Designation: A 659/A 659M – 06

Standard Specification for Commercial Steel (CS), Sheet and Strip, Carbon (0.16 Maximum to 0.25 Maximum Percent), Hot-Rolled[1]

This standard is issued under the fixed designation A 659/A 659M; 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 hot-rolled carbon steel (CS) sheet and strip, in coils and cut lengths, in which the maximum of the specified carbon range is over 0.15 and not over 0.25 % and the maximum of the specified manganese range is not over 0.90 %. This material is ordered to chemical composition.

1.2 This specification is not applicable to the steels covered by Specification A 635/A 635M.

1.3 The values stated in either acceptable SI (metric) units or in other units shall be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

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

A 635/A 635M Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for

A 749/A 749M Specification for Steel, Strip, Carbon and High-Strength, Low-Alloy, Hot-Rolled, General Requirements for

E 527 Practice for Numbering Metals and Alloys (UNS)

2.2 *Society of Automotive Engineers Standard:*[3]

J 1086 Numbering Metals and Alloys

3. Ordering Information

3.1 It is the purchaser's responsibility to specify in the purchase order all ordering information necessary to purchase the needed material. Examples of such information include but are not limited to the following:

3.1.1 ASTM specification number and year of issue,

3.1.2 Name of material (hot-rolled commercial steel (CS) sheet, or hot-rolled commercial steel (CS) strip),

3.1.3 Grade designation or chemical composition, or both,

3.1.4 Copper-bearing steel (if required),

3.1.5 Condition (as-rolled, pickled, or blast cleaned) (see 4.1),

3.1.5.1 Material to this specification is furnished in the hot-rolled condition. Pickled (or blast cleaned) must be specified if required,

3.1.6 Oiling (see 7.2),

3.1.7 Edges (see 7.1),

3.1.8 Dimensions (thickness, width, and whether cut lengths or coils),

3.1.8.1 As agreed upon between the purchaser and the producer, material ordered to this specification will be supplied to meet the appropriate standard or restricted thickness tolerance table shown in Specification A 568/A 568M.

NOTE 1—Not all producers are capable of meeting all of the limitations of the thickness tolerance tables in Specification A 568/A 568M. The purchaser should contact the producer regarding possible limitations prior to placing an order.

3.1.9 Coil size (must include inside diameter, outside diameter, and maximum mass),

3.1.10 Quantity,

3.1.11 Application (show part identification and description),

3.1.12 Special requirements (if required), and

3.1.13 Cast or heat analysis report (request, if required).

NOTE 2—A typical ordering description is as follows:
"ASTM A659-XX [or A659M-XX], Hot-Rolled Commercial Steel (CS) Sheet, Grade 1017, Pickled and Oiled, Cut Edge, 0.075 by 36 in. [or 1.85

[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.19 on Steel Sheet and Strip.

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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.

[3] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.

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

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by 900 mm], by coil, ID 24 in., OD 48 in., max weight 11 250 lb max [or ID 600 mm, OD 1200 mm, max, weight 7500 kg, max], 100 000 lb [or 45 000 kg] for Part No. 6509, Shelf Leg, Cast or heat analysis report required."

4. Materials and Manufacture

4.1 *Condition*—Unless otherwise specified, the material is furnished in the as-rolled condition (not annealed or pickled).

5. Chemical Composition

5.1 *The Cast or Heat Analysis* of the steel shall conform to the chemical requirements shown in Table 1, or chemical compositions can be specified from carbon 0.16 maximum to 0.25 % maximum, inclusive, and manganese 0.90 % maximum, inclusive, which conform to the standard chemical ranges and limits tables in the Appendixes of Specifications A 568/A 568M and A 749/A 749M.

5.1.1 Unspecified elements may be present. Limits on elements shall be as stated in Table 2.

5.1.1.1 Each of the elements listed in Table 2 shall be included in the report of the heat analysis. When the amount of copper, nickel, chromium, or molybdenum is less than 0.02 %, the analysis may be reported as "<0.02 %." When the amount of vanadium or columbium is less than 0.008 %, the analysis may be reported as "<0.008 %."

5.2 Where material is used for fabrication by welding, care must be exercised in selection of the chemical composition to assure compatibility with the welding process and its effect on altering the properties of the steel.

6. Bending Properties

6.1 The minimum forming radius (radii) that steel covered by this specification can be expected to sustain is listed in the appendix and is discussed in more detail in Specifications A 568/A 568M, and A 749/A 749M. When tighter bend radii are required, or curved or offset bends are involved, or when stretching or drawing are also a consideration, the producers shall be consulted.

7. Workmanship, Finish, and Appearance

7.1 *Edge*:

7.1.1 Sheet can be supplied with mill edge or cut edge.

7.1.2 Strip can be supplied with mill edge or slit (cut) edge.

7.2 *Oiling*—Hot-rolled, non-pickled material is commonly furnished not oiled, while hot-rolled pickled (or blast cleaned) material is commonly furnished oiled. When required, pickled (or blast cleaned) material may be specified to be furnished not oiled, and non-pickled material may be specified to be furnished oiled.

8. General Requirements for Delivery

8.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 568/A 568M for sheet, and Specification A 749/A 749M for strip, unless otherwise provided herein.

9. Certification and Reports

9.1 When requested, the producer shall furnish copies of a report showing test results of the cast or heat analysis. The report shall include the purchase order number, the ASTM designation number, and the cast or heat number representing the material.

10. Keywords

10.1 carbon steel sheet; carbon steel strip; hot rolled steel sheet; hot rolled steel strip; steel sheet; steel strip

TABLE 1 Typical Grade Designations and Chemical Compositions[A]

UNS Designation[B]	Grade Designation	Carbon, %	Manganese, %	Phosphorus, max, %	Sulfur, max, %
G10150	1015	0.13–0.18	0.30–0.60	0.030	0.035
G10160	1016	0.13–0.18	0.60–0.90	0.030	0.035
G10170	1017	0.15–0.20	0.30–0.60	0.030	0.035
G10180	1018	0.15–0.20	0.60–0.90	0.030	0.035
G10200	1020	0.18–0.23	0.30–0.60	0.030	0.035
G10210	1021	0.18–0.23	0.60–0.90	0.030	0.035
G10230	1023	0.20–0.25	0.30–0.60	0.030	0.035

[A] Copper, when specified, shall have a minimum content of 0.20 % by cast or heat analysis.
[B] Designation established in accordance with Practice E 527 and SAE J 1086.

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TABLE 2 Limits on Unspecified Elements (see 5.1.1)

Copper, max %[A]	Heat analysis	0.20
	Product analysis	0.23
Nickel, max %[A]	Heat analysis	0.20
	Product analysis	0.23
Chromium, max %[A]	Heat analysis	0.15
	Product analysis	0.19
Molybdenum, max %[A]	Heat analysis	0.06
	Product analysis	0.07
Vanadium, max %	Heat analysis	0.008
	Product analysis	0.018
Columbium, max %	Heat analysis	0.008
	Product analysis	0.018

[A] The sum of copper, nickel, chromium, and molybdenum shall not exceed 0.50 % on heat analysis. When one or more of these elements are specified, the sum does not apply; in which case, only the individual limits on the remaining unspecified elements will apply.

APPENDIX

(Nonmandatory Information)

X1. BENDING PROPERTIES

X1.1 Table X1.1 shows suggested minimum inside radii for cold bending.

TABLE X1.1 Suggested Minimum Inside Radii for Cold Bending[A]

NOTE 1—(*t*) equals a radius equivalent to the steel thickness.
NOTE 2—The suggested radii should be used as minimums for 90° bends in actual shop practice.

Maximum of Specified Manganese Range, %	Minimum Inside Radius for Cold Bending
To 0.60 incl.	2 *t*
Over 0.60 to 0.90 incl.	2½ *t*

[A] Material that does not perform satisfactorily, when fabricated in accordance with the above requirements, may be subject to rejection pending negotiation with the steel supplier.

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A 659/A 659M – 97 (2001)) that may impact the use of this standard. (Approved Oct. 1, 2006.)

(*1*) Revised 5.1.

(*2*) Revised Table 1.

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