Designation: A 742/A 742M – 03

American Association State Highway and Transportation Officials Standard
AASHTO No. M 246/M 246M

Standard Specification for Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe[1]

This standard is issued under the fixed designation A 742/A 742M; 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 polymer precoated steel sheet for corrugated steel pipe (CSP) which is coated after metallic coating on continuous lines by coil coating (roller coating or laminating) processes. The metallic coating is either zinc, 55 % aluminum-zinc alloy, or zinc-5 % aluminum-mischmetal alloy. Sheet for this purpose is furnished flat in coils, flat in cut lengths, or corrugated in cut lengths, all being protected by a mill-applied polymer coating on both sides.

1.2 The values stated in either inch-pound units or SI units are to be regarded separately as the standard. Within the text, the SI units are shown in brackets. The values stated in each system are not equivalents; therefore, each system must be used independently of the other.

1.3 The following precautionary caveat refers only to the test method portion, Section 9, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

A 929/A 929M Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe[2]

D 543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents[3]

D 658 Test Method for Abrasion Resistance of Organic Coatings by the Air-Blast Abrasion Test[4]

D 1005 Test Methods for Measurement of Dry–Film Thickness of Organic Coatings Using Micrometers[4]

D 2794 Test Method for Resistance of Organic Coatings on the Effects of Rapid Deformation (Impact)[4]

G 22 Practice for Determining Resistance of Plastics to Bacteria[5]

G 23 Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Nonmetallic Materials[3]

G 62 Test Methods for Holiday Detection in Pipeline Coatings[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *fabricator—in this specification*, fabricator refers to the producer of the pipe.

3.1.2 *manufacturer—in this specification*, manufacturer refers to the producer of the sheet.

3.1.3 *purchaser—in this specification*, purchaser refers to the purchaser of the finished pipe.

3.2 *Abbreviations: 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 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]

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

5. Ordering Information

5.1 The polymer precoated sheet covered by this specification shall be ordered only to the specified thickness listed in Table 1. The specified thickness is based on the thickness of the metallic-coated steel sheet, not including the thickness of the polymer coating.

[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 A05.11 on Sheet Specifications.

Current edition approved April 10, 2003. Published May 2003. Originally approved in 1977. Last previous edition approved in 1998 as A 742/A 742M – 98.

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

[3] *Annual Book of ASTM Standards*, Vol 08.01.

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

[5] *Annual Book of ASTM Standards*, Vol 14.02.

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

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TABLE 1 Thicknesses of Metallic-Coated Steel Sheet[A]

Specified Thickness, in. [mm]	Metallic Coating		
	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 which are available in the corresponding coating type.

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

5.2.1 Name of material (polymer precoated steel sheet for CSP),

5.2.2 Type of metallic coating (see 6.1),

5.2.3 ASTM designation and year of issue, as A 742 – ___ for inch-pound units or A 742M – ___ for SI units,

5.2.4 Corrugation size, if corrugated (see 6.3),

5.2.5 Substrate dimensions (specified thickness; width, either flat or overall corrugated; and length, if cut length),

5.2.6 Grade of polymer coating (see Section 4), indicating thickness on each side,

5.2.7 Coil size requirements (specify maximum outside diameter (OD), acceptable inside diameter (ID), and maximum weight),

5.2.8 Certification, if required (see 11.1), and

5.2.9 Special requirements.

NOTE 1—Typical ordering descriptions are as follows:

Polymer precoated steel sheet, zinc-coated for CSP, conforming to ASTM A 742 – ___, 2⅔ by ½ -in. corrugations, 0.064 by 25½ by 60 in., with Grade 10/10 polymer coating (0.010 in./0.010 in.), certified with test report.

[Polymer precoated steel sheet, aluminum-zinc alloy coated for CSP, conforming to ASTM A 742M – ___, 2.77 by 700 mm by coil, with Grade 250/250 polymer coating; coil 1200-mm max outside diameter, 600-mm inside diameter, 10 000-kg max coil weight.]

6. General Requirements

6.1 The metallic-coated substrate shall conform to all applicable requirements of Specification A 929/A 929M for zinc coating, 55 % aluminum-zinc alloy coating, or zinc-5 % aluminum-mischmetal alloy coating, whichever is stated in the order. If the type of metallic coating is not stated in the order, zinc-coated steel sheet shall be furnished.

6.1.1 The steel sheet shall be thoroughly cleaned of any chromate pretreatment or other passivation using a multi-brush cleaning process. All traces of the caustic cleaning solution shall be immediately rinsed from the sheet following caustic cleaning. After drying, the steel sheet shall be treated with chromic acid solution and heat-cured prior to application of the polymer film. The deposited chromium content shall range from 135 to 190 mg/m^2.

6.2 The polymer coating shall be a film coating comprised of at least 85 % ethylene acrylic acid copolymer and be capable of being applied to the sheet specified in 6.1. After application, the polymer coating shall be free of holes, tears, and discontinuities, and shall be sufficiently flexible so that it will withstand the corrugating, forming, and lockseaming operations, and punching of holes for rivets or perforations.

6.3 If the polymer-coated sheet is to be furnished with corrugations, the corrugations shall conform to the requirements stated in Specification A 929/A 929M.

7. Requirements for Polymer Coating

7.1 *Adhesion*—There shall be no spalling or cracking of the coating, or disbonding of the coating at the cut, when tested in accordance with 9.1.

7.2 *Impact*—There shall be no break in the polymer coating when tested in accordance with 9.2.

7.3 *Thickness of Coating*—The thickness of the polymer coating shall meet the requirements of Section 4, or as specified in the purchase order, when tested in accordance with 9.3. The thicknesses indicated are minimum values at any point not less than ⅜ in. [10 mm] from an edge.

7.4 *Holidays*—The polymer coating on the steel shall be substantially free of holidays when tested in accordance with 9.4. An average of two holidays per square foot [22 holidays per square metre] of actual surface area on the test specimen shall be permitted.

NOTE 2—Holidays are pinholes or voids in the polymer coating that are not visually discernible.

7.5 *Abrasion Resistance*—The average abrasion coefficient when tested in accordance with 9.5, shall be a minimum of 100 (expressed in g/mil of thickness) or 3.9 [expressed in g/µm of thickness].

7.6 *Imperviousness*—There shall be no loosening or separation of the polymer coating from the metallic-coated steel substrate when tested in accordance with 9.6.

7.7 *Freeze-Thaw Resistance*—The specimen shall withstand 100 freeze-thaw cycles, as described in 9.7, without spalling, disbonding, or other detrimental effects.

7.8 *Weatherability*—The specimens shall withstand 100 h of weathering with no observable delamination or cracking, when tested in accordance with 9.8.

7.9 *Resistance to Microbial Attack*— There shall be no effect of microbial attack of the polymer coating when tested in accordance with 9.9.

NOTE 3—Tests 7.1 through 7.4 are suggested as quality control tests. When these tests are used for quality control, they may be run at room temperature only. Tests 7.5 through 7.9 are suggested as qualifying tests. However, the purchaser may use any of the tests listed to verify compliance.

8. Sampling and Testing

8.1 The manufacturer shall make adequate tests and measurements to ensure that the material produced complies with this specification.

8.1.1 Test results to show compliance with this specification shall be retained by the manufacturer for seven years and shall be made available to the fabricator and purchaser upon request.

8.2 The fabricator or purchaser shall conduct such tests as are determined necessary to determine the acceptability of the material or to verify the correctness of a certification.

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8.3 Flat samples of polymer precoated steel shall be taken by the manufacturer from each coil or in accordance with the sampling procedure as mutually agreed upon between the manufacturer and the purchaser. Each sample shall be at least 24 in. [600 mm] long by the coil width and shall carry an identification to relate it to the coil from which it was taken.

9. Test Methods for Polymer Coatings

9.1 *Adhesion*:

9.1.1 *Scope*—This procedure measures the adhesion of the polymer coating to the metallic-coated substrate.

9.1.2 *Significance and Use*—This test indicates the ability of the polymer to withstand forces in fabrication and use tending to disbond the coating from the substrate.

9.1.3 *Procedure*—Cut a 2 by 8-in. [50 by 200-mm] coupon from the sample of precoated steel. Bend the coupon 180° over a 0.5-in. [12.5-mm] diameter mandrel. The surface with the polymer coating to be tested shall be on the outside of the bend. After making bend, make a cut through the polymer coating along an element on the outside of the bend to check for polymer coating adhesion. Perform this test at 0, 77, and 122 ± 2°F [−18, 25, and 50 ± 1°C]. Check for spalling or cracking of the polymer coating, or for disbonding from the metallic-coated substrate.

9.1.4 *Precision and Bias*—No statement is made about either the precision or the bias of the procedure for measuring adhesion since the result merely states whether there is conformance to the criteria for success specified in the procedure.

9.2 *Impact*:

9.2.1 *Scope*—This procedure measures the ability of the polymer coating to withstand impact.

9.2.2 *Significance and Use*—This test provides a measure of the ability of the polymer coating to resist damage by impact, to which it may be subjected in service.

9.2.3 *Procedure*—Cut a 6 by 6-in. [150 by 150-mm] coupon from the sample of precoated steel. Direct impact the coating with an energy of 35 in.·lb [4.0 J] using an impact tester[6] with a 0.625-in. [15.88-mm] diameter punch and with the specimen set on a 0.640-in. [16.26-mm] diameter punch die. Test at approximately 77°F [25°C] (Note 4). Check for breaks in the polymer coating.

NOTE 4—This test procedure is described in detail in Test Method D 2794.

9.2.4 *Precision and Bias*—No statement is made about either the precision or the bias of the procedure for measuring impact resistance since the result merely states whether there is conformance to the criteria for success specified in the process.

9.3 *Thickness of Coating*—Measure polymer coating thickness in accordance with Test Methods D 1005.

9.4 *Holidays*—Test a specimen that is at least 12 in. [300 mm] long and the full coil width in accordance with Practice G 62, Method A, using a nominal voltage of 67½ V.

9.5 *Abrasion Resistance*—Determine the abrasion coefficient in accordance with Test Method D 658 except use a silicon carbide grain passing a No. 140 [106-µm] sieve and retained on a No. 170 [90-µm] sieve, and an air test pressure of 4.82 psi [250 mm Hg] [33.25 kPa].

9.5.1 The modifications to the procedure in Test Method D 658 are not expected to have an effect on the precision and bias as indicated in Test Method D 658.

9.6 *Imperviousness*—Test the polymer coating for imperviousness to chemical reagents in accordance with the applicable sections of Practices D 543 using a 10 % solution of sodium chloride, a 10 % solution of sodium hydroxide, and a 30 % solution of sulfuric acid. Hold each reagent in a separate confined area of the polymer precoated sheet for a period of 48 h. Avoid excessive evaporation of the test solutions.

9.7 *Freeze-Thaw Resistance*:

9.7.1 *Scope*—This procedure evaluates the ability of the polymer coating to resist freeze-thaw cycling.

9.7.2 *Significance and Use*—As pipe fabricated from polymer-coated steel sheet will be exposed to freeze-thaw action while saturated, the procedure will measure ability to withstand such action without damage to the polymer coating.

9.7.3 *Procedure*—Cut a minimum of three 6 by 6-in. [150 by 150-mm] coupons from the sample of precoated metal. Immerse the coupons in water at room temperature for two weeks and then subject them to freeze-thaw cycling. One cycle shall consist of 8 h at 0°F [−18°C] followed immediately by immersion in water at room temperature for 16 h. Cycle time may be interrupted over weekends and holidays, but the specimens shall be maintained in water at room temperature, and such interruptions should be noted. Make observations during the cycling and note any visible changes in the coating, such as spalling, disbonding, etc. After 100 cycles, make a final examination of the effects as a result of freezing and thawing.

9.7.4 *Precision and Bias*—No statement is made about either the precision or the bias of the procedure for measuring freeze-thaw resistance since the result merely states whether there is conformance to the criteria for success specified in the procedure.

9.8 *Weatherability*—Subject coupons of the precoated metal to accelerated weathering in accordance with Practice G 23 using the specimen spray arrangement for Type E, Single Open-Flame Sunshine Carbon-Arc Lamp Apparatus. Test conditions shall consist of a 2-h cycle including 18 min of water spray and a maximum temperature of 140°F [60°C].

9.9 *Resistance to Microbial Attack*—Subject test specimens of the polymer coating to conditions described in Practice G 22, Procedure B. There shall be no visible effects of bacterial attack on the polymer coating after the prescribed incubation period (21 days minimum).

10. Rejection

10.1 Material tested by the purchaser and found not conforming to this specification shall be subject to rejection.

11. Certification

11.1 When specified in the purchase order or contract, a manufacturer's certification shall be furnished to the fabricator or to the purchaser stating that samples representing each lot

[6] The Gardner-Impact Tester, Variable, Model IG 1120, available from Pacific Scientific Co., Gardner/Neotec Instrument Division, 2431 Linden Lane, Silver Spring, MD 20910, has been found suitable for this purpose.

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have been tested and inspected in accordance with this specification and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished. For results of tests suggested in Section 7 as qualifying tests, the use of typical results is permitted rather than results of tests on the specific lot of material.

12. Product Marking

12.1 Each 2 to 5 ft [0.6 to 1.5 m] of sheet in coils or cut lengths shall be identified by marking as follows:

12.1.1 Name of sheet producer,

12.1.2 Brand name,

12.1.3 Specified thickness of metallic-coated sheet,

12.1.4 Type of metallic coating,

12.1.5 Grade or thickness of polymer coating,

12.1.6 Identification symbols relating to a specific heat number and coating lot number, and

12.1.7 ASTM designation.

12.2 The brand shall be removed, obliterated, or the sheet rebranded "Non Specification" on each 2 to 5 ft [0.6 to 1.5 m] of material in a coating lot or heat where control tests, as prescribed herein, show nonconformance to this specification, or where the metallic-coated steel substrate shows nonconformance to the appropriate sheet specification.

13. Keywords

13.1 aluminum-mischmetal alloy; aluminum-mischmetal alloy coated; coatings-55 % aluminum-zinc alloy; coatings-metallic; coatings-polymer; coatings-zinc; coatings zinc 5 %; corrugated steel pipe; pipe-corrugated steel; polymer coatings; steel sheet-55 % aluminum-zinc alloy coated; steel sheet-metalic coated; steel sheet-polymer coated; steel sheet-zinc coated; steel sheet-zinc 5 %

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 742/A 742M - 03:

(*1*) Added paragraph 6.1.1 and revised paragraph 6.2 to clarify the chemical composition of the polymer film and describe an improved pre-treatment of the steel to improve performance of the coated product.

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(*1*) Changes were made to 4.1 and Note 1.

(*2*) Added a Summary of Changes section.

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