



Designation: A684/A684M – 17

Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled¹

This standard is issued under the fixed designation A684/A684M; 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 U.S. Department of Defense.

1. Scope*

1.1 This specification covers cold-rolled, high-carbon 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 $23\frac{15}{16}$ in. [12.5 to 600 mm] in width, inclusive. Strip tolerance products may be available in widths wider than $23\frac{15}{16}$ in. (600 mm) by agreement between purchaser and supplier; however, such products are technically classified as cold-rolled sheet. The maximum of the specified carbon range is over 0.25 to 1.35 %, inclusive. It is furnished in the following types as specified:

1.1.1 Soft spheroidized annealed high-carbon steel is intended for applications requiring maximum cold forming. It is normally produced to give the lowest maximum Rockwell hardness for each grade.

1.1.2 Soft annealed high-carbon steel is intended for applications requiring moderate cold forming. It is produced to a maximum Rockwell hardness.

1.1.3 Intermediate hardness high-carbon steel is intended for applications where cold forming is slight or a stiff, springy product is needed, or both. It is produced to specified Rockwell hardness ranges, the maximum being higher than obtained for the annealed type.

1.1.4 Full hard high-carbon steel is intended for flat applications. It is produced to minimum Rockwell hardness requirements, which vary with grade, microstructure and gauge. Full hard can be produced with either a pearlitic or spheroidized microstructure or a mixture of both. The minimum hardness should be established between the consumer and the producer.

1.2 This specification is applicable for orders in either inch-pound units or SI units.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each

system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.4 The tolerances in this specification are different than those in Specification [A568/A568M](#) and Specification [A109/A109M](#).

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 [E29](#).

1.6 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. 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 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

[A109/A109M Specification for Steel, Strip, Carbon \(0.25 Maximum Percent\), Cold-Rolled](#)

[A370 Test Methods and Definitions for Mechanical Testing of Steel Products](#)

[A568/A568M Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and](#)

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.

Current edition approved May 1, 2017. Published May 2017. Originally approved in 1973. Last previous edition approved in 2015 as A684/A684M – 15. DOI: 10.1520/A0684_A0684M-17.

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



TABLE 1 Heat (Formerly Ladle) Analysis Chemical Composition, %

Steel Designation No.	Carbon	Manganese	Phosphorus, max	Sulfur, max	Silicon
1030	0.28 to 0.34	0.60 to 0.90	0.030	0.035	A
1035	0.32 to 0.38	0.60 to 0.90	0.030	0.035	A
1040	0.37 to 0.44	0.60 to 0.90	0.030	0.035	A
1045	0.43 to 0.50	0.60 to 0.90	0.030	0.035	A
1050	0.48 to 0.55	0.60 to 0.90	0.030	0.035	A
1055	0.50 to 0.60	0.60 to 0.90	0.030	0.035	A
1060	0.55 to 0.65	0.60 to 0.90	0.030	0.035	A
1064 ^B	0.59 to 0.70	0.50 to 0.80	0.030	0.035	A
1065	0.60 to 0.70	0.60 to 0.90	0.030	0.035	A
1070	0.65 to 0.75	0.60 to 0.90	0.030	0.035	A
1074	0.70 to 0.80	0.50 to 0.80	0.030	0.035	A
1075	0.70 to 0.80	0.40 to 0.70	0.030	0.035	A
1080	0.75 to 0.88	0.60 to 0.90	0.030	0.035	A
1085	0.80 to 0.93	0.70 to 1.00	0.030	0.035	A
1086	0.80 to 0.93	0.30 to 0.50	0.030	0.035	A
1095	0.90 to 1.03	0.30 to 0.50	0.030	0.035	A

^A Silicon composition as one of the following:

Type 1: 0.15–0.30

Type 2: 0.10 max

Or other silicon ranges are permissible when agreed upon by purchaser and producer.

^B 1064 is not an SAE steel grade.

Cold-Rolled, General Requirements for
A700 Guide for Packaging, Marking, and Loading Methods
for Steel Products for Shipment

A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

A1073/A1073M Practice for Using Hand Micrometers to Measure the Thickness of Uncoated Steel Sheet and Nonmetallic and Metallic-Coated Steel Sheet

E3 Guide for Preparation of Metallographic Specimens

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E430 Test Methods for Measurement of Gloss of High-Gloss Surfaces by Abridged Goniophotometry

2.2 Federal Standards:

Fed. Std. No. 123 Marking for Shipments (Civil Agencies)³

Fed. Std. No. 183 Continuous Identification Marking of Iron and Steel Products³

2.3 Military Standard:

MIL-STD-129 Marking for Shipping and Storage³

2.4 SAE Standard:

J 1086 Recommended Practice for Numbering Metals and Alloys (UNS)⁴

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

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

3.1.2 *lot, n*—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.

3.1.3 *spheroidizing, n*—the heating and cooling of the strip in controlled conditions (annealing) to produce a spheroidal or globular form of carbide microconstituent.

3.1.4 *stretcher strains, n*—elongated markings that appear on the surface of the strip when dead soft (fully annealed) material is deformed beyond its yield point (see 5.2).

3.2 Refer to Terminology A941 for additional terms used in this standard.

4. Ordering Information

4.1 Orders for material under this specification shall include the following information:

4.1.1 ASTM designation and date of issue.

4.1.2 Name, type, and steel grade number.

4.1.3 Hardness (if intermediate or restricted hardness is specified).

4.1.4 Decarburization (if required).

4.1.5 Application.

4.1.6 Dimensions.

4.1.7 Coil size requirements.

4.1.8 Edge (indicate No. 1 round, square, and so forth).

4.1.9 Finish (indicate and specify).

4.1.10 Conditions (specify whether material is oiled or dry).

4.1.11 Package (bare coils, skid, and so forth).

4.1.12 Cast or heat (formerly ladle) analysis report (if required).

4.1.12.1 The additional chemical composition requirements (heat analysis) for copper, nickel, chromium, and molybdenum shall be specified as Limits L or Limits H. If no limits are specified, Limits L will be provided.

³ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://www.dodssp.daps.mil>.

⁴ Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.



TABLE 2 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.

4.1.12.2 Silicon requirement specified (Type 1, Type 2, or other as agreed between purchaser and producer). If no specification is supplied, then Type 1 (see Table 1, Footnote A) will be supplied.

4.1.13 Special requirements (if required).

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

NOTE 2—A typical ordering description is as follows: ASTM A684 dated _____ Cold Rolled, High-Carbon Soft, Strip, Spheroidized 1064, 0.042 in. by 6 in. by coil (16 in. ID by 40 in. OD max), No. 5 Edge, No. 2 Finish, Oiled, Bare Skid or “ASTM A684 dated _____ Cold Rolled, High-Carbon, Soft, Strip, Spheroidized 1064, 0.6 mm by 200 mm by coil (400 mm ID by 7500 mm OD max), No. 3 Edge, No. 2 Finish, Oiled, Bare Skid.”

5. Manufacture

5.1 Condition:

5.1.1 The strip shall be furnished cold rolled spheroidized annealed, soft annealed, intermediate hardness, or full hard, as specified.

5.1.2 Intermediate hardness may be obtained by either rolling the strip after final annealing or by varying the annealing treatment, or both.

5.2 *Pinch Pass*—Spheroidized annealed and annealed material may be pinch rolled after the final anneal to improve flatness, uniformly oil, modify surface, obtain proper mechanical properties, and minimize stretcher strains if required by the purchaser.

6. Chemical Requirements

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 2. The elements compris-

TABLE 3 Additional Chemical Composition Requirements—Heat Analysis

Element	Composition—Weight %	
Aluminum ^A	...	
Vanadium ^A	...	
Columbium ^A	...	
Titanium ^A	...	
	Limits	
	L	H
Copper, max ^B	0.30	0.50
Nickel, max ^B	0.30	0.30
Chromium, max ^{B, C}	0.25	0.30
Molybdenum, max ^B	0.10	0.16

^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 For antigraphitization, the maximum for chromium shall be 1.40 %.

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).

6.1.2 Steel grade numbers indicating chemical composition commonly produced to this specification are shown in Table 1 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 representative. Each of the elements listed in Tables 1 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 composition requirements of the appropriate grade in Table 1, 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*—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 ordered chemical composition is within specified limits for each element as listed in Table 1, including applicable tolerance for product analysis, or to determine variations in compositions within a cast or heat. The



TABLE 4 Tolerances for Product Analysis

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

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 4.

6.4 *Methods of Analysis*—Test Methods, Practices, and Terminology A751 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.

7.1.2 Pearlite is the normal structure of cold rolled high-carbon strip unless it has had an intermediate anneal.

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. [0.025 mm] or 1.5 % of the thickness of the strip, whichever is greater, except that strip less than 0.011 in. [0.279 mm] thick shall show no complete decarburization.

7.3 Annealed is mostly a spheroidized structure, but may contain some vestiges of pearlite.

7.4 Spheroidized annealed is essentially free of pearlite.

7.5 At least one specimen shall be taken from each lot for microexamination.

7.5.1 The specimens shall be prepared for microscopic examination in accordance with Guide E3.

8. Mechanical Requirements

8.1 Unless otherwise specified in the applicable product specification, test specimens must be prepared in accordance with Test Methods and Definitions A370.

8.2 Mechanical tests shall be conducted in accordance with Test Methods and Definitions A370.

8.3 Hardness:

8.3.1 *Spheroidized Annealed and Annealed Types*—When furnished spheroidized annealed or annealed, the hardness of the strip shall not exceed the maximum values specified in Figs. 1 and 2 for the applicable carbon range and type.

8.3.2 *Intermediate Hardness Type*—When furnished as intermediate hardness, the hardness of the strip shall conform to the range specified on the purchase order. The maximum hardness limit and the corresponding minimum shall be specified by the purchaser. If the maximum temper is under Rockwell B 100 (15T93 or 30T82), that scale should be used exclusively. If the minimum temper is over Rockwell C 20 (15N69.5 or 30N41.5), that scale should be used exclusively. For accuracy in testing, the hardness scales should not overlap. On either hardness scale, a range of ten points arithmetic difference is required. Refer to Table 5 for appropriate scale testing requirements.

8.3.3 Full hard is specified to a minimum hardness value. Refer to Table 5 for appropriate scale testing requirements.

8.3.4 At least one specimen shall be taken from each lot.

8.3.5 The sample shall be tested in accordance with Test Methods and Definitions A370.

8.4 Bend Test:

8.4.1 The steel strip produced as spheroidized, or the annealed type shall meet the cold bend requirement in Table 6. Any visible cracking on the tension side of the bend portion shall be cause for rejection.

8.4.2 At least one specimen shall be taken from each lot.

8.4.3 The specimen shall be the full thickness and shall be taken transverse to the rolling direction as described in Test Methods and Definitions A370. The edges of the bend test specimens shall be rounded and free of burrs; filing or machining is permissible.

9. Dimensions, Mass, and Permissible Variations

9.1 The thickness, width, camber, and length tolerances shall conform to the requirements specified in Tables 7-12.

9.1.1 When thickness is measured using hand held micrometers refer to Practice A1073/A1073M.

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 strip shall be furnished with a No. 1 Matte (Dull), or No. 2 (Regular Bright), No. 2½ (Better Bright), or No. 3 (Best Bright) finish, as specified.

10.2 *Oiling*—The strip shall be furnished oiled or dry, as specified.

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

10.3.1 *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.

10.3.2 *No. 2*—A natural mill edge carried through the cold rolling from the hot-rolled strip without additional processing of the edge.

10.3.3 *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

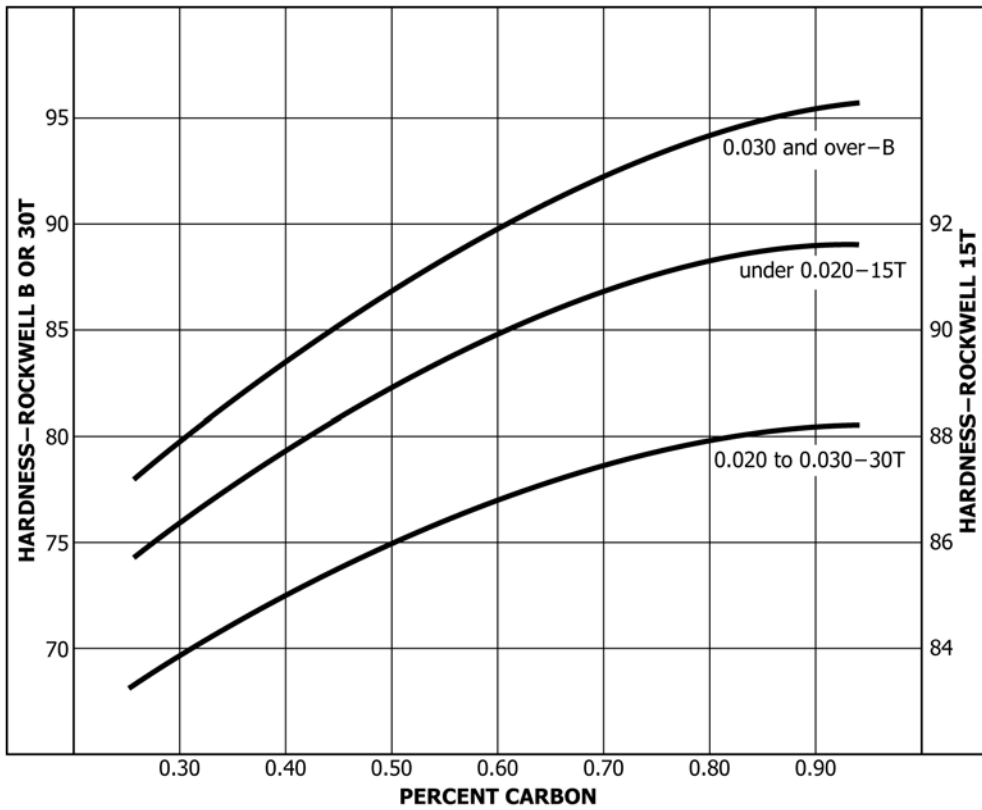


FIG. 1 Approximate Relationship Between Carbon Designations and Maximum Hardness Limit of Soft Type Annealed Cold Rolled High Carbon Steel Strip

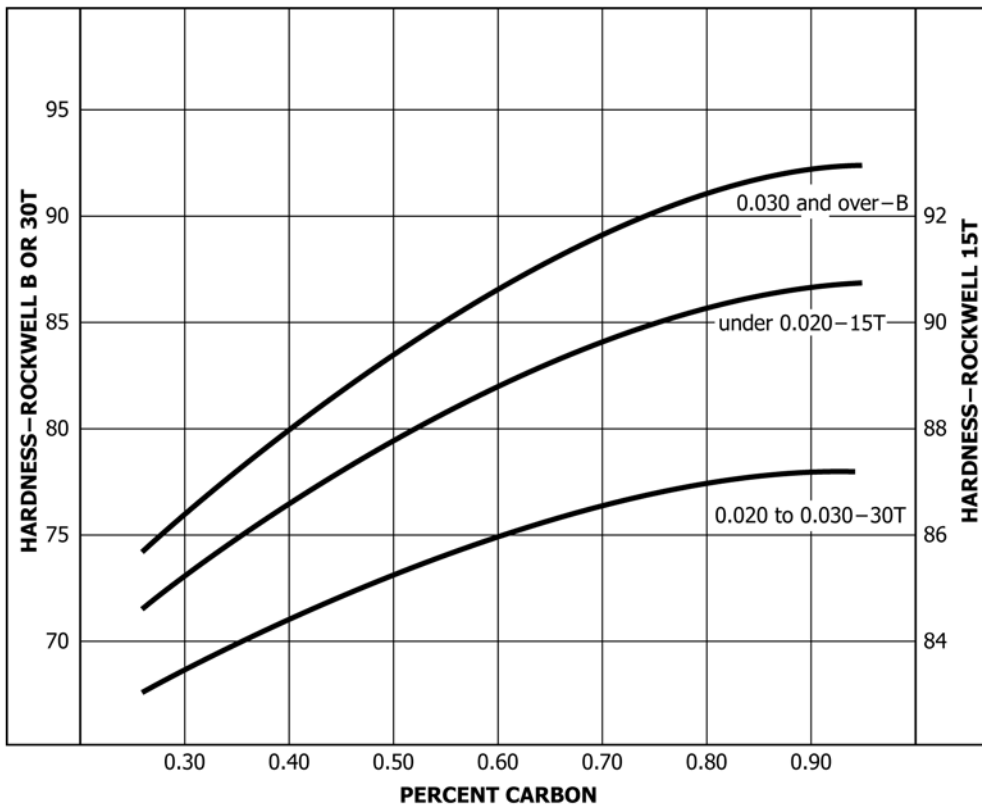


FIG. 2 Approximate Relationship Between Carbon Designations and Maximum Hardness Limit of Spheroidized Annealed Cold Rolled High Carbon Steel Strip

**TABLE 5 Rockwell Hardness Testing Ranges for Cold-Rolled High-Carbon Steel Strip**

Rockwell “B” and “T” Scales		Rockwell “C” and “N” Scales	
Thickness	Scale	Thickness	Scale
Over 0.030 in. [over 0.8 mm]	B	Over 0.040 in. [over 1.0 mm]	C
0.020 to 0.030 in. [0.5 to 0.8 mm]	30T	0.025 to 0.040 in. [0.6 to 1.0 mm]	30N
Under 0.020 in. [under 0.5 mm]	15T	Under 0.025 in. [under 0.6 mm]	15N

TABLE 6 Cold Bending Requirements^{A,B} for Spheroidized, Annealed, and Soft-Annealed Cold-Rolled Carbon Steel Strip

Type	Degree of Bend	Inside Radius to Thickness	Relation of Bend Test Specimen to Rolling Direction
Annealed	180°	3t	transverse ^C
Spheroidized	180°	2t	transverse ^C

^A Up to 0.100 in. [2.5 mm], incl, thickness maximum. When bend radius for thickness is over 0.100 in. [2.5 mm] the producer should be consulted. These ratios apply to bending performance of the test specimen.

^B These bend tests apply to the bending performance of test specimens only. Where material is to be bent in fabricating operations a more liberal bend radius may be required and should be based on prior experience or consultation with the steel producer, or both.

^C If finished strip width prohibits taking a transverse bend test specimen, a longitudinal specimen may be substituted, except the bend radius shall be reduced by 1 t.

finished part. Normal coiling or piling does not provide a definite positioning of the slitting burr.

10.3.4 *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.

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

10.3.6 *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.

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

10.4 *Finish*—Cold-rolled carbon steel strip shall be supplied with the following finishes. Typical surface roughness (Ra) ranges for each are included in [Table 13](#).

10.4.1 *Number 1 or Matte (Dull) Finish*—Finish without luster, produced by rolling on rolls roughened by mechanical or chemical means. This finish is especially suitable for lacquer or paint adhesion, and is beneficial in aiding drawing operations by reducing the contact friction between the die and the strip. The user and producer should agree on the permissible surface roughness range based on the intended end-use.

10.4.2 *Number 2 (Regular Bright) Finish*—Finish produced by rolling on rolls having a moderately smooth finish. It is suitable for many requirements, but not generally applicable to bright plating.

10.4.3 *Number 2½ or Better Bright Finish* is a smooth finish suitable for those plating applications where higher luster is not required.

10.4.4 *Number 3 or Best Bright Finish* is generally of high luster produced by special rolling practices, including the use of specially prepared rolls. It is the highest quality finish

TABLE 7 Thickness Tolerances of Cold-Rolled Carbon Steel Strip^{A,B,C}

Inch-Pound Units (in.)			
Thickness Tolerances (Plus or Minus, in.)			
Nominal Gauge (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 Gauge (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 ¾ 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 ¾ in. (10 mm) from the slit edge, is available by agreement between consumer and strip manufacturer.

commonly produced and is particularly suited for bright plating. The production of this finish requires extreme care in processing and extensive inspection. In addition to the surface roughness values in [Table 13](#), the user and producer may agree on goniophotometric measurement values (Rs/DI) in accordance with Test Methods [E430](#).

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.

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

**TABLE 8 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	½	¾	...	0.0938	0.005
1	¾	5	...	0.125	0.005
4	½	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	½	¾	...	0.0938	0.005
5	¾	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	23⅞	0.023	0.080	0.015
6	½	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 Number	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.**TABLE 9 Width Tolerances for Edge Number 2 of Cold-Rolled Carbon-Steel Strip**

Inch Pound Units		
Specified Width, in.		Width Tolerance, Plus and Minus, in.
Over	Through	
1/2	2	1/32
2	5	3/64
5	10	5/64
10	15	3/32
15	20	1/8
20	23 ¹⁵ / ₁₆	5/32
SI Units		
Specified Width, mm		Width Tolerance, Plus and Minus, mm
Over	Through	
12.5	50	0.8
50	100	1.2
100	200	1.6
200	400	2.5
400	500	3.0
500	600	4.0

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 this specification. Mill inspection by the purchaser shall not interfere unnecessarily with the manufacturer's operations. Unless otherwise agreed to, all tests and inspections, except product analysis, shall be made at the place of production.

15. Rejection and Rehearing

15.1 Unless otherwise specified, any rejection based on tests made in accordance with this specification shall be reported to the purchaser within a reasonable time.

15.2 Material that shows injurious defects subsequent to its acceptance at the purchaser's works shall be rejected and the manufacturer shall be notified. The material must be adequately protected and correctly identified in order that the manufacturer may make a proper investigation. In case of dissatisfaction with the results of the test, the manufacturer may make claims for a rehearing.

16. Certification and Reports

16.1 When test reports are required by the purchaser, the supplier shall report the results of all tests required by this specification and any additional tests required by the material specification or the purchase order, or both.

16.2 When certification is required by the purchase order, the supplier shall furnish a certification that the material has been manufactured and tested in accordance with the requirements of this specification and the applicable material specification.

16.3 A signature is not required on test reports. However, the document shall clearly identify the organization submitting the document. Notwithstanding the absence of a signature, the organization submitting the document is responsible for the content of the document.

16.4 When test reports are required, it is acceptable for the supplier to report test data from the original manufacturer, provided such data is not rendered invalid by the stripmaking process.

16.5 A Material Test Report, Certificate of Inspection, or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document must meet the requirements of the invoked ASTM



TABLE 10 Width Tolerances for Edge Number 3 (Slit), Cold-Rolled Carbon Spring Steel Strip

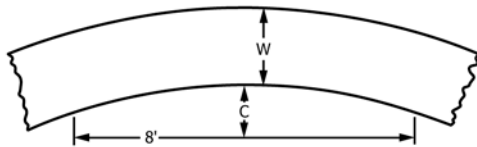
Inch-Pound Units						
Specified Thickness, in.		Width Tolerance, Plus and Minus, in. for Specified Width, in. ^A				
Over	Through	Over 1/2 Through 6	Over 6 Through 9	Over 9 Through 12	Over 12 Through 20	Over 20 Through 23 ¹⁵ / ₁₆
...	0.016	0.005	0.005	0.010	0.016	0.020
0.016	0.068	0.005	0.005	0.010	0.016	0.020
0.068	0.099	0.008	0.010	0.010	0.016	0.020
0.099	0.160	0.010	0.016	0.016	0.020	0.020
0.160	0.300	0.016	0.020	0.020	0.031	0.031

SI Units						
Specified Thickness, mm		Width Tolerance, Plus and Minus, mm for Specified Width, mm ^A				
Over	Through	Through 100	Over 100 Through 200	Over 200 Through 300	Over 300 Through 450	Over 450 Through 600
...	1.5	0.13	0.13	0.25	0.40	0.50
1.5	2.5	0.20	0.25	0.25	0.40	0.50
2.5	4.5	0.25	0.40	0.40	0.50	0.50
4.5	7.5	0.40	0.50	0.50	0.80	0.80

^A Width is measured from the shear surface of the slit edge and not from the break.

TABLE 11 Camber Tolerances of Cold-Rolled Carbon Steel Strip

Note 1—Camber is the greatest deviation of a side edge from a straight line, the measurement being taken on the concave side with a straight edge.
 Note 2—Camber tolerances as shown in the table are for any 8 ft of length. For strip length under 8 ft, camber tolerance shall be subject to negotiation.
 Note 3—When the camber tolerances shown in Table 8 are not suitable for a particular purpose, cold-rolled strip is sometimes machine straightened.

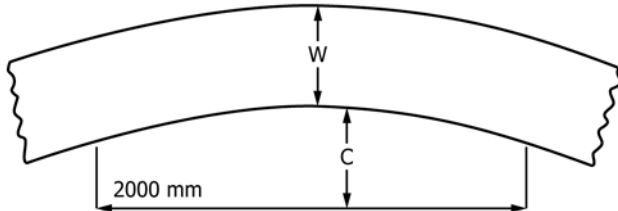


W = width of strip, in.

C = camber, in.

Specified Width, in.		Camber Tolerance, in.
Over	Through	
1/2	1 1/2	1/2
1 1/2	23 ¹⁵ / ₁₆	1/4

Note 1—Camber is the greatest deviation of a side edge from a straight line, the measurement being taken on the concave side with a straight edge.
 Note 2—Camber tolerances as shown in the table are for any 2000 mm length. For strip length under 2000 mm, camber tolerance shall be subject to negotiation.
 Note 3—When the camber tolerances shown in Table 8 are not suitable for a particular purpose, cold-rolled strip is sometimes machine straightened.



W = width of strip, mm

C = camber, mm

Specified Width, mm		Camber Tolerance, mm
Over	Through	
...	50	10
50	600	5

TABLE 12 Length Tolerances of Cold-Rolled Carbon Steel Strip

Inch-Pound Units				
Specified Width, in.		Length Tolerance, Plus Only, in. for Specified Length, in.		
Over	Through	From 24 Through 60	Over 60 Through 120	Over 120 Through 240
1/2	12	1/4	1/2	3/4
12	23 ¹⁵ / ₁₆	1/2	3/4	1

SI Units				
Specified Width, mm		Length Tolerance, Plus Only, mm for Specified Length, mm		
Over	Through	From 600 Through 1500	Over 1500 Through 3000	Over 3000
...	300	10	15	25
300	600	15	20	25

TABLE 13 Typical Surface Roughness Ranges^A

Number 1 or Matte (Dull) ^B	Ra 20-80 µin.
Number 2 or Regular Bright ^C	Ra 20 µin. max
Number 2 1/2 or Better Bright ^C	Ra 10 µin. max
Number 3 or Best Bright ^C	Ra 4 µin. max

^A Due to vagaries in measuring surface roughness, as well as the inherent variability in such rolled surfaces, these values are only typical, and values outside these ranges would not be considered unexpected.

^B Measured either parallel with or across the rolling direction.

^C Measured across the rolling direction.

standard(s) and conform to any existing EDI agreement between the purchaser and the supplier. Notwithstanding the absence of a signature, the organization submitting the EDI transmission is responsible for the context of the report.

NOTE 3—The industry definition as invoked here is: EDI is the computer to computer exchange of business information in an agreed upon standard format such as ANSI ASC X12.

17. Marking

17.1 Unless otherwise specified, the material shall be identified by having the manufacturer's name or mark, ASTM designation, weight, purchase order number, and material identification legibly stenciled on top of each lift or shown on a tag attached to each coil or shipping unit.

17.2 When specified in the contract or order, and for direct procurement by or direct shipment to the Government, marking



for shipment, in addition to requirements specified in the contract or order, shall be in accordance with MIL-STD-129 for military agencies and in accordance with Fed. Std. No. 123 for civil agencies.

17.3 For U.S. Government procurement by the Defense Supply Agency, strip material shall be continuously marked for identification in accordance with Fed. Std. No. 183.

17.4 Bar coding is acceptable as a supplementary identification method. Bar coding should be consistent with the Automotive Industry Action Group (AIAG) standard prepared by the primary metals subcommittee of the AIAG bar code project team.

18. Packaging

18.1 Unless otherwise specified, the strip shall be packaged and loaded in accordance with Practices **A700**.

18.2 When Level A is specified in the contract or order and for direct procurement by or direct shipment to the U.S. Government, preservation, packaging, and packing shall be in accordance with the Level A requirements of MIL-STD-163.

18.3 When coils are ordered it is customary to specify a minimum or range of inside diameter and maximum outside diameter and a maximum coil weight, if required. The ability of manufacturers to meet the maximum coil weights depends upon individual mill equipment. When required, minimum coil weights are subject to negotiation.

19. Keywords

19.1 cold rolled strip; high carbon; steel; strip

SUMMARY OF CHANGES

Committee **A01** has identified the location of selected changes to this standard since the last issue (A684/A684M – 15) that may impact the use of this standard. (Approved May 1, 2017.)

(1) Revised surface finish definitions and added **Table 13** (“Typical Surface Roughness Ranges”).

Committee **A01** has identified the location of selected changes to this standard since the last issue (A684/A684M – 14) that may impact the use of this standard. (Approved Nov. 1, 2015.)

(1) Added Practice **A1073/A1073M** to Section **2**.

(2) Added **9.1.1**.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/