Designation: A 308/A 308M – 06

Standard Specification for Steel Sheet, Terne (Lead-Tin Alloy) Coated by the Hot-Dip Process[1]

This standard is issued under the fixed designation A 308/A 308M; 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 sheet steel in coils and cut lengths coated with lead-tin alloy (terne metal, see 3.2.3) by the hot-dip process. This material is commonly known as terne and is used where ease of solderability and a degree of corrosion resistance are desirable. It is especially suitable where resistance to gasoline is required. Terne-coated sheet is also used for stamping, where the coating acts as a lubricant in the die, lessening difficulties in drawing. The weight of coating, always expressed as total coating on both sides, shall be specified in accordance with Table 1.

1.2 Material furnished under this specification shall conform to the applicable requirements of the latest issue of Specification A 924/A 924M, unless otherwise provided herein.

1.3 Terne-coated steel is available in a number of designations, types, and grades.

1.4 This specification is applicable to orders in either inch-pound units (as A 308) or SI units (as A 308M). 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 independently of the other.

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

1.6 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.

1.7 *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:* [2]

A 309 Test Method for Weight and Composition of Coating on Terne Sheet by the Triple-Spot Test

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*—For definitions of terms and abbreviations used in this specification, see Terminology A 902.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *electrolytic nickel plate*, *n*—a nickel coating predeposited on steel sheet; used to promote a more uniform and more corrosion-resistant hot-dipped, long terne coating.

3.2.2 *terne-coated sheet*, *n*—steel sheet coated by immersion in molten terne metal; the steel sheet prior to immersion in the terne metal is either bare (uncoated) or with a predeposited electrolytic nickel coating.

3.2.3 *terne metal*, *n*—an alloy of lead with a small percentage of tin sufficient to obtain a smooth continuous coating.

3.2.3.1 *Discussion*—The minimum tin content is normally 8 %, with higher percentages used depending on the type of coating equipment used.

4. Classification

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

4.1.1 Commercial steel (CS Types A, B, and C),

4.1.2 Deep drawing steel (DDS),

[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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[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.

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

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TABLE 1 Weight [Mass] of Coating (Total Both Sides)[A,B]

NOTE 1—*Coating Thickness/Weight [Mass] Equivalence*—The coating thickness may be estimated from the coating weight [mass] by using the following relationship: 0.25 oz/ft^2 [75 g/m^2] total both sides (LT25 [LTZ75]) is equal to 0.00027 in. or 0.27 mils [0.00508 mm] total both sides. This formula is not to be used for calculation of tensile strength of the base metal, which must be based on actual base metal thickness measurement.

Coating Designation	Minimum Requirements	
	Triple-Spot Test	Single-Spot Test
	Inch-Pound Units	
	oz/ft^2	oz/ft^2
LT01	no minimum[C]	no minimum[C]
LT25	0.25	0.20
LT35	0.35	0.25
LT40	0.40	0.30
LT55	0.55	0.40
LT85	0.85	0.70
LT110	1.10	0.90
	SI Units	
	g/m^2	g/m^2
LTZ01	no minimum[C]	no minimum[C]
LTZ75	75	60
LTZ110	110	75
LTZ120	120	90
LTZ170	170	120
LTZ260	260	215
LTZ335	335	275

[A] The coating designation number is the term by which this material is specified. The weight [mass] of coating in ounces per square foot [grams per square metre] of sheet refers to the total coating on both surfaces. Because of the many variables and changing conditions that are characteristic of continuous terne coating, the terne coating is not always evenly divided between the two surfaces of the terne-coated sheet, nor is the terne coating always evenly distributed from edge to edge. However, it can normally be expected that not less than 40 % of the single-spot check limit will be found on either surface.

[B] As the performance for the long terne-coated sheet is related to the coating thickness, material carrying the statement "meets ASTM A 308 [A 308M] requirements" should also specify the particular coating designation.

[C] "No minimum" means that there are no established minimum requirements for triple- and single-spot tests.

4.1.3 Extra deep drawing steel (EDDS), and

4.1.4 Structural steel (SS).

4.2 Structural steel is available in several grades.

4.3 The material is available with several coating weights [masses] (coating designations) as shown in Table 1.

5. Ordering Information

5.1 Terne-coated sheet in coils or cut lengths is produced to thickness requirements expressed to 0.001 in. [0.01 mm]. The thickness of the sheet includes both the base metal and the coating.

5.2 Orders for material under this specification shall include the following information, as necessary, to describe adequately the required material:

5.2.1 Name of material (long terne-coated steel sheet),

5.2.2 Designations of sheet steel (CS (Types A, B, and C) DDS, EDDS, and SS including grade or SS),

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

5.2.3 ASTM designation number and year of issue,

5.2.4 Coating designation (see 8.1.1 and Table 1),

5.2.5 Nickel plating; specify with or without (if unspecified, the sheet steel would usually be supplied without nickel plating),

5.2.6 Specify whether oiled or not oiled,

5.2.7 Dimensions (show thickness, minimum or nominal width, 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.

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

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

5.2.10 Application (part identification and description), and

5.2.11 Special requirements (if any).

NOTE 1—Typical ordering descriptions are as follows: terne-coated sheet, Deep Drawing Steel (DDS), ASTM A 308 – ____; coating designation LT25, oiled 0.024 in. minimum by 32 in. by coil, 24 in. ID, 15 000–lb max for fuel tank—upper half, or terne-coated sheet, Deep Drawing Steel (DDS), ASTM A 308M–coating designation LTZ75, oiled, 0.60 mm minimum by 810–mm by coil, 600–mm ID, 7000–kg max for fuel tank upper half.

6. Chemical Composition, Base Metal

6.1 The heat analysis of the base metal furnished under this specification shall conform to the requirements shown in Table 2.

6.1.1 Include in the report of the heat analysis, each of the elements in Table 2. When the amount of copper, nickel, chromium, or molybdenum is less than 0.02 %, report the analysis as <0.02 % or the actual determined value. When the amount of vanadium, titanium, or columbium is less than 0.008 %, report the analysis 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.

7. Mechanical Properties

7.1 Structural steel sheet shall conform to the mechanical property requirements in Table 3 for the type, grade, or class specified, or combination thereof.

7.2 The typical mechanical properties for CS (Types A, B, and C), DDS, and EDDS sheet designations are listed in Table 4. These 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 of these ranges are to be expected.

7.3 When base metal mechanical properties are required, all tests shall be conducted in accordance with the methods specified in Specification A 924/A 924M.

7.4 *Bending Properties*:

7.4.1 *Minimum Cold-Bending Radii*—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

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TABLE 2 Chemical Requirements[A]

Designation	Composition, %—Heat Analysis Element, max (unless otherwise shown)													
	C	Mn	P	S	Al	Cu	Ni	Cr	Mo	V	Cb	Ti[B]	N	B
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[F,C]	0.02–0.15	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	...	...
DDS[D,E]	0.06	0.50	0.020	0.030	0.01, min	0.20	0.20	0.15	0.06	0.008	0.008	0.025	...	...
EDDS[G]	0.02	0.40	0.020	0.025	0.01, min	0.20	0.20	0.15	0.06	0.10	0.10	0.15	...	...
SS:														
Grades 25, 30, 33 (Type 1) and 80	0.20	0.60	0.04	0.04	. . .	0.20	0.20	0.15	0.06	0.008	0.008	0.025	...	...
													...	...
Grade 40 (Type 1)	0.20	0.90	0.04	0.04	. . .	0.20	0.20	0.15	0.06	0.008	0.008	0.025	...	...
Grades 33 (Type 2) and 40 (Type 2)	0.15	0.60	0.20	0.04	. . .	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 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 and SS 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 the 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 the 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 be furnished as a stabilized steel.

TABLE 3 Mechanical Requirements, Base Metal[A]

Structural Steel (SS) Grade	Inch-Pound Units: Yield Strength, min, ksi	Tensile Strength, min, ksi	Elongation in 2 in., min %
25	25	42	26
30	30	45	24
33 (Types 1 and 2)	33	48	22
40 (Types 1 and 2)	40	52	20
80[B]	80	82	. . .
	SI Units		
	Yield Strength, min, MPa	Tensile Strength, min, MPa	Elongation in 50 mm, min %
170	170	290	26
205	205	310	24
230 (Types 1 and 2)	230	330	22
275 (Types 1 and 2)	275	360	20
550	550	565	. . .

[A] Longitudinal sample direction (for example, test sample taken in the direction of rolling).
[B] On the full-hard product, the yield point approaches the tensile strength and since there is no halt in the gage or drop in the beam, the yield point shall be taken as the yield stress at 0.5 % extension under load. If hardness result is 85 Hardness Rockwell B (HRB) or higher, no tension test is required.

TABLE 4 Typical Ranges of Mechanical Properties (Nonmandatory) (Longitudinal Direction)[A,B]

Designation	Yield Strength ksi [MPa]	Elongation in 2 in. [50 mm], %	r_m Value[C]	n Value[D]
CS Type A	20/40 [140/275]	≥30	[E]	[E]
CS Type B	24/42 [165/290]	≥28	[E]	[E]
CS Type C	20/40 [140/275]	≥30	[E]	[E]
DDS[F]	22/35 [150/240]	≥36	1.3/1/7	0.17/0.22
EDDS[G]	15/25 [105/170]	≥40	1.7/2.1	0.23/0.27

[A] The typical mechanical property values presented here 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.
[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 steel sheet thickness decreases.
[C] r_m Value—Average plastic strain rates as determined by Test Method E 517.
[D] n Value—Strain hardening exponent as determined by Test Method E 646.
[E] No typical mechanical properties have been established.
[F] The DDS designation encompasses the previous drawing quality, special killed product.
[G] Furnish EDDS as a stabilized steel. It will be free from changes in mechanical properties over time, that is, nonaging.

TABLE 5 Coating Bend Test Requirements

Designation	Grade	Ratio of the Inside Bend Diameter to Thickness of the Specimen (Any Direction)
Structural steel	25 [170]	½ *t*
Structural steel	30 [205]	1*t*
Structural steel	33 [230] (Types 1 and 2)	1½ *t*
Structural steel	40 [275] (Types 1 and 2)	2*t*
Structural steel	80 [550]	not applicable

include: thickness, strength level, degree of restraint, relationship to rolling direction, chemistry, and base metal microstructure. Table 5 lists the suggested minimum inside radius for 90° cold bending for structural steel. They presuppose "hard way" bending (bend axis parallel to rolling direction) and reasonably good shop forming practices. Where possible, the use of larger radii or "easy way" bends are recommended for improved performance.

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.

8.2 *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 Test Method A 309.

8.3 *Coating Bend Test*:

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8.3.1 For all designations other than structural steel, the coated sheet shall be capable of being bent through 180° flat on itself in any direction without flaking of the coating on the outside of the bend only. Flaking of the coating within ¼ in. [6 mm] of the edge of the bend specimen shall not be a cause for rejection.

8.3.1.1 For structural steel, the bend test inside diameter shall have a relation to the thickness of the specimen as shown in Table 5.

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 A 924/A 924M, 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 A 924/A 924M.

10. Dimensions and Permissible Variations

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

11. Keywords

11.1 lead-tin coating; steel sheet; terne; terne coating

APPENDIX

(Nonmandatory Information)

X1. RATIONALE FOR CHANGES IN PRODUCT DESIGNATIONS

X1.1 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.

X1.1.1 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.

X1.1.2 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.

X1.1.3 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.

X1.1.4 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 with 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.

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SUMMARY OF CHANGES

Committee A05 has identified the location of selected changes to this standard since the last issue (A 308/A 308M - 03) that may impact the use of this standard. (November 15, 2006)

(*1*) Added new Section 9.
(*2*) Added boron reporting requirement to Table 2.
(*3*) Defined boron reporting precision in 6.1.1.

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