



Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, General Requirements For¹

This standard is issued under the fixed designation A 682/A 682M; 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 the general requirements for cold-rolled carbon spring steel strip in coils or cut lengths. Strip is classified as product that is 0.3000 in. (7.6 mm) or less in thickness and over $\frac{1}{2}$ to $23^{15}/16$ in. (12.5 to 600 mm) in width, inclusive. Strip tolerance products may be available in widths wider than $23^{15}/16$ in. (600 mm) by agreement between purchaser and supplier; however, such products are technically classified as cold-rolled sheet.

1.2 The maximum of the specified carbon range is over 0.25 % to 1.35 %, inclusive.

1.3 The above shall apply to the cold-rolled carbon spring steel strip furnished under each of the following specifications issued by ASTM:

Title of Specification	ASTM Designation
Steel, Strip, High Carbon, Cold Rolled	A 684/A 684M

1.4 The tolerances in this specification are different than Specification A 568/A 568M and Specification A 109/A 109M.

1.5 For the purpose of determining conformance with this specification, values shall be rounded to the nearest unit in the right hand place of figures used in expressing the limiting values in accordance with the rounding method of Practice E 29.

1.6 The metric portions of the tables herein list permissible variations in dimensions and mass (see Note 1) in SI (metric) units. The values listed are not exact conversions of the values listed in the inch-pound tables, but instead are rounded or rationalized values. Conformance to SI tolerances is mandatory when the “M” specification is used.

NOTE 1—The term *weight* is used when inch-pound units are the standard. However, under SI the preferred term is *mass*.

1.7 The values stated in either inch-pound units or SI units are to be regarded as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not

exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems will result in nonconformance with the specification.

1.8 This specification is expressed in both inch-pound units and SI units. However, unless the order specifies the applicable “M” specification designation (SI units), the material shall be furnished to inch-pound units.

2. Referenced Documents

2.1 ASTM Standards:

- A 109/ A 109M Specification for Steel, Strip, Carbon, Cold-Rolled²
- A 370 Test Methods and Definitions for Mechanical Testing of Steel Products²
- A 568/ A 568M Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for²
- A 680/A 680M Specification for Steel-Hydrocarbon, Strip, Cold-Rolled Hard Untempered Quality²
- A 684/A 684M Specification for Steel, Strip, High Carbon, Cold Rolled²
- A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment³
- A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products²
- A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys⁴
- E 3 Methods of Preparation of Metallographic Specimens⁵
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁶
- E 112 Test Methods for Determining Average Grain Size⁵
- E 527 Practice for Numbering Metals and Alloys (UNS)⁴

2.2 Federal Standards:

- Fed. Std. No. 123 Marking for Shipments (Civil Agencies)⁷
- Fed. Std. No. 183 Continuous Identification Marking of

² Annual Book of ASTM Standards, Vol 01.03.

³ Annual Book of ASTM Standards, Vol 01.05.

⁴ Annual Book of ASTM Standards, Vol 01.01.

⁵ Annual Book of ASTM Standards, Vol 03.01.

⁶ Annual Book of ASTM Standards, Vol 14.02.

⁷ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS

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

Current edition approved May 10, 2000. Published July 2000. Originally published as A 682 – 73. Last previous edition A 682 – 98a.

Iron and Steel Products⁷

2.3 *Military Standards:*

MIL-STD-129 Marking for Shipping and Storage⁷

MIL-STD-163 Steel Mill Products Preparation for Shipping and Storage⁷

2.4 *SAE Standard:*

J 1086 Recommended Practice for Numbering Metals and Alloys (UNS)⁸

3. Terminology

3.1 *Definitions:*

3.1.1 *burr*—metal displaced beyond the plane of the surface by slitting or shearing.

3.1.2 *decarburization*—refer to Terminology A 941.

3.1.3 *lot*—the quantity of material of the same type, size, and finish produced at one time from the same cast or heat, and heat treated in the same heat-treatment cycle.

4. General Requirements for Delivery

4.1 The requirements of the purchase order, the individual material specification, and this general specification shall govern in the sequence stated.

4.2 Products covered by this specification are produced to decimal thickness only, and decimal thickness tolerances apply.

5. Materials and Manufacture

5.1 *Melting Practice*—The steel shall be made by either the open-hearth, basic-oxygen, or electric-furnace process. It is normally produced as a fully killed steel. Elements such as aluminum may be added in sufficient amounts to control the austenitic grain size.

5.2 *Cold Working Procedure:*

5.2.1 Prior to cold rolling, the hot-rolled strip shall be descaled by chemical or mechanical means.

5.2.2 The strip shall be cold rolled by reducing to thickness at room temperature (that is, below the recrystallization temperature).

6. Chemical Composition

6.1 *Limits:*

6.1.1 When carbon steel strip is specified to chemical composition, the compositions are commonly prepared using the ranges and limits shown in Table 1. The elements comprising the desired chemical composition are specified in one of three ways:

6.1.1.1 By a maximum limit,

6.1.1.2 By a minimum limit, or

6.1.1.3 By minimum and maximum limits, termed the “range.” By common usage, the range is the arithmetical difference between the two limits (for example, 0.60 to 0.71 is 0.11 range).

6.1.2 Steel grade numbers indicating chemical composition commonly produced to this specification are shown in Table 2 and may be used.

6.1.3 Additional elements may be present. Limits on such elements are by agreement between purchaser and supplier.

TABLE 1 Heat (Formerly Ladle) Analysis Limits and Ranges

Element	Standard Chemical Limits and Ranges, Limit or Max of Specified Range	Range, %
Carbon ^A	over 0.25 to 0.30, incl	0.06
	over 0.30 to 0.40, incl	0.07
	over 0.40 to 0.60, incl	0.08
	over 0.60 to 0.80, incl	0.11
	over 0.80 to 1.35, incl	0.14
Manganese	to 0.50, incl	0.20
	over 0.50 to 1.15, incl	0.30
	over 1.15 to 1.65, incl	0.35
Phosphorous	to 0.08, incl	0.03
	over 0.08 to 0.15, incl	0.05
Sulfur	to 0.08, incl	0.03
	over 0.08 to 0.15, incl	0.05
	over 0.15 to 0.23, incl	0.07
	over 0.23 to 0.33, incl	0.10
Silicon	to 0.20, incl	0.10
	over 0.20 to 0.30, incl	0.15
	over 0.30 to 0.60, incl	0.30

^A The carbon ranges shown in the column headed Range apply when the specified maximum limit for manganese does not exceed 1.00 %. When the maximum manganese limit exceeds 1.00 %, add 0.01 to the carbon ranges shown above.

6.1.3.1 Any additional elements specified shall be included in the report of heat analysis.

6.2 *Heat (Formerly Ladle) Analysis:*

6.2.1 An analysis of each heat of steel shall be made by the manufacturer to determine the percentage of elements specified or restricted by the applicable specification.

6.2.2 When requested, heat analysis for elements listed or required shall be reported to the purchaser or to his representative. Aluminum content shall be reported.

6.3 *Product Analysis (Formerly Check Analysis)*—Product analysis is the chemical analysis of the semi-finished product form. The strip may be subjected to product analysis by the purchaser either for the purpose of verifying that the chemical composition is within specified limits for each element, including applicable tolerance for product analysis, or to determine variations in compositions within a cast or heat. The results of analyses taken from different pieces within a heat may differ from each other and from the cast analysis. The chemical composition thus determined shall not vary from the limits specified by more than the amounts shown in Table 3, but the several determinations of any element in any cast may not vary both above and below the specified range.

6.4 *Methods of Analysis*—Test Methods, Practices, and Terminology A 751 shall be used for referee purposes.

7. Metallurgical Structure

7.1 *Grain Size:*

7.1.1 Unless otherwise specified, the steel strip shall be manufactured to a fine grain (austenitic and ferritic) practice.

7.2 *Decarburization:*

7.2.1 When specified, the steel strip shall have a maximum permissible depth of complete plus partial decarburization of 0.001 in. or 1.5 % of the thickness of the strip, whichever is greater, except that strip less than 0.011 in. thick shall show no complete decarburization.

⁸ Available from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

TABLE 2 Heat (Formerly Ladle) Analysis Chemical Composition, %

UNS Designation ^A	Steel Grade	Carbon	Manganese	Phosphorus, max	Sulfur, max	Silicon ^B
G10300	1030	0.27 to 0.34	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10350	1035	0.31 to 0.38	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10400	1040	0.36 to 0.44	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10450	1045	0.42 to 0.50	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10500	1050	0.47 to 0.55	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10550	1055	0.52 to 0.60	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10600	1060	0.55 to 0.66	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10640	1064	0.59 to 0.70	0.50 to 0.80	0.035	0.040	0.15 to 0.30
G10650	1065	0.59 to 0.70	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10700	1070	0.65 to 0.76	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10740	1074	0.69 to 0.80	0.50 to 0.80	0.035	0.040	0.15 to 0.30
G10800	1080	0.74 to 0.88	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10850	1085	0.80 to 0.94	0.70 to 1.00	0.035	0.040	0.15 to 0.30
G10860	1086	0.80 to 0.94	0.30 to 0.50	0.035	0.040	0.15 to 0.30
G10950	1095	0.90 to 1.04	0.30 to 0.50	0.035	0.040	0.15 to 0.30

^A New designation established in accordance with Practice E 527 and SAE J1086, Recommended Practice for Numbering Metals and Alloys (UNS).

^B When agreed by purchaser and supplier, other silicon ranges are permissible.

TABLE 3 Permissible Variations from Specified Cast or Heat (Formerly Ladle) Analysis Ranges and Limits

Element	Limit or Max of Specification, %	Variations Over Max Limit or Under Min Limit	
		Under Min Limit	Over Max Limit
Carbon	over 0.25 to 0.40, incl	0.03	0.04
	over 0.40 to 0.80, incl	0.03	0.05
	over 0.80	0.03	0.06
Manganese	to 0.60, incl	0.03	0.03
	over 0.60 to 1.15, incl	0.04	0.04
	over 1.15 to 1.65, incl	0.05	0.05
Phosphorus	0.01
Sulfur	0.01
Silicon	to 0.30, incl	0.02	0.03
	over 0.30 to 0.60	0.05	0.05

TABLE 4 Thickness Tolerances of Cold-Rolled Carbon Steel Strip^{A,B,C}

Inch-Pound Units (in.)			
Thickness Tolerances (Plus or Minus, in.)			
Nominal Gage (in.)	Over ½ to less than 12 wide	12 to less than 18	18 to 23 15/16
0.251-0.300	0.0030	0.0035	0.0040
0.160-0.250	0.0025	0.0032	0.0036
0.125-0.1599	0.0022	0.0028	0.0032
0.070-0.1249	0.0018	0.0022	0.0028
0.040-0.0699	0.0014	0.0018	0.0024
0.030-0.0399	0.0012	0.0015	0.0020
0.020-0.0299	0.0010	0.0013	0.0015
0.015-0.0199	0.0008	0.0010	0.0012
0.010-0.0149	0.0005	0.0008	0.0010
<0.010	0.0003	0.0006	0.0008

SI Units (mm)			
Thickness Tolerances (Plus or Minus, mm)			
Nominal Gage (mm)	Over 12.7 to less than 300	300 to less than 450	450 to 600
6.40-7.50	0.080	0.090	0.100
4.00-6.39	0.065	0.080	0.090
3.20-3.99	0.055	0.070	0.080
1.80-3.19	0.045	0.055	0.070
1.00-1.79	0.035	0.045	0.060
0.75-0.99	0.030	0.030	0.050
0.50-0.74	0.025	0.035	0.040
0.38-0.49	0.020	0.025	0.030
0.25-0.37	0.013	0.020	0.025
<0.25	0.007	0.015	0.020

^A Measured 3/8 in. or more in from edge; and on narrower than 1 in., at any place between edges.

^B Measured 10 mm or more in from edge; and on narrower than 25 mm, at any place between edges.

^C Number 3 edge strip with thickness tolerance guaranteed at less than 3/8 in. (10 mm) from the slit edge, is available by agreement between consumer and strip manufacturer.

8. Mechanical Requirements

8.1 The mechanical property requirements, number of specimens, and test locations and specimen orientation shall be in accordance with the applicable product specification.

8.2 Unless otherwise specified in the applicable product specification, test specimens must be prepared in accordance with Test Methods and Definitions A 370.

8.3 Mechanical tests shall be conducted in accordance with Test Methods and Definitions A 370.

9. Dimensions, Mass, and Permissible Variations

9.1 The thickness, width, camber, and length tolerances shall conform to the requirements specified in Tables 4-9.

9.2 *Flatness*—It is not practical to formulate flatness tolerances for cold-rolled carbon spring steel strip to represent the range of widths and thicknesses in coils and cut lengths.

10. Finish and Edges

10.1 *Surface*—The surface requirements shall be as specified in the product specifications.

10.2 *Edges*—Cold-rolled carbon spring steel strip shall be supplied with one of the following edges as specified:

10.2.1 *No. 1*—A prepared edge of a specified contour (round or square) that is produced when a very accurate width is required or when an edge condition suitable for electroplating is required, or both.

10.2.2 *No. 2*—A natural mill edge carried through the cold

rolling from the hot-rolled strip without additional processing of the edge.

10.2.3 *No. 3*—An approximately square edge produced by slitting on which the burr is not eliminated. This is produced when the edge condition is not a critical requirement for the finished part. Normal coiling or piling does not provide a definite positioning of the slitting burr.

10.2.4 *No. 4*—An approximately rounded edge. This edge is