Designation: A 792/A 792M – 05

Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process[1]

This standard is issued under the fixed designation A 792/A 792M; 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 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 A 924/A 924M, unless otherwise provided herein.

1.5 This specification is applicable to orders in either inch-pound units (as A 792) or SI units (as A 792M). 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.

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

1.7 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.

1.8 *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.*

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

A 568/A 568M Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

A 902 Terminology Relating to Metallic Coated Steel Products

A 924/A 924M Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

E 517 Test Method for Plastic Strain Ratio *r* for Sheet Metal

E 646 Test Method for Tensile Strain-Hardening Exponents (*n*-Values) of Metallic Sheet Materials

3. Terminology

3.1 *Definitions*—See Terminology A 902 for definitions of general terminology relating to metallic-coated hot-dip products.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *regular spangle*—the unaltered 55 % aluminum-zinc (Al-Zn) crystal structure that occurs during normal solidification of a hot-dip coated steel sheet.

3.2.2 *high temperature steel*—a product intended for use in elevated temperature applications.

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 *Forming Steel*—FS,

4.1.3 *Drawing Steel*—DS,

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.

[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.

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

TABLE 1 Weight [Mass] of Coating Requirements[A]

NOTE 1—The coating thickness may be estimated from the coating weight [mass] by using Table X1.1.

	Minimum Requirements	
	Triple-Spot Test	Single-Spot Test
	Inch-Pound Units	
Coating Designation	Total Both Sides, oz/ft^2	Total Both Sides, oz/ft^2
AZ50	0.50	0.43
AZ55	0.55	0.50
AZ60	0.60	0.52
	Minimum Requirements	
	Triple-Spot Test	Single-Spot Test
	SI Units	
Coating Designation	Total Both Sides, g/m^2	Total Both Sides, g/m^2
AZM150	150	130
AZM165	165	150
AZM180	180	155

[A] 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.

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,

5.2.4 ASTM designation number and year of issue, such as A 792 – ____ for inch-pound units or A 792M – ____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, width, flatness requirements (if appropriate), and length (if cut length)). The purchaser shall specify the appropriate table of thickness tolerances in Specification A 924/A 924M that applies to the order, that is, the table of thickness tolerances for ⅜-in. [10-mm] edge distance, or the table of thickness tolerances for 1-in. [25-mm] edge distance.

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 A 792 – ____, 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 A 792M – ____, 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.

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.

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

TABLE 2 Chemical Requirements[A]

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

[A] Where an ellipsis (. . .) appears in the table, there is no requirement, but the analysis result shall be reported.

[B] For steels containing more than 0.02% carbon, titanium is permitted to 0.025% provided the ratio of % titanium to % nitrogen does not exceed 3.4.

[C] 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.

[D] Steel is permitted to be furnished as a vacuum degassed or chemically stabilized steel, or both, at producer's option.

[E] 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.

[F] For CS, specify Type B to avoid carbon levels below 0.02 %.

[G] 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[A]	N[B]
Structural Steel:												
Grade 33 [230]	0.20	1.15	0.04	0.040	0.20	0.20	0.15	0.06	0.008	0.008	0.025	...
Grade 37 [255]	0.20	1.15	0.10	0.040	0.20	0.20	0.15	0.06	0.008	0.008	0.025	...
Grade 40 [275]	0.25	1.15	0.10	0.040	0.20	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	1.15	0.20	0.040	0.20	0.20	0.15	0.06	0.008	0.008	0.025	...
Grade 80 [550] Class 1	0.20	1.15	0.04	0.040	0.20	0.20	0.15	0.06	0.008	0.015	0.025	...
Grade 80 [550] Class 2[C]	0.02	1.15	0.05	0.020	0.20	0.20	0.15	0.06	0.10	0.10	0.15	...

[A] Titanium is permitted to 0.025 % provided the ratio of % titanium to % nitrogen does not exceed 3.4.
[B] Where an ellipsis (. . .) appears in the table, there is no requirement, but the analysis shall be reported.
[C] Shall be furnished as a stabilized steel.

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 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 A 924/A 924M.

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.

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

Inch-Pound Units

Grade	Yield Strength, min, ksi	Tensile Strength,[A] 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
80 Class 1[B]	80[C]	82	. . .
80 Class 2[B,D]	80[C]	82	. . .

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
550 Class 1[B]	550[C]	570	. . .
550 Class 2[B,D]	550[C]	570	. . .

[A] Where an ellipses (. . .) appears in the table, there is no requirement.
[B] For sheet thicknesses of 0.028 in. and thinner, no tension test is required if the hardness result is Rockwell B 85 or higher.
[C] 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.
[D] SS Grade 80 [550] Class 2 may exhibit different forming characteristics than Class 1, due to a difference in chemistry.

TABLE 5 Typical Ranges of Mechanical Properties (Nonmandatory)[A, B]

Designation	Longitudinal Direction				
	Yield Strength		Elongation 2 in. [50 mm] %	r_m Value[C]	*n* Value[D]
	ksi	MPa			
CS Type A	30/60	[205/410]	≥20	E	E
CS Type B	35/60	[245/410]	≥20	E	E
CS Type C	30/65	[205/450]	≥15	E	E
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	E	E

[A] 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.
[B] 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.
[C] r_m Value—Average plastic strain ratio as described in Test Method E 517.
[D] *n* Value—Strain hardening exponent as described in Test Method E 646.
[E] No typical properties have been established.

8. Coating Properties

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

8.2 *Coating Weight [Mass] Tests*:

8.2.1 Coating weight [mass] tests shall be performed in accordance with the requirements stated in Specification A 924/A 924M.

8.2.2 The referee method to be used shall be the dilute hydrochloric acid method, in Test Method A 90/A 90M.

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 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.

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 [340 Class 1, Class 2, and Class 4]	[A]
80 Class 1 and Class 2 [550 Class 1 and Class 2]	[A]

[A] Grades not subject to bend test requirements.

9. Dimensions and Permissible Variations

9.1 All dimensions and permissible variations shall comply with the requirements of Specification A 924/A 924M.

10. Keywords

10.1 coatings, metallic; 55 % aluminum-zinc alloy coating; 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 A 568/A 568M.

APPENDIXES

(Nonmandatory Information)

X1. RELATIONSHIP BETWEEN COATING WEIGHT [MASS] AND THICKNESS

TABLE X1.1 Conversion Factors Between Coating Weight [Mass] and Thickness[A]

Coating Weight [Mass]		Coating Thickness	
oz/ft^2	g/m^2	mils	μm
1.0	305.15[B]	3.2	81.28[B]
0.00328[B]	1.0	0.010487[B]	0.26636[B]
0.3125[B]	95.360[B]	1.0	25.4[B]
0.012303[B]	3.7543[B]	0.03937[B]	1.0

[A] One ounce of 55 % Al-Zn alloy coating per square foot of surface corresponds to an average coating thickness of 0.0032 in. [3.2 mils]. All other values in Table X1.1 are based on this relationship and on standard inch-pound to SI conversions.

[B] Weight [mass] to thickness conversions are reliable to only two significant figures. Inch-pound to SI conversions are reliable to five significant figures. A greater number of digits are shown in this table to reduce errors due to rounding when calculating equivalencies for coating weight [mass] or thickness greater than unity.

X2. 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 X2.1 Suggested Minimum Inside Radii for Cold Bending

Designation	Grade	Minimum Inside Radius for Cold Bending[A]
Structural Steel	33 [230]	1½ 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

[A] Bending capability may be limited by the coating designation.

X3. RATIONALE FOR CHANGES IN PRODUCT DESIGNATIONS

X3.1 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.

X3.2 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.

X3.3 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.

X3.4 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.

X3.5 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, A 792/A 792M – 03, that may impact the use of this standard. (June 1, 2005)

(*1*) Revised subsection 4.2.
(*2*) Renamed existing Grade 80 [550] to Grade 80 [550] Class 1.
(*3*) Added Grade 80 [550] Class 2 to Tables 3 and 4.

Committee A05 has identified the location of selected changes to this standard since the last issue, (A 792/A 792M – 02, that may impact the use of this standard. (October 1, 2003)

(*1*) Added a new SS Grade 50 Class 4 to paragraph 4.2, Tables 3, 4, and 6.
(*2*) Revised the metric yield strength from 345 to 340 in Table 4 and Appendix X2.