



Designation: A 682/A 682M – 02

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 1/2 to 23¹⁵/₁₆ in. (12.5 to 600 mm) in width, inclusive. Strip tolerance products may be available in widths wider than 23¹⁵/₁₆ 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 those in 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:²

A 109/A 109M Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

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

A 680/A 680M Specification for Steel—High-Carbon, Strip, Cold-Rolled Hard, Untempered Quality³

A 684/A 684M Specification for Steel, Strip, High-Carbon, Cold-Rolled

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

E 3 Methods of Preparation of Metallographic Specimens

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E 112 Test Methods for Determining Average Grain Size

E 527 Practice for Numbering Metals and Alloys (UNS)

2.2 Federal Standards:

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 Sheet Steel and Steel Sheets.

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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 Withdrawn.

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

Fed. Std. No. 123 Marking for Shipments (Civil Agencies)⁴
Fed. Std. No. 183 Continuous Identification Marking of
 Iron and Steel Products⁴

2.3 *Military Standards:*

MIL-STD-129 Marking for Shipping and Storage⁴

MIL-STD-163 Steel Mill Products Preparation for Ship-
 ment and Storage⁴

2.4 *SAE Standard:*

J 1086 Recommended Practice for Numbering Metals and
 Alloys (UNS)⁵

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 tem-
 perature).

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 compris-
 ing 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).

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.

6.1.2 Steel grade numbers indicating chemical composition
 commonly produced to this specification are shown in **Table 2**
 and may be used. **Table 3** shows requirements for additional
 elements.

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

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 represen-
 tative. Each of the elements listed in **Tables 2 and 3** and
 additional elements agreed upon by the purchaser and the
 supplier shall be included in the report of 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, columbium, or titanium is less
 than 0.008 %, the analysis may be reported as < 0.008 %.
 The reported heat analysis shall conform to the chemical composi-
 tion requirements of the appropriate grade in **Table 2**, if used,
 the additional elements in **Table 3**, and the limits of any other
 elements agreed upon by the purchaser and supplier.

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, includ-
 ing 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

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

⁵ 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	0.28 to 0.34	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10350	1035	0.32 to 0.38	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10400	1040	0.37 to 0.44	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10450	1045	0.43 to 0.50	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10500	1050	0.48 to 0.55	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10550	1055	0.50 to 0.60	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10600	1060	0.55 to 0.65	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10640	1064	0.60 to 0.70	0.50 to 0.80	0.035	0.040	0.15 to 0.30
G10650	1065	0.60 to 0.70	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10700	1070	0.65 to 0.75	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10740	1074	0.70 to 0.80	0.50 to 0.80	0.035	0.040	0.15 to 0.30
G10800	1080	0.75 to 0.88	0.60 to 0.90	0.035	0.040	0.15 to 0.30
G10850	1085	0.80 to 0.93	0.70 to 1.00	0.035	0.040	0.15 to 0.30
G10860	1086	0.80 to 0.93	0.30 to 0.50	0.035	0.040	0.15 to 0.30
G10950	1095	0.90 to 1.03	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 J 1086.

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

TABLE 3 Additional Chemical Composition Requirements—Heat Analysis

Element	Composition—Weight %
Aluminum ^A	...
Copper, max ^B	0.30
Nickel, max ^B	0.30
Chromium, max ^{B,C}	0.25
Molybdenum, max ^B	0.10
Vanadium ^A	...
Columbium ^A	...
Titanium ^A	...

^A Where an ellipsis (. . .) appears in this table, there is no specified limit, but the analysis shall be reported.

^B The sum of copper, nickel, chromium, and molybdenum shall not exceed 0.80 % on heat analysis. When one or more of these elements is specified, the sum does not apply, in which case only the individual limits on the remaining elements will apply.

^C When the chromium is specified or added for antigraphitization, the maximum shall be 1.40 wt. %

composition thus determined shall not vary from the limits specified by more than the amounts shown in Table 4, 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:

TABLE 4 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

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. 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 5-10.

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

TABLE 5 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 1/2 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.

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 produced when the width tolerance and edge condition are not as exacting as for No. 1 edges.

10.2.5 *No. 5*—An approximately square edge produced from slit edge material on which the burr is eliminated.

10.2.6 *No. 6*—An approximately square edge. This edge is produced when the width tolerance and edge condition are not as exacting as for No. 1 edges.

10.2.7 *Skived Edges*—Custom-shaped edges produced by mechanical edge shaving with special tooling.

11. Workmanship

11.1 The steel shall have a workmanlike appearance and shall not have defects of a nature or degree for the grade and quality ordered that will be detrimental to the fabrication of the finished part.

11.2 Coils may contain some abnormalities that render a portion of the coil unusable since the inspection of coils does not afford the same opportunity to remove portions containing imperfections as is the case with cut lengths.

TABLE 6 Width Tolerances for Edge Numbers 1, 4, 5, and 6 of Cold-Rolled Carbon-Steel Strip

Inch-Pound Units					
Edge Number	Specified Width, in. ^A		Specified Thickness, in. ^B		Width Tolerance, Plus and Minus, in. ^C
	Over	Through	min	max	
1	1/2	3/4	...	0.0938	0.005
1	3/4	5	...	0.125	0.005
4	1/2	1	0.025	0.1875	0.015
4	1	2	0.025	0.2499	0.025
4	2	4	0.035	0.2499	0.047
4	4	6	0.047	0.2499	0.047
5	1/2	3/4	...	0.0938	0.005
5	3/4	5	...	0.125	0.005
5	5	9	0.008	0.125	0.010
5	9	20	0.015	0.105	0.010
5	20	23 ¹⁵ / ₁₆	0.023	0.080	0.015
6	1/2	1	0.025	0.1875	0.015
6	1	2	0.025	0.2499	0.025
6	2	4	0.035	0.2499	0.047
6	4	6	0.047	0.2499	0.047

SI Units					
Edge No.	Specified Width, mm ^A		Specified Thickness, mm ^B		Width Tolerance, Plus and Minus, mm ^C
	Over	Through	min	max	
1	12.5	200	...	3.0	0.13
4	...	25	0.6	5.0	0.38
4	25	50	0.6	6.0	0.65
4	50	150	1.0	6.0	1.20
5	...	100	...	3.0	0.13
5	100	500	0.4	3.0	0.25
5	500	600	0.6	2.0	0.38
6	...	25	0.6	5.0	0.38
6	25	50	0.6	6.0	0.65
6	50	150	1.0	6.0	1.20

^A Specified width must be within ranges stated for specified edge number.

^B Specified thickness must be within ranges stated for specified width.

^C When edge, width and thickness are not defined by this table, tolerances are by agreement between producer and supplier.

12. Number of Tests and Retests

12.1 The difficulties in obtaining truly representative samples of strip without destroying the usefulness of the coil account for the generally accepted practice of allowing retests for mechanical properties and surface examination. Two additional samples are secured from each end of the coil from which the original sample was taken. A portion of the coil may be discarded prior to cutting the samples for retest. If any of the retests fail to comply with the requirements, the coil shall be rejected.

13. Rework and Retreatment

13.1 Lots rejected for failure to meet the specified requirements may be resubmitted for test provided the manufacturer has reworked the lots as necessary to correct the deficiency or has removed the nonconforming material.

14. Inspection

14.1 The manufacturer shall afford the purchaser's inspector all reasonable facilities necessary to satisfy him that the material is being produced and furnished in accordance with