



# Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process<sup>1</sup>

This standard is issued under the fixed designation A792/A792M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

## 1. Scope\*

1.1 This specification covers 55 % aluminum-zinc alloy-coated steel sheet in coils and cut lengths.

1.2 This product is intended for applications requiring corrosion resistance or heat resistance, or both.

1.3 The product is produced in a number of designations, types, and grades which are designed to be compatible with differing application requirements.

1.4 Product furnished under this specification shall conform to the applicable requirements of the latest issue of Specification A924/A924M, unless otherwise provided herein.

1.5 The text of this specification references notes and footnotes that provide explanatory material. These notes and footnotes, excluding those in tables and figures, shall not be considered as requirements of this specification.

1.6 This specification is applicable to orders in either inch-pound units (as A792) or SI units (as A792M). Values in inch-pound and SI units are not necessarily equivalent. Within the text, SI units are shown in brackets. Each system shall be used independent of the other.

1.7 Unless the order specifies the “M” designation (SI units), the product shall be furnished to inch-pound units.

1.8 *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.*

<sup>1</sup> 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.

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## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- A90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
- A568/A568M Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
- A902 Terminology Relating to Metallic Coated Steel Products
- A924/A924M Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
- E517 Test Method for Plastic Strain Ratio  $r$  for Sheet Metal
- E646 Test Method for Tensile Strain-Hardening Exponents ( $n$  -Values) of Metallic Sheet Materials

## 3. Terminology

3.1 *Definitions*—See Terminology A902 for definitions of general terminology relating to metallic-coated hot-dip products.

### 3.2 Definitions of Terms Specific to This Standard:

- 3.2.1 *high temperature steel*—a product intended for use in elevated temperature applications.
- 3.2.2 *regular spangle*—the unaltered 55 % aluminum-zinc (Al-Zn) crystal structure that occurs during normal solidification of a hot-dip coated steel sheet.

## 4. Classification

4.1 The material is available in several designations, as follows:

- 4.1.1 *Commercial Steel*—CS Types A, B, and C,
- 4.1.2 *Drawing Steel*—DS,
- 4.1.3 *Forming Steel*—FS,

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

4.1.4 *High Temperature Steel*—HTS, and

4.1.5 *Structural Steel*—SS.

4.2 Structural steel is available in several grades based on mechanical properties. Structural Steel Grade 50 [340] is available in three classes based on tensile strength. Structural Steel Grade 80 [550] is available in two classes, based on chemistry.

4.3 The product is available in several coating weights [masses] with the coating designation in accordance with **Table 1**.

## 5. Ordering Information

5.1 55 % aluminum-zinc alloy-coated steel sheet in coils and cut lengths is produced to thickness requirements expressed to 0.001 in. [0.01 mm]. The thickness of the sheet includes the base metal and the coating.

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

5.2.1 Name of product (steel sheet, 55 % aluminum-zinc alloy coated),

5.2.2 Designation of sheet steel {CS (Type A, B, or C), FS, DS, HTS, or SS}.

5.2.2.1 When a CS type is not specified, Type B will be furnished.

5.2.3 Strength grade as required for Structural Steel,

5.2.3.1 When a SS grade 80 class is not specified class 1 will be furnished,

5.2.4 ASTM designation number and year of issue, such as A792 – \_\_\_\_ for inch-pound units or A792M – \_\_\_\_ for SI units,

5.2.5 Coating designation,

5.2.6 Chemically treated or not chemically treated,

5.2.7 Oiled or not oiled,

5.2.8 Dimensions (show thickness, minimum or nominal, width, flatness requirements (if appropriate), and length (if cut lengths)).

5.2.9 Coil size requirements (specify maximum outside diameter (OD), acceptable inside diameter (ID), and maximum weight [mass]),

5.2.10 Packaging,

5.2.11 Certification, if required, and heat analysis and mechanical property report,

5.2.12 Application (show part identification and description), and

5.2.13 Special requirements (if any).

5.2.13.1 If required, the product may be ordered to a specified base metal thickness. See Supplementary Requirement S1.

NOTE 1—Typical ordering descriptions are as follows:

Steel sheet, 55 % aluminum-zinc alloy-coated, Forming Steel (FS), ASTM A792 – \_\_\_\_, coating designation AZ55, chemical treatment, no oil, minimum 0.035 by 36 in. by coil, 48-in. maximum OD, 24-in. ID, 10 000-lb maximum, for muffler wrappers.

Steel sheet, 55 % aluminum-zinc alloy-coated, Commercial Steel (CS Type A), ASTM A792M – \_\_\_\_, coating designation AZM150, chemical treatment, no oil, minimum 0.90 by 900 mm by coil, 1200-mm maximum OD, 600-mm ID, 4500-kg maximum, for building panels.

5.2.13.2 When the purchaser requires thickness tolerances for 3/8-in. [10-mm] minimum edge distance (see Supplementary Requirement in Specification **A924/A924M**), this requirement shall be specified in the purchase order or contract.

**TABLE 1 Weight [Mass] of Coating Requirements<sup>A</sup>**

NOTE 1—Use the information provided in **8.1.2** to obtain the approximate coating thickness from the coating weight [mass].

NOTE 2—When considering material with coating designation less than AZ50 [AZM150], users are advised to discuss the intended application with the manufacturer to determine if the product is appropriate for the end use.

Coating Designation	Minimum Requirements	
	Triple-Spot Test	Single-Spot Test
	Inch-Pound Units	
	Total Both Sides, oz/ft <sup>2</sup>	Total Both Sides, oz/ft <sup>2</sup>
AZ30	0.30	0.26
AZ35	0.35	0.30
AZ40	0.40	0.35
AZ50	0.50	0.43
AZ55	0.55	0.50
AZ60	0.60	0.52
AZ70	0.70	0.60
Coating Designation	Minimum Requirements	
	Triple-Spot Test	Single-Spot Test
	SI Units	
	Total Both Sides, g/m <sup>2</sup>	Total Both Sides, g/m <sup>2</sup>
AZM100	100	85
AZM110	110	95
AZM120	120	105
AZM150	150	130
AZM165	165	150
AZM180	180	155
AZM210	210	180

<sup>A</sup> The coating designation number is the term by which this product is specified. Because of the many variables and changing conditions that are characteristic of continuous hot-dip coating lines, the weight [mass] of the coating is not always evenly divided between the two surfaces of a sheet, nor is the coating evenly distributed from edge to edge. However, it can normally be expected that not less than 40 % of the single-spot test limit will be found on either surface.

## 6. Chemical Composition

### 6.1 Base Metal:

6.1.1 The heat analysis of the base metal shall conform to the requirements of **Table 2** for CS (Types A, B, and C), FS, DS, HTS, **Table 3** for SS.

6.1.2 Include each of the elements listed in **Tables 2 and 3** in the report of heat analysis. When the amount of copper, nickel, chromium, or molybdenum is less than 0.02 %, report the analysis either as <0.02 % or the actual determined value. When the amount of vanadium, titanium, or columbium is less than 0.008 %, report the analysis either as <0.008 % or the actual determined value. When the amount of boron is less than 0.0005 %, report as <0.0005 % or the actual determined value.

6.2 *Coating Composition*—The 55 % aluminum-zinc alloy coating composition, by weight, is nominally 55 % aluminum, 1.6 % silicon, and the balance zinc.

## 7. Mechanical Properties

7.1 Structural Steel sheet shall conform to the mechanical property requirements of **Table 4** for the grade specified.

7.2 The typical mechanical properties for CS (Types A, B, and C), FS, DS, and HTS are listed in **Table 5**. These typical

**TABLE 2 Chemical Requirements<sup>A</sup>**

Designation	Composition, %—Heat Analysis Element, Maximum, Unless Otherwise Shown											
	C	Mn	P	S	Al	Cu	Ni	Cr	Mo	V	Cb	Ti <sup>B</sup>
CS Type A <sup>C, D, E</sup>	0.10	0.60	0.030	0.035	...	0.25	0.20	0.15	0.06	0.008	0.008	0.025
CS Type B <sup>C, F</sup>	0.02 to 0.15	0.60	0.030	0.035	...	0.25	0.20	0.15	0.06	0.008	0.008	0.025
CS Type C <sup>C, D, E</sup>	0.08	0.60	0.10	0.035	...	0.25	0.20	0.15	0.06	0.008	0.008	0.025
FS <sup>C, G</sup>	0.02 to 0.10	0.50	0.020	0.030	...	0.25	0.20	0.15	0.06	0.008	0.008	0.025
DS <sup>D, E</sup>	0.06	0.50	0.020	0.025	0.01, min	0.25	0.20	0.15	0.06	0.008	0.008	0.025
HTS <sup>C</sup>	0.02 to 0.15	0.60	0.040, min	0.035	...	0.25	0.20	0.15	0.06	0.008	0.008	0.025

<sup>A</sup>Where an ellipsis ( . . . ) appears in the table, there is no requirement, but the analysis result shall be reported.

<sup>B</sup>For steels containing more than 0.02 % carbon, titanium is permitted at the producer's option, to the lesser of 3.4N + 1.5S or 0.025 %, for the purpose of stabilization.

<sup>C</sup>When a deoxidized steel is required for the application, the purchaser has the option to order CS, FS, and HTS to a minimum of 0.01 % total aluminum.

<sup>D</sup>Steel is permitted to be furnished as a vacuum degassed or chemically stabilized steel, or both, at producer's option.

<sup>E</sup>For carbon levels less than or equal to 0.02 %, vanadium, columbium, or titanium, or combinations thereof are permitted to be used as stabilizing elements at producer's option. In such cases, the applicable limit for vanadium and columbium shall be 0.10 % max. and the limit for titanium shall be 0.15 % max.

<sup>F</sup>For CS, specify Type B to avoid carbon levels below 0.02 %.

<sup>G</sup>Shall not be furnished as a stabilized steel.

**TABLE 3 Chemical Requirements**

Designation	Composition, %—Heat Analysis Element, maximum, Unless Otherwise Shown											
	C	Mn	P	S	Cu	Ni	Cr	Mo	V	Cb	Ti <sup>A</sup>	N <sup>B</sup>
Structural Steel:												
Grade 33 [230]	0.20	1.35	0.04	0.040	0.25	0.20	0.15	0.06	0.008	0.008	0.025	...
Grade 37 [255]	0.20	1.35	0.10	0.040	0.25	0.20	0.15	0.06	0.008	0.008	0.025	...
Grade 40 [275]	0.25	1.35	0.10	0.040	0.25	0.20	0.15	0.06	0.008	0.008	0.025	...
Grade 50 Class 1, Class 2, and Class 4 [340 Class 1, Class 2, and Class 4]	0.25	1.35	0.20	0.040	0.25	0.20	0.15	0.06	0.008	0.008	0.025	...
Grade 60 [410]	0.25	1.35	0.20	0.040	0.25	0.20	0.15	0.06	0.008	0.008	0.025	...
Grade 70 [480]	0.25	1.35	0.20	0.040	0.25	0.20	0.15	0.06	0.008	0.008	0.025	...
Grade 80 [550] Class 1	0.20	1.35	0.04	0.040	0.25	0.20	0.15	0.06	0.008	0.015	0.025	...
Grade 80 [550] Class 2 <sup>C</sup>	0.10	1.35	0.05	0.020	0.25	0.20	0.15	0.06	0.10	0.10	0.15	...
Grade 80 [550] Class 3	0.20	1.35	0.04	0.040	0.25	0.20	0.15	0.06	0.008	0.015	0.025	...

<sup>A</sup>Titanium is permitted at the producer's option, to the lesser of 3.4N + 1.5S or 0.025 %, for the purpose of stabilization.

<sup>B</sup>Where an ellipsis ( . . . ) appears in the table, there is no requirement, but the analysis shall be reported.

<sup>C</sup>Steels containing less than or equal to 0.02 % carbon shall be furnished as a stabilized steel.

mechanical properties are nonmandatory. They are intended solely to provide the purchaser with as much information as possible to make an informed decision on the steel to be specified. Values outside these ranges are to be expected.

7.3 All tests for mechanical properties shall be conducted in accordance with the methods described in Specification **A924/A924M**.

#### 7.4 Bending Properties:

7.4.1 *Minimum Inside Radii for Cold Bending*—Structural Steel sheet is commonly fabricated by cold bending. There are many interrelated factors that affect the ability of a steel to cold form over a given radius under shop conditions. These factors include thickness, strength level, degree of restraint, relationship to rolling direction, chemistry, and base metal microstructure. Table X2.1 lists the suggested minimum inside radii for 90° cold bending for Structural Steels. They presuppose “hard way” bending (bend axis parallel to the rolling direction) and reasonably good shop forming practices. Where possible, the use of larger radii or “easy way” bends are recommended for improved performance.

7.4.2 Fabricators should be aware that cracks may initiate upon bending a sheared or cold-worked edge. This is not considered to be a fault of the steel but is rather a function of the induced localized cold-work zone.

## 8. Coating Properties

### 8.1 Coating Weight [Mass]—

8.1.1 Coating weight [mass] shall conform to the requirements as shown in **Table 1** for the specific coating designation.

8.1.2 Use the following relationships to estimate the coating thickness from the coating weight [mass]:

8.1.2.1 1.00 oz /ft<sup>2</sup> coating weight = 3.20 mils coating thickness, and

8.1.2.2 3.75 g/m<sup>2</sup> coating mass = 1.00 μm coating thickness

8.1.3 Use the following relationship to convert coating weight to coating mass:

8.1.3.1 1.00 oz/ft<sup>2</sup> coating weight = 305 g/m<sup>2</sup> coating mass

### 8.2 Coating Weight [Mass] Tests:

8.2.1 Coating weight [mass] tests shall be performed in accordance with the requirements stated in Specification **A924/A924M**.

8.2.2 The referee method to be used shall be the dilute hydrochloric acid method, in Test Method **A90/A90M**.

8.3 *Coating Bend Test*—The coating bend test specimens for all designations other than Structural Steel shall be capable of being bent through 180° flat on itself in any direction without flaking on the outside of the bend only. For Structural Steel, the coating bend test inside diameter shall have a relation to the

**TABLE 4 Mechanical Property Requirements, Structural Steel Base Metal (Longitudinal)**

Inch-Pound Units			
Grade	Yield Strength, min, ksi	Tensile Strength, <sup>A</sup> min, ksi	Elongation in 2 in., min, %
33	33	45	20
37	37	52	18
40	40	55	16
50 Class 1	50	65	12
50 Class 2	50	...	12
50 Class 4	50	60	12
60	60	70	10 <sup>B</sup>
70	70	80	9 <sup>B</sup>
80 Class 1 <sup>C</sup>	80 <sup>D</sup>	82	...
80 Class 2 <sup>C,E</sup>	80 <sup>D</sup>	82	...
80 Class 3	80 <sup>D</sup>	82 <sup>F</sup>	3

  

SI Units			
Grade	Yield Strength, min, MPa	Tensile Strength, min, MPa	Elongation in 50 mm, min, %
230	230	310	20
255	255	360	18
275	275	380	16
340 Class 1	340	450	12
340 Class 2	340	...	12
340 Class 4	340	410	12
410	410	480	10 <sup>B</sup>
480	480	550	9 <sup>B</sup>
550 Class 1 <sup>C</sup>	550 <sup>D</sup>	570	...
550 Class 2 <sup>C,E</sup>	550 <sup>D</sup>	570	...
550 Class 3	550 <sup>D</sup>	570 <sup>F</sup>	3

<sup>A</sup> Where an ellipsis ( . . . ) appears in the table, there is no requirement.

<sup>B</sup> For sheet thickness of 0.028 in. [0.71 mm] or thinner, the elongation requirement is reduced two percentage points for SS Grades 60 [410] and 70 [480].

<sup>C</sup> For sheet thicknesses of 0.028 in. and thinner, no tension test is required if the hardness result is Rockwell B85 or higher.

<sup>D</sup> As there is no discontinuous yield curve, the yield strength should be taken as the stress at 0.5 % elongation under load or 0.2 % offset.

<sup>E</sup> SS Grade 80 [550] Class 2 may exhibit different forming characteristics than Class 1, due to a difference in chemistry.

<sup>F</sup> The purchaser should consult with the producer when ordering SS Grade 80 [550] Class 3 material in sheet thicknesses 0.028 in. [0.71 mm] or thinner regarding elongation and tension test requirements.

**TABLE 5 Typical Ranges of Mechanical Properties (Nonmandatory)<sup>A, B</sup>**

Designation	Longitudinal Direction				
	Yield Strength		Elongation	$r_m$ Value <sup>C</sup>	$n$ Value <sup>D</sup>
	ksi	MPa	2 in. [50 mm] %		
CS Type A	30/60	[205/410]	≥20	<sup>E</sup>	<sup>E</sup>
CS Type B	35/60	[245/410]	≥20	<sup>E</sup>	<sup>E</sup>
CS Type C	30/65	[205/450]	≥15	<sup>E</sup>	<sup>E</sup>
FS	25/40	[170/275]	≥24	1.0/1.4	0.16/0.20
DS	20/35	[140/240]	≥30	1.3/1.7	0.18/0.22
HTS	30/65	[205/450]	≥15	<sup>E</sup>	<sup>E</sup>

<sup>A</sup> The typical mechanical property values presented in this table are nonmandatory. They are intended solely to provide the purchaser with as much information as possible to make an informed decision on the steel to be specified. Values outside of these ranges are to be expected. The purchaser may negotiate with the supplier if a specific or restricted range is required for the application.

<sup>B</sup> These typical mechanical properties apply to the full range of steel sheet thicknesses. The yield strength tends to increase and some of the formability values tend to decrease as the sheet thickness decreases.

<sup>C</sup>  $r_m$  Value—Average plastic strain ratio as described in Test Method E517.

<sup>D</sup>  $n$  Value—Strain hardening exponent as described in Test Method E646.

<sup>E</sup> No typical properties have been established.

**TABLE 6 Coating Bend Test Requirements—Structural Steel**

Grade	Ratio of the Inside Bend Diameter to Thickness of the Specimen (Any Direction)
33 [230]	1½
37 [255]	2
40 [275]	2½
50 Class 1, Class 2, and Class 4	<sup>A</sup>
60	<sup>A</sup>
70	<sup>A</sup>
[340 Class 1, Class 2, and Class 4]	
80 Class 1, Class 2, and Class 3	<sup>A</sup>
[550 Class 1, Class 2, and Class 3]	

<sup>A</sup> Grades not subject to bend test requirements.

thickness of the specimen as shown in Table 6. Flaking of the coating within 0.25 in. [6 mm] of the edge of the bend specimen shall not be cause for rejection.

## 9. Retests and Disposition of Non-Conforming Material

9.1 Retests, conducted in accordance with the requirements of the section on Retests and Disposition of Non-Conforming Material of Specification A924/A924M, are permitted when an unsatisfactory test result is suspected to be the consequence of the test method procedure.

9.2 Disposition of non-conforming material shall be subject to the requirements of 9.2 of Specification A924/A924M.

## 10. Dimensions and Permissible Variations

10.1 All dimensions and permissible variations shall comply with the requirements of Specification A924/A924M.

## 11. Keywords

11.1 55 % aluminum-zinc alloy coating; coatings, metallic; steel sheet, metallic coated

## SUPPLEMENTARY REQUIREMENTS

The following standardized supplementary requirements are for use when desired by the purchaser. These additional requirements shall apply only when specified on the order.

### S1. Base Metal Thickness

S1.1 The specified minimum thickness shall apply to the base metal only.

S1.2 The coating designation shown on the order indicates the coating to be applied to the specified minimum base metal thickness.

S1.3 The applicable tolerances for base metal thickness are shown in Tables 16 and 17, Thickness Tolerance of Cold-Rolled Sheet (Carbon and High-Strength, Low-Alloy Steel), of Specification **A568/A568M**.

## APPENDIXES

### X1. BENDING PROPERTIES

Note 1—  $t$  = radius equivalent to the steel thickness.

Note 2—The suggested radii should be used as minimums for 90° bends in actual shop practice.

**TABLE X1.1 Suggested Minimum Inside Radii for Cold Bending**

Designation	Grade	Minimum Inside Radius for Cold Bending <sup>A</sup>
Structural Steel	33 [230]	$1\frac{1}{2} t$
	37 [255]	$2t$
	40 [275]	$2t$
	50 Class 1, Class 2, and Class 4 [340 Class 1, Class 2, and Class 4]	not applicable
	60 [410]	not applicable
	70 [480]	not applicable
	80 class 1, Class 2, and Class 3 [550 Class 1, Class 2, and Class 3]	not applicable

<sup>A</sup> Bending capability may be limited by the coating designation.

### X2. RATIONALE FOR CHANGES IN PRODUCT DESIGNATIONS

X2.1 Subcommittee A05.11 has revised the designations used to classify the various products available in each hot-dip coated specification. The previous “quality” designations have been replaced with designations and descriptions more closely related with product characteristics. Many of the former “quality” specifications described the steel only in terms of limited chemical composition, which in some cases was identical for two or more qualities. The former designations also did not reflect the availability of new steels which are the result of the use of new technologies such as vacuum degassing and steel ladle treatments.

X2.2 The former “quality” designators, defined in very broad qualitative terms, did not provide the user with all the information needed to select the appropriate steel for an application. The new designations are defined with technical information such as specific chemical composition limits and typical-nonmandatory mechanical properties. These steel characteristics are important to users concerned with the weldability and formability of the coated steel products. The typical mechanical properties included in the new designation system are those indicated by the tension test. These properties are more predictive of steel formability than other tests such as the

hardness test which may not compensate adequately for product variables such as substrate thickness and coating weight.

X2.3 The new designations also provide the user with the flexibility to restrict the steels applied on any order. For example, a user can restrict the application of ultra low carbon steels on an application through the selection of an appropriate “type” designator.

X2.4 There is a limited relationship between the former and current systems of designation. Some of the reasons for this limited relationship are: addition of steels not previously described in ASTM specifications, restrictions placed on ranges of chemical composition, the addition of typical mechanical properties, and the enhanced capability of steel producers to combine chemical composition and processing methods to achieve properties tailored to specific applications.

X2.5 The changes in designation are significant which may create transition issues that will have to be resolved. Continued dialogue between users and producers will have to be maintained to assist the transition to the new system of designations. A user with concerns about the appropriate coated steel to order



for a specific application should consult with a steel supplier or producer.

## SUMMARY OF CHANGES

Committee A05 has identified the location of selected changes to this standard since the last issue (A792/A792M – 09A) that may impact the use of this standard. (November 1, 2010)

- |   |   |
|---|---|
| (1) Revised coating weight [mass] to thickness conversion values in 8.1 to three significant figures. | (3) Changed composition in Table 3 for SS Grade 80 class 2. |
| (2) Added 5.2.3.1 for default class for grade 80 SS.  | (4) Changed footnote C for Table 3.                         |

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