 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. Paints containing zinc dust shall be used for repair of damage to all types of metallic coatings such as zinc and alloys of zinc and aluminum.

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

11.4.2 Where 55 % aluminum-zinc alloy coating is to be metallized, it shall be done using zinc wire containing not less than 99.98 % zinc, aluminum wire containing not less than 99 % aluminum, or an alloy wire of 55 % aluminum and 45 % zinc by weight.

11.4.3 Where Zn-5 Al-MM alloy coating is to be metallized, it shall be done using zinc wire containing not less than 99.98 % zinc or an alloy wire of 85 % zinc and 15 % aluminum by weight.

11.5 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.

11.5.1 Polymer coating damaged during shipping or installation may be repaired using materials as described in 11.5 or by the application of a protective coating material conforming to Specification A849.

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 and method of fabrication.

12.2 On a random basis, samples may 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 A90/A90M. The thickness of polymer coating shall be measured according to Test Method D1005.

13. Rejection

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

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 corrugated steel pipe; drainage pipe; metallic coated steel pipe; polymer precoated; sewer pipe