Designation: A 761/A 761M – 04

American Association State Highway and Transportation Officials Standard
AASHTO No. M 167/M 167 M

Standard Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches[1]

This standard is issued under the fixed designation A 761/A 761M; 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 structural plate, zinc-coated, used in the construction of pipe, pipe-arches, arches, underpasses, and special shapes for field assembly. Appropriate fasteners and accessory materials are also described. The pipe, arches, and other shapes are generally used for drainage purposes, pedestrian and vehicular underpasses, and utility tunnels.

1.2 This specification does not include requirements for bedding, backfill, or the relationship between earth cover load and plate thickness of the pipe. Experience has shown that the successful performance of this product depends upon the proper selection of plate thickness, type of bedding and backfill, manufacture in the plant, and care in the installation. The purchaser must correlate the preceding factors and also the corrosion and abrasion requirements of the field installation with the plate thickness. The structural design of corrugated steel structural plate pipe and the proper installation procedures are described in Practices A 796/A 796M and A 807/A 807M.

1.3 This specification is applicable to orders in either inch-pound units (as A 761) or SI units (as A 761M). Inch-pound units and SI units are not necessarily equivalent. SI units are shown in brackets in the text, but they are the applicable values when the material is ordered to A 761M.

1.4 This specification references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this specification.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 36/A 36M Specification for Carbon Structural Steel
A 90/A 90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
A 123/A 123M Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A 153/A 153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A 307 Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength
A 370 Test Methods and Definitions for Mechanical Testing of Steel Products
A 449 Specification for Quenched and Tempered Steel Bolts and Studs
A 563 Specification for Carbon and Alloy Steel Nuts
A 563M Specification for Carbon and Alloy Steel Nuts [Metric]
A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
A 754 Test Method for Coating Thickness by X-ray Fluorescence
A 780 Practice for Repair of Damaged Hot-Dip Galvanized Coatings
A 796/A 796M Practice for Structural Design of Corrugated Steel Pipe, Pipe-Arches, and Arches for Storm and Sanitary Sewers and Other Buried Applications
A 807/A 807M Practice for Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications
A 902 Terminology Relating to Metallic Coated Steel Products
B 6 Specification for Zinc (Slab Zinc)
B 695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E 376 Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods
F 568 Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

2.2 *ANSI Standards:*[3]

[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.

Current edition approved May 1, 2004. Published May 2004. Originally approved in 1979. Last previous edition approved in 2003 as A 761 – 03.

[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.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

***A Summary of Changes section appears at the end of this standard.**

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TABLE 1 Mechanical Requirements for Flat Plate[A]

Corrugation Size in. [mm]	Yield Strength[B], min, ksi [MPa]	Tensile Strength[B], min, ksi [MPa]	Elongation in 2 in. [50 mm],[C] min, %
6 by 2 [150 by 50]			
Type 33	28.0 [190]	42.0 [290]	25
Type 38	33.0 [225]	45.0 [310]	25
15 by 5½ [380 by 140] and 16 by 6 [400 by 150]	40.0 [275]	55.0 [380]	25

[A]To determine conformance with this specification, round each value for tensile strength and for 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 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 tension testing machine.
[C]Elongation requirement does not apply to material tested after corrugating.

B18.2.1 Square and Hex Bolts and Screws, Inch Series
B18.2.2 Square and Hex Nuts
B18.2.3.6M Bolts, Metric Heavy Hex
B18.2.4.6M Hex Nuts, Heavy, Metric
2.3 *AASHTO Standard:*[4]
Standard Specifications for Highway Bridges, Division I

3. Terminology

3.1 *Definitions*—See Terminology A 902 for definitions of general terminology relating to metallic-coated steel products.
3.2 *Definitions of Terms Specific to This Standard:*
3.2.1 *arch*, *n*—a part circle shape spanning an open invert between the footings on which it rests.
3.2.2 *box culvert*, *n*—a rectangular box with a long-radius crown and short radius corners, and having either a full invert or footings.
3.2.3 *fabricator*, *n*—the producer of the components for the finished product.
3.2.4 *flat plate*, *n*—sheet or plate used to fabricate structural plate.
3.2.5 *manufacturer*, *n*—the producer of the flat plate and accessories.
3.2.6 *pipe*, *n*—a conduit having full circular shape; also, in a general context, all structure shapes covered by this specification.
3.2.7 *pipe-arch*, *n*—an arch shape with an approximate semicircular crown, small-radius, corners, and large-radius invert.
3.2.8 *pipe, horizontal ellipse*, *n*—an elliptically shaped pipe with the horizontal diameter approximately 25 % greater than the nominal diameter.
3.2.9 *pipe, vertically elongated*, *n*—an elliptically shaped pipe with the vertical diameter up to 10 % greater than the nominal diameter.
3.2.10 *purchaser*, *n*—the person or agency that purchases the finished pipe structure.
3.2.11 *special shape*, *n*—a shape, other than described elsewhere in this section, suitable for fabrication with structural plate.
3.2.12 *structural plate*, *n*—a corrugated and curved plate which is field assembled with other structural plates to form the required structure.
3.2.13 *vehicular underpass*, *n*—a high arch shape with an approximate semicircular crown, large-radius sides, small-radius corners between sides and invert, and large-radius invert.

4. Ordering Information

4.1 Orders for material under this specification shall include the following information as necessary to adequately describe the desired product:
4.1.1 Name of material (corrugated steel structural plate and accessories),
4.1.2 Description of structure (see Section 3),
4.1.3 Number of structures,
4.1.4 ASTM designation and year of issue, as A 761– ____for inch-pound units or A 761M – ____for SI units.
4.1.5 Dimensions of structure (diameter or span and rise, and length, and so forth) (see 8.2 and Note 7),
4.1.6 Thickness of plate (see 8.1), and for the 6 by 2-in. [150 by 50-mm] corrugation, the type of steel in accordance with 5.1.3 and Table 1,
4.1.7 Description of corrugations (see 6.2),
4.1.8 End treatment (bevel, skew, grade or slope corrections, or other special provision if required by the project plans or specifications),
4.1.9 Seam bolt size and number per corrugation, if different than the minimums specified (see 6.3 and Table 2 and Table 3),
4.1.10 Special requirements (including reinforcement locations, shapes, and thicknesses), if required, and
4.1.11 Certification, if required (see 12.1).

NOTE 1—Typical ordering descriptions are as follows: (1) Structural plates and fasteners for two corrugated steel structural plate pipes, in accordance with ASTM A 761 – ____, 180-in. diameter, 0.168-in. plate thickness, 6 by 2-in. corrugations, each 140-ft nominal centerline length with end treatment as shown on plans; (2) Structural plates and fasteners for one corrugated steel structural plate pipe-arch, in accordance with ASTM A 761M – ____, 3860-mm span by 2460-mm rise, 5.54-mm plate thickness, 150 by 50-mm corrugations, 27.0-m nominal centerline length with square ends, longitudinal seams with four M20 bolts per corrugation.

5. Materials

5.1 *Flat Plate*:
5.1.1 *Manufacture*—The base steel shall be made by any of the following processes: open-hearth, basic-oxygen, or electric-furnace.
5.1.2 *Chemical Composition*—The base metal heat analysis shall conform to the chemical requirements of Table 4. The

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TABLE 2 Bolt and Nut Requirements

	Bolts[A]	Nuts
	A 761 (in.)	
General dimensions[B]	ANSI B18.2.1 Heavy Hex	ANSI B18.2.2 Heavy Hex
Seam bolts and nuts[C]	A 449	A 563 Grade C
Anchorage bolts and nuts	A 307	A 563 Grade A
Zinc coating	A 153 or B 695, Class 55	A 153 or B 695, Class 55
Nominal diameter, min, in.[D]	¾	¾
	A 761M [mm]	
General dimensions[B]	ANSI B18.2.3.4M Heavy Hex	ANSI B18.2.4.6M Heavy Hex
Seam bolts and nuts[C]	F 568 Class 8.8	A 563M Class 12
Anchorage bolts and nuts	F 568 Class 4.6	A 563M Class 5
Zinc coating	A 153 or B 695, Class 55	A 153 or B 695, Class 55
Nominal diameter, min, metric size[D]	M20	M20

[A]Bolts with a special hemispherical base under the head are only available in inch sizes. They are also intended for use with metric plate.
[B]See 5.4.1 for requirements for bolt and nut bearing surfaces.
[C]Bolts and nuts also used for connecting arch plates to bearings and structural reinforcement to structural plates.
[D]Bolt size of ⅞ in. or 1 in. [M22, M24, or M27] shall be furnished when specified in the order (see 5.4 and Note 4).

requirements of this specification shall be met in continuous mass production during which the manufacturer has made analysis of individual heats so as to ensure that material is controlled within the specified limits.

5.1.3 *Mechanical Requirements*—The mechanical properties of the flat plate material prior to corrugating shall conform to the requirements in Table 1. For the 6 by 2-in. [150 by 50-mm] corrugation, either Type 33 or Type 38 must be specified.

NOTE 2—The properties given in Table 1 for the flat plate normally provide the minimum yield strength of 33 ksi [230 MPa] for Type 33 material and 38 ksi [265 MPa] for Type 38 material (used in structural design for pipe with 6 by 2-in. [150 by 50-mm] corrugations), or 44 ksi [300 MPa] (used in structural design for pipe with 15 by 5½-in. [380 by 140-mm] and 16 by 6-in. [400 by 150-mm] corrugations), after the plate is corrugated.

5.2 *Bearings for Arches*—When specified, metal bearings for arches shall be cold-formed channels made from flat plate material conforming to 5.1, and not less than 0.188 in. [4.78 mm] in specified thickness.

5.3 *Members for Structural Reinforcement*—Steel members for circumferential or longitudinal stiffeners, or secondary structural components, shall be fabricated from rolled shapes conforming to Specification A 36/A 36M, or from flat plate material conforming to 5.1.

NOTE 3—When used, steel transverse structural reinforcing members are part of long span or box corrugated steel structural plate structures. Members of these types of structures can be designed using Practice A 796. The structural design of long-span structures is given in AASHTO Standard Specifications for Highway Bridges, Division I, Section 12.6. The structural design of beams is under development by AASHTO.

5.4 *Assembly Fasteners*—Except as provided in 5.4.1, bolts and nuts shall conform to the requirements specified in Table 2 (Note 4). Bolts shall have sufficient length to provide at least "full nut" engagement when tightened in place. The number of bolts furnished shall be 2 % in excess of the theoretical number required to erect the structure or structures.

5.4.1 Bolts and nuts for use with 6 by 2-in. [150 by 50-mm] and 16 by 6–in. [400 by 150–mm] corrugations shall have the bearing surface of both bolt and nut shaped to a 1-in. [25-mm] radius spherical surface, or shall be standard-type bolts and nuts with special washers providing comparable bearing surface. Bolts and nuts for use with 15 by 5 ½-in. [380 by 140-mm] corrugations shall have either standard bearing surfaces or bearing surfaces shaped to a 1–in. [25–mm] spherical radius.

NOTE 4—The purchaser should determine the appropriate bolt size and number of bolts per corrugation for longitudinal seams in accordance with the design criteria in Practice A 796/A 796M or other appropriate guidelines. Bolts of larger diameter than specified in Table 2 may be required with thicker plates.

5.5 *Head Wall and Bearing Anchorage*—Bolts and nuts for head wall anchorage and for anchoring arch bearings to foundations shall be fabricated as shown on the plans and shall conform to the requirements specified in Table 2.

6. Fabrication

6.1 *Structural Plates*—Structural plates shall be fabricated from flat sheets or plates, corrugated in accordance with 6.2, punched for bolted lap seams in accordance with 6.3, and curved to the required radius.

6.2 *Corrugations*— Corrugations shall form smooth continuous curves and tangents. Corrugations shall form annular rings (complete or partial) about the axis of the structure. The dimensions of the corrugations shall be in accordance with Table 5 for the size specified in the order.

6.3 *Bolt Holes (General)*—The bolt holes shall be punched so that all plates having like dimensions, curvature, and same size and number of bolts per foot of seam shall be interchangeable. Except as otherwise specified, the location and number of seam bolt holes shall conform to the requirements of Table 3 for the size of bolts indicated in Table 2 (see Note 4). Holes shall be provided as required for connecting headwall anchors, structural reinforcement, and miscellaneous attachments.

6.3.1 For 6 by 2–in. [150 by 52–mm] corrugations, the diameter of the bolt holes in the longitudinal seams shall not exceed the bolt diameter by more than ⅛ in. [3 mm] except those in plate corners. Bolt holes in circumferential seams, including plate corners, shall be round holes with the diameter not exceeding the bolt diameter by more than ¼ in. [6 mm], or shall be slotted holes with a width equal to the bolt diameter plus ⅛ in. [3 mm] and a length equal to the bolt diameter plus ⅜ in. [10 mm].

6.3.2 For 15 by 5 ½-in. [380 by 140-mm] corrugations, the diameter of the bolt holes in the longitudinal and circumferential seams shall not exceed the bolt diameter by more than ¼ in. [6 mm]. Bolt holes for the attachment of circumferential reinforcing, where required, shall be slotted with a width not greater than the bolt diameter plus ¼ in. [6 mm] and a length not greater than the bolt diameter plus ½ in. [12 mm].

6.3.3 For 16 by 6–in. [400 by 150–mm] corrugations, the diameter of bolt holes in the longitudinal seams shall not exceed the bolt diameter by more than ¼ in. [6 mm], except for those in the plate corners and two other locations (aligned with the center hole of the group of three corner holes, and in

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TABLE 3 Bolt Hole Patterns in Structural Plate[A]

Corrugation Size, in. [mm]	6 by 2 [150 by 50]	15 by 5½ [380 by 140]	16 by 6 [400 by 150]
Longitudinal seams:			
Number of rows	2	3	3
Holes per corrugation, each row, min:			
plates less than 0.310 [7.87] thick	1[B]	2[C]	2[C]
plates 0.310 [7.87] and thicker	2	2[C]	2[C]
Spacing between rows, min, in. [mm]	2 [50]	3 [75]	4 [100]
Circumferential seams:			
Number of rows	1	1	1
Spacing in rows, max, in. [mm]	10 [250]	16 [400]	16.75 [425]
Arch anchorage seams:			
Number of rows	1	1	1
Spacing in rows, nominal max, in. [mm]	24 [600]	15 [380]	16 [400]

[A]All bolt holes shall be located 1.75 bolt diameters, minimum, center of hole to edge of sheet.
[B]For minimum of one hole per corrugation, holes shall be staggered with holes in one row in valleys and holes in the other row in crests of corrugations.
[C]One hole each crest and valley of all corrugations for each row.

TABLE 4 Chemical Composition By Heat Analysis

Corrugation Size in. [mm]		Composition, %	Tolerance Over the Maximum Limit by Product Analysis, %
6 by 2 [150 by 50]	Sulfur, max	0.05	+0.01
	Sum of carbon, manganese, phosphorus, silicon, and sulfur, max	0.75	+0.04
15 by 5½ [380 by 140] and 16 by 6 [400 by 150]	Sulfur, max	0.04	+0.01
	Sum of carbon, manganese, phosphorus, silicon, and sulfur, max	1.86	+0.13

TABLE 5 Corrugation Requirements

Nominal Size	Maximum Pitch[A]	Minimum Depth[B]	Minimum Inside Radius
		A 761 (in.)	
6 by 2	6.25	1.90	1.0
15 by 5½	15.5	5.23	2.7
16 by 6	16.3	5.67	2.9
		A 761M (mm)	
150 by 50	158	48	25
380 by 140	394	133	68
400 by 150	413	144	74

[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 straight-edge resting on the corrugation crests parallel to the axis of the pipe to the bottom of the intervening valley.

adjacent corrugations) which will be the same as the circumferential holes. The bolt holes in the circumferential seams shall be slotted holes with a width not greater than the bolt diameter plus 3⁄16 in. [5 mm] and a length not greater than the bolt diameter plus 3⁄8 in. [110 mm].

6.3.4 *Bolt Holes in Bearings for Arches*—Bolt holes for anchoring bearings to foundation shall be punched as shown on the plans, with a spacing that is a multiple of the structural plate pitch, but not more than 24 in. [600 mm] on centers. Bolt holes shall be punched in the vertical leg of bearings to match corresponding bolt holes in the bottom arch plate.

6.4 *Special Plates*— Plates for forming skewed ends, beveled ends, or curved alignment shall be accurately cut to fit the order plans. Cut edges of plates shall be free of notches, gouges, or burrs, and shall present a workmanlike finish. Legible identification shall be placed on each special plate to designate its proper position in the finished structure and reference to the approved erection drawings.

6.5 *Structural Reinforcement*—Members for longitudinal or circumferential reinforcing, if required, shall be as sized and located on the order plans and fabricated from materials described in 5.3.

7. Zinc Coating

7.1 All structural plates, including fittings and cut ends, shall be zinc coated after cutting, corrugating, punching of holes, and welding (when required). The structural plates are permitted to be curved to the required radius either before or after zinc coating when it has been demonstrated that the zinc coating is not damaged using the specific tooling and fabrication equipment. All arch bearings and structural reinforcement shall be zinc coated after all fabrication is completed. The zinc used for the coating shall conform to Specification B 6 and shall be at least equal to the grade designated as "prime western".

7.2 *Coating Weight [Mass] (Plates)*—Plates shall be zinc coated to provide an average coating weight [mass] of 3.0 oz/ft^2 [910 g/m^2] of sheet (total both surfaces), and a minimum coating weight [mass] for any single specimen of 2.7 oz/ft^2 [820 g/m^2] of sheet (total both surfaces).

7.2.1 To determine conformance with this specification, each single value for coating weight [mass] and the average of all values, shall be rounded to the nearest 0.1 oz/ft^2 [10 g/m^2] in accordance with the rounding method of Practice E 29.

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TABLE 6 Thickness for Zinc-Coated Plates[A]

Corrugated Size	Specified Thickness		Minimum Thickness	
in. [mm]	in.	[mm]	in.	[mm]
6 by 2 [150 by 50] and 15 by 5½ [380 by 140]	0.111	[2.82]	0.099	[2.51]
	0.140	[3.56]	0.128	[3.25]
	0.170	[4.32]	0.158	[4.01]
	0.188	[4.78]	0.176	[4.47]
	0.218	[5.54]	0.206	[5.23]
	0.249	[6.32]	0.237	[6.02]
	0.280	[7.11]	0.268	[6.81]
	0.310	[7.87]	0.295	[7.49]
	0.380	[9.65]	0.358	[9.09]
16 by 6 [400 by 150]	0.118	[3.0]	0.106	[2.70]
	0.157	[4.0]	0.146	[3.70]
	0.197	[5.0]	0.185	[4.70]
	0.236	[6.0]	0.224	[5.70]
	0.276	[7.0]	0.264	[6.70]

[A]Thickness is measured at any point on the plate not less than ⅜ in. [10 mm] from an edge, and if corrugated, on the tangents of corrugations. There is no limit on over-thickness.

7.3 *Coating Weight [Mass] (Structural Reinforcement and Arch Bearings)*—Members fabricated from rolled shapes shall be zinc-coated to conform to Specification A 123. Members fabricated from plate material shall be zinc-coated in accordance with 7.2.

7.4 *Repair of Damaged Zinc Coating*—Plate or accessory material on which the metallic coating has been burned by welding, or has been otherwise damaged in fabricating or handling, shall be repaired. The repair shall be done so that the completed material shall show careful finished workmanship in all particulars. Material which, 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 presence.

7.4.1 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, using either the procedure in 7.4.2 or 7.4.3, unless specified otherwise.

7.4.2 *Zinc-Rich Paint Coating*—Zinc-rich paint shall be applied to a dry film thickness of at least 0.005 in. [0.013 mm] over the damaged section and surrounding cleaned area.

7.4.3 *Metallizing Coating*—The damaged area shall be cleaned as described in 7.4.1, 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. Metallizing shall be performed using zinc wire containing not less than 99.98 % zinc.

NOTE 5—Practice A 780 contains additional information on repair of damaged zinc coatings.

7.5 *Coating Adherence*—The coating shall adhere to the base metal so that no peeling or flaking occurs during normal handling.

8. Dimensions and Tolerances

8.1 *Plate Thickness*— Plate thickness shall conform to the requirements of Table 6 as specified by the purchaser from the specified plate thicknesses listed in that table (see Note 6). For corrugated plate, the thickness shall be measured on the tangents of the corrugations. The thickness shall include both the base metal and the coating.

NOTE 6—The purchaser should determine the required thickness according to the design criteria in Practice A 796/A 796M or other appropriate guidelines.

8.2 *Cross-Section Dimensions*—Cross-section dimensions, such as diameter, span and rise, and radius of curvature, shall be measured to the inside crest of corrugations. Tolerances herein specified apply to the as-erected shape before backfill placement. The diameter of circular pipe, based on the average of two measurements at 90° to each other, shall not vary by more than ±2 % from the calculated inside diameter shown in Table 7, Table 8, and Table 9. The span and rise of pipe-arch, arch, underpass, and other noncircular structures shall be as specified within ±2 %.

NOTE 7—The purchaser should consult the fabricator to determine the standard dimensions for the various types of structures, other than circular structures.

9. Workmanship

9.1 Plates, fasteners, and accessories shall be of uniform quality consistent with good manufacturing and inspection practices.

10. Sampling and Testing

10.1 Sampling and testing of plate for chemical composition shall be in accordance with Test Methods A 751, and for mechanical requirements shall be in accordance with the procedure for sheet-type specimens in Test Methods and Definitions A 370. The manufacturer or steel supplier shall make adequate tests and measurements to ensure that the material produced complies with this specification.

10.2 *Coating Weight [Mass] Determination*—Determine the coating weight [mass] in accordance with one of the procedures described in 10.2.1, 10.2.2, or 10.2.3. The average coating weight [mass] shall be the average of three or more single-spot tests, each taken from different plates in the order. In case of dispute, results of testing in accordance with 10.2.1 shall govern.

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TABLE 7 Diameter of Circular Pipe, 6 by 2-in. [150 by 50-mm] Corrugation

Nominal Diameter Specified in. [mm]	Calculated Inside Diameter in. [mm]
60 [1500]	58.9 [1475]
66 [1650]	65.0 [1626]
72 [1800]	71.1 [1775]
78 [1950]	77.3 [1935]
84 [2100]	83.4 [2085]
90 [2250]	89.5 [2240]
96 [2400]	95.6 [2390]
102 [2550]	101.7 [2545]
108 [2700]	107.8 [2695]
114 [2850]	113.9 [2850]
120 [3000]	120.0 [3000]
126 [3150]	126.1 [3155]
132 [3300]	132.3 [3310]
138 [3450]	138.4 [3460]
144 [3600]	144.5 [3615]
150 [3750]	150.6 [3765]
156 [3900]	156.7 [3920]
162 [4050]	162.8 [4070]
168 [4200]	168.9 [4225]
174 [4350]	175.0 [4375]
180 [4500]	181.2 [4530]
186 [4650]	187.3 [4685]
192 [4800]	193.4 [4835]
198 [4950]	199.5 [4990]
204 [5100]	205.6 [5140]
210 [5250]	211.7 [5295]
216 [5400]	217.8 [5445]
222 [5550]	223.9 [5600]
228 [5700]	230.0 [5750]
234 [5850]	236.2 [5905]
240 [6000]	242.3 [6060]
246 [6150]	248.4 [6210]
252 [6300]	254.5 [6365]
258 [6450]	260.6 [6515]
264 [6600]	266.7 [6670]
270 [6750]	272.8 [6820]
276 [6900]	278.9 [6975]
282 [7050]	285.0 [7125]
288 [7200]	291.2 [7280]
294 [7350]	297.3 [7435]
300 [7500]	303.4 [7585]
306 [7650]	309.5 [7740]
312 [7800]	315.6 [7890]

TABLE 8 Diameter of Circular Pipe, 15 by 5.5-in. [380 by 140-mm] Corrugation

Nominal Diameter Specified in. [mm]	Calculated Inside Diameter in. [mm]
240 [6000]	238.5 [5965]
255 [6380]	253.7 [6345]
270 [6750]	269.0 [6725]
285 [7130]	284.3 [7110]
300 [7500]	299.6 [7490]
315 [7880]	314.8 [7870]
330 [8250]	330.1 [8255]
345 [8630]	345.4 [8635]
360 [9000]	360.7 [9018]
375 [9380]	376.0 [9400]
390 [9750]	391.2 [9780]
405 [10130]	406.5 [10165]
420 [10500]	421.8 [10545]
435 [10880]	437.1 [10930]
450 [11250]	452.4 [11310]
465 [11630]	467.6 [11690]
480 [12000]	482.9 [12080]
495 [12380]	498.2 [12455]
510 [12750]	513.5 [12840]
525 [13130]	528.7 [13220]
540 [13500]	544.0 [13600]
555 [13880]	559.3 [13990]
570 [14250]	574.6 [14365]
585 [14630]	589.9 [14750]
600 [15000]	605.1 [15130]
615 [15380]	620.4 [15510]
630 [15750]	635.7 [15990]
645 [16130]	651.0 [16275]
660 [16500]	666.3 [16660]
675 [16880]	681.5 [17040]
690 [17250]	696.8 [17420]
705 [17630]	712.1 [17810]
720 [18000]	727.4 [18185]
735 [18380]	742.7 [18570]
750 [18750]	757.9 [18950]

10.2.1 Test for zinc coating weight [mass] in accordance with Test Method A 90/A 90M, using a specimen with an area of 5 in.^{2} [3000 mm^2] or greater. Calculate the coating weight [mass] in accordance with the procedure for zinc-coated sheet.

10.2.2 Test for zinc coating thickness using a magnetic coating-thickness gage, suitably checked and demonstrated for accuracy (Note 8). Total the coating thickness on the two surfaces of the plate, and convert to coating weight [mass] per unit area of sheet (total both surfaces) using the following relationship: 1 mil (0.001 in. = 0.59 oz/ft^2) [1 μm = 7.1 g/m^2].

10.2.3 Test for zinc coating weight [mass] using the X-ray fluorescence procedure of Test Method A 754.

NOTE 8—Several magnetic and electromagnetic types of coating-thickness gages are commercially available and are a satisfactory basis for acceptance when properly calibrated just prior to inspection use (see Practice E 376).

10.3 Determine the mechanical properties on plate prior to corrugating or other fabrication, except testing by the purchaser after fabrication is permitted for tensile and yield strengths.

10.4 Test results including chemical composition and mechanical properties shall be maintained by the steel manufacturer or supplier for seven years. Test results for coating weight [mass] or other tests, and a copy of the steel manufacturer or supplier's certified test results for chemical composition and mechanical properties, shall be maintained by the fabricator for seven years. Such results shall be made available to the purchaser upon request.

11. Rejection and Rehearing

11.1 Material that fails to conform to the requirements of this specification is subject to rejection. Rejection shall be reported to the manufacturer, supplier or fabricator promptly and in writing. In case of dissatisfaction with the results of the test, the manufacturer, supplier or fabricator shall make claim for a rehearing.

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TABLE 9 Diameter of Circular Pipe, 16 by 6–in. [400 by 150–mm] Corrugation

Nominal Diameter Specified in. [mm]	Calculated Inside Diameter in. [mm]
245 [6225]	239.2 [6075]
256 [6495]	249.8 [6345]
266 [6765]	260.4 [6615]
277 [7035]	271.1 [6885]
288 [7305]	281.7 [7155]
298 [7575]	292.3 [7425]
309 [7845]	303.0 [7695]
319 [8115]	313.6 [7965]
330 [8385]	324.2 [8235]
341 [8660]	335.0 [8510]
352 [8930]	345.7 [8780]
362 [9200]	356.3 [9050]
373 [9470]	366.9 [9320]
383 [9740]	377.6 [9590]
394 [10010]	388.2 [9860]
405 [10280]	398.8 [10130]
415 [10550]	409.4 [10400]
426 [10825]	420.3 [10675]
437 [11095]	430.9 [10945]
447 [11365]	441.5 [11215]
458 [11635]	452.2 [11485]
469 [11905]	462.8 [11755]
479 [12175]	473.4 [12025]
490 [12445]	484.1 [12295]
501 [12715]	494.7 [12565]
511 [12985]	505.3 [12835]
522 [13260]	516.1 [13110]
533 [13530]	526.8 [13380]
543 [13800]	537.4 [13650]
554 [14070]	548.0 [13920]
565 [14340]	558.7 [14190]
575 [14610]	569.3 [14460]
586 [14880]	579.9 [14730]
596 [15150]	590.6 [15000]
607 [15420]	601.2 [15270]
618 [15695]	612.0 [15545]
629 [15965]	622.6 [15815]

12. Certification

12.1 When specified in the purchase order or contract, a steel manufacturer or supplier's certification 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 purchase order or contract, a report of the test results shall be furnished.

13. Product Marking

13.1 Each plate shall be identified by showing the following:

13.1.1 Name of fabricator,

13.1.2 Specified zinc-coated plate thickness,

13.1.3 Specified coating weight [mass],

13.1.4 Identification showing heat number and coating lot number. The heat number is not required if the fabricator's records tie the coating lot number to a specific heat number and manufacturer, and

13.1.5 ASTM designation.

13.2 The marking shall be so placed that when the structure is erected, the identification will appear on the inside.

14. Keywords

14.1 corrugated steel pipe; drainage pipe; pipe—corrugated steel; steel pipe—corrugated; steel structural plate; structural plate pipe

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SUMMARY OF CHANGES

This section identifies the location of selected changes to this specification. For the convenience of the user, Committee A05 has highlighted those changes that may impact the use of this specification. This section may also include descriptions of the changes or reasons for the changes, or both.

A 761/A 761M - 04:

(*1*) Added two steel grades to plate size "6 by 2 in. [150 by 50 mm]." The revisions were made in 4.1.6, 5.1.3, Note 2, and Table 1.

A 761/A 761M - 03:

Specification modified to update material properties and current fabrication practice for 15 by 5 ½-in. [380 by 140 mm] corrugated plate.

(*1*) Note 2 in 5.1.3 revised to reflect higher design yield strength.

(*2*) Revised 5.4.1 to add provision for standard or spherical bearing surfaces on bolts and nuts.

(*3*) Added 6.3.2 to update bolt hole fabrication information.

(*4*) Table 3 updated.

(*5*) Table 4 updated.

(*6*) Added Summary of Changes section.

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