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American Association State Highway
and Transportation Officials Standard
AASHTO No. M 36/M 36M

Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains[1]

This standard is issued under the fixed designation A 760/A 760M; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers 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 protective metallic coating of zinc (galvanizing), aluminum, 55 % aluminum-zinc alloy, or zinc-5 % aluminum-mischmetal alloy.

1.1.1 Steel sheet with zinc and aramid fiber composite coating may be specified for fabrication of pipe. Pipe made from sheet with this composite coating is always furnished with an asphalt coating. Therefore, the requirements in this specification should be considered as applying to a semifinished pipe; the finished pipe must include provisions of Specification A 849.

NOTE 1—Pipe fabricated with zinc and aramid fiber composite coated sheet and asphalt post coating may be used for sanitary sewers and industrial applications. Petroleum products or similar materials in the sewer effluent may affect the performance of the asphalt coating.

1.2 The several different metallic coatings may not provide equal protection of the base metal against corrosion or abrasion in all environments, or both. Some environments may be so severe that none of the metallic coatings included in this specification will provide adequate protection. Additional protection for corrugated steel pipe can be provided by use of coatings applied after fabrication of the pipe as described in Specification A 849, or by use of polymer precoated corrugated steel pipe as described in Specification A 762/A 762M.

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 A 798.

1.4 This specification is applicable to orders in either inch-pound units as A 760 or in SI units as A 760M. 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 760M.

2. Referenced Documents

2.1 *ASTM Standards:*

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

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

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

A 428/A 428M Test Method for Weight of Coating on Aluminum-Coated Iron or Steel Articles[2]

A 449 Specification for Quenched and Tempered Steel Bolts and Studs[3]

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

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

A 762/A 762M Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains[2]

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

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

A 798/A 798M 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 885/A 885M Specification for Steel Sheet, Zinc and Aramid Fiber Composite Coated for Corrugated Steel Sewer, Culvert, and Underdrain Pipe[2]

[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.

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A 929/A 929M Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe[2]
B 633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel[4]
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]
C 443M Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets [Metric][5]
D 1056 Specification for Flexible Cellular Materials—Sponge or Expanded Rubber[6]
F 568M Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners[3]

2.2 *AASHTO Standards:*

T241 Test for Helical Continuous Welded Seam Corrugated Steel Pipe[7]
T249 Test for Helical Lock Seam Corrugated Pipe[7]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *fabricator*—the producer of the pipe.

3.1.2 *manufacturer*—the producer of the sheet.

3.1.3 *minimized coating structure*— 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*—the purchaser of the finished product.

3.1.5 *regular coating structure*— 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 *MM*—mischmetal.

3.2.3 *Zn-5 Al-MM*—zinc-5 % aluminum-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 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 inflow or outflow 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 three 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.

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 (corrugated steel pipe),

5.1.2 Type of metallic coating (zinc, aluminum, 55 Al-Zn alloy, Zn-5 Al-MM alloy, or zinc and aramid fiber composite coating (see 6.1)).

5.1.2.1 For Zn-5A1-MM coating, the class coating structure (Class A minimized, etc.) (4.3).

5.1.3 ASTM designation and year of issue, as A 760-_____ for inch-pound units or as A 760M-_____ for SI units.

5.1.4 Type of pipe (4.1),

5.1.5 Diameter of circular pipe (Table 1), or span and rise of pipe-arch section (Tables 2-9),

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

5.1.7 Description of corrugations (7.2),

5.1.8 Sheet thickness (8.1.2),

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

NOTE 2—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.

5.1.10 When zinc and aramid fiber composite coated sheet is used for fabrication of pipe, the type of asphalt coating (1.1.1 and 8.5),

NOTE 3—See Specification A 849 for additional ordering information appropriate to post-coatings on pipe.

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.

[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 08.01.
[7] Available from American Association of State Highway and Transportation Officials, 444 N. Capitol, Washington DC 20001.

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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	X	317.6	7941
108	2700			X	X	X	X	X	336.3	8408
114	2850			X	X	X		X	355.0	8874
120	3000			X	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 (A 760)

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 [A 760M]

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, 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.

6. Materials and Manufacture

6.1 *Steel Sheet for Pipe*—All pipe fabricated under this specification shall be formed from zinc-coated sheet, aluminum-coated sheet, 55 % aluminum-zinc alloy-coated sheet, zinc-5 % aluminum-mischmetal alloy-coated sheet all conforming to Specification A 929/A 929M, or zinc and aramid fiber composite coated sheet conforming to Specification A 885. If the type of metallic coating is not stated in the order, zinc-coated sheet conforming to Specification A 929/A 929M 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 have the same coating and shall conform to the same specification listed in 6.1 as that used for fabrication of the pipe furnished under the order.

6.3 *Rivets*—The rivets used in riveted pipe shall be of the same material as the base metal specified for the corrugated

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TABLE 4 Pipe Arch Requirements—3 by 1-in. or 5 by 1-in. Corrugations (A 760)

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 [A 760M]

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	2840 − 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.

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 A 760 pipe	A 449	A 563, Grade C
[For A 760M pipe]	[F 568, Class 8.8]	[A 563M, Class 12]

The bolts and nuts shall be hot-dip galvanized in conformance with Specification A 153, or be mechanically galvanized in conformance with Specification B 695, Class 40.

6.4 *Hardware for Coupling Bands*—Bolts and nuts for coupling bands shall conform to the following requirements:

	Bolts	Nuts
For A 760 pipe	A 307	A 563, Grade A
[For A 760M pipe]	[F 568, Class 4.6]	[A 563M, 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 A 153/A 153M; 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/A 153M; electroplating process as provided in Specification B 633, Class Fe/Zn 25; or mechanical process as provided in Specification B 695, Class 25.

TABLE 6 Pipe-Arch Requirements ¾by ¾ by 7½ in. Rib Corrugation

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
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 – 3.9	63 + 3.9	14
95 by 67	84	95 – 4.2	67 + 4.2	16
103 by 71	90	103 – 4.5	71 + 4.5	16
112 by 75	96	112 – 4.8	75 + 4.8	18
117 by 79	102	117 – 5.1	79 + 5.1	18

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

TABLE 7 Pipe-Arch Requirements 19 by 19 by 190 mm Rib Corrugation

Pipe-Arch Size, mm	Equivalent Diameter, mm	Span,[A] mm	Rise,[A] mm	Minimum Corner Radius, mm
500 by 410	450	500 – 25	410 + 25	130
580 by 490	525	580 – 25	490 + 25	130
680 by 540	600	680 – 40	540 + 40	130
750 by 620	675	750 – 40	620 + 40	130
830 by 670	750	830 – 40	670 + 40	130
900 by 750	825	900 – 45	750 + 45	130
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 – 90	1500 + 90	355
2200 by 1620	1950	2200 – 100	1620 + 100	355
2400 by 1720	2100	2400 – 105	1720 + 105	410
2600 by 1820	2250	2600 – 115	1820 + 115	410
2840 by 1920	2400	2840 – 120	1880 + 120	450
2920 by 1980	2550	2920 – 130	1980 + 130	450

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

TABLE 8 Pipe Arch Requirements—¾by 1 by 11½-in. Rib Corrugation

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.

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