Designation: A505 – 16

Standard Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, General Requirements for[1]

This standard is issued under the fixed designation A505; 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 a group of common requirements that, unless otherwise specified in the material specification, apply to hot-rolled and cold-rolled alloy steel sheet and strip under each of the following specifications: A506, A507, and A873/A873M.

1.2 In case of any conflict in requirements, the requirements of the individual material specification shall prevail over those of this general specification.

1.3 The purchaser may specify additional requirements which do not negate any of the provisions of this general specification or of the individual material specification. Such additional requirements, the acceptance of which are subject to negotiation with the supplier, must be included in the order information (see 4.1.9).

1.4 For purposes of determining conformance with this specification and the various material specifications referenced in 1.1, 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 provisions of Test Methods and Definitions A370 and Test Methods, Practices, and Terminology A751.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A506 Specification for Alloy and Structural Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled

A507 Specification for Drawing Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled

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

A873/A873M Specification for Steel Sheet and Strip, Chromium-Molybdenum Alloy, for Pressure Vessels (Withdrawn 1997)[3]

A919 Terminology Relating to Heat Treatment of Metals (Withdrawn 1999)[3]

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

2.2 *Federal Standard:*[4]

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

2.3 *Military Standard:*[4]

MIL-STD-129 Marking for Shipment and Storage

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *sheet and strip, n*—hot-rolled and cold-rolled alloy steel sheet and strip is classified as shown in Table 1(a) and Table 1(b).

3.1.2 *exclusive, adj*—when used in relation to ranges, as for ranges of thicknesses in the tables of permissible variations in dimensions, the term "exclusive" is intended to exclude only the greater value of the range. Thus a range from 60 to 72 in. (1524 to 1829 mm) *exclusive* includes 60 in. but does not include 72 in.

3.1.3 *manufacturer (material manufacturer), n*—an organization that performs or directly controls one or more operations, such as melting, rolling, coiling, and heat

[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloysand 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] The last approved version of this historical standard is referenced on www.astm.org.

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

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

treatment, that affects the chemical composition or mechanical properties of the material.

4. Ordering Information

4.1 Orders shall include the following information, as necessary, to describe adequately the desired material:

4.1.1 Specification designation, including year of issue,

4.1.2 Chemical composition (grade),

4.1.3 Classification of the material (that is, hot-rolled sheet),

4.1.4 Dimensions (thickness, width, length) in decimal inches,

4.1.5 Quantity (weight or number of pieces),

4.1.6 Condition (that is, "hot-rolled," "cold-rolled"),

4.1.7 Heat treatment required, if any,

4.1.8 Type of edge,

4.1.9 Additional information as specified in the individual material specification,

4.1.10 Any special requirements not specified in the individual material specification, and

4.1.11 Whether certification of compliance or test reports are required.

5. Materials and Manufacture

5.1 *Melting Process*—Unless otherwise specified in the individual material specification, the steel may be made by any process that produces material that conforms to the specified requirements.

5.2 *Hot or Cold Rolling*—The sheet and strip shall be produced by hot rolling or cold rolling, as specified in the individual material specification and as specified on the order.

5.3 *Heat Treatment*—When heat treatment is required, it shall be performed in accordance with the requirements specified in the individual material specification. Heat treatment may be performed by either the manufacturer or the purchaser; however, if the purchaser intends to perform the heat treatment, it shall be so stated on the order.

5.3.1 Heat treatment terms shall be in accordance with Terminology A919.

6. Chemical Requirements

6.1 *Cast or Heat Analysis* of each cast or heat shall be made by the manufacturer to determine the percentage of elements specified in the individual material specification. This analysis shall be made from a test specimen preferably taken during the teeming of the cast or heat. The chemical composition thus determined shall be reported to the purchaser or his representative upon request, and shall conform to the cast or heat analysis requirements of the applicable material specification.

6.2 *Product or Verification Analysis*—An analysis may be made by the purchaser from finished material representing each cast or heat. The composition thus determined shall conform to the requirements for product analysis specified in the individual material specification or on the order; however, if only cast or heat analysis requirements are specified in the material specification or on the order, the composition determined on product analysis shall conform to those requirements subject to the product analysis tolerances specified in Table 2.

6.3 *Referee Analysis*—In case referee analysis is required to resolve a dispute concerning the results of a chemical analysis, the procedures for performing the referee analysis shall be in accordance with Test Methods, Practices, and Terminology A751.

7. Metallurgical Structure

7.1 The requirements for metallurgical structure, if any, shall be as specified in the individual material specification.

8. Mechanical Property Requirements

8.1 *Requirements*—The requirements for mechanical properties, if any, shall be as specified in the individual material specification.

8.2 *Number of Tests*—The number of specimens shall be as specified in the individual material specification.

8.3 *Location and Orientation of Tension Test Specimens*—Unless otherwise specified in the individual material specification, tension test specimens shall be the full thickness of the material. The test coupons shall be taken from the material in its finished condition except as otherwise provided in 8.4; shall be taken approximately midway between the edge and centerline of the sheet or strip; and shall be taken such that the long axis of the test specimen will be transverse to the final direction of rolling.

8.4 *Heat Treatment of Test Coupons:*

8.4.1 When heat treatment is required by the material specification and is to be performed by the purchaser or his agent, and the material is to be supplied by the manufacturer in a condition other than that required by the material specification, the material shall be qualified on the basis of tests made on specimens taken from coupons, obtained from the material in its as-shipped condition, that have been heat treated in accordance with the requirements specified in the material specification or on the order. If the heat-treatment temperatures are not specified, the manufacturer shall heat treat the coupons under conditions he considers appropriate.

8.4.2 When specified on the order, the test coupons may be subjected to additional heat treatment to simulate thermal treatments that will be used during fabrication.

8.4.3 The purchaser shall be informed of the procedures followed in heat treating the test coupons.

8.5 *Test Methods:*

8.5.1 All tests shall be conducted in accordance with Test Methods and Definitions A370.

8.5.2 Yield strength shall be determined either by the 0.2 % offset method or by the 0.5 % extension-under-load method.

9. Quality

9.1 *General*—Sheet and strip furnished under this specification shall be clean, sound, and free of internal or external imperfections which would make the material unsuitable for the intended application. Care should be taken to avoid cracks, seams, slivers, grooves, laminations, pits, blisters, buckles, coil breaks, creases, holes, pickling stains and patches, ragged and torn edges, and "rolled-in" dirt and scale.

9.2 *Surface Finish*—The degree or amount of surface imperfections on material in cut lengths shall be such that only a reasonable amount of metal finishing is required. Slight surface imperfections that are completely removable without reducing the thickness below the minimum permissible limits shall not be considered to be defects. Coils may contain some abnormal defects such as holes, welds, and so forth, which render a portion of the coil unusable, since the inspection of coils does not afford the same opportunity to reject portions containing defects as is the case with cut lengths. However, an excessive number of abnormal imperfections is cause for rejection.

10. Edges

10.1 *Edges*—The types of edges procurable in hot-rolled and in cold-rolled alloy-steel sheet and strip are as follows:

10.2 *Hot-Rolled Sheet and Strip:*

10.2.1 *Mill Edge*—Normal edge produced in hot rolling that does not conform to any definite contour.

10.2.2 *Cut Edge*—Approximately square edge resulting from the cutting of sheet into one or more desired widths by means of rotary knives (slit edge) or blade shears (sheared edge).

10.2.3 *Square Edge*—Type of mill edge produced by hot edge-rolling; furnished on strip only.

10.3 *Cold-Rolled Sheet:*

10.3.1 *Cut Edge*—Same description as shown in 10.2.2 for hot-rolled sheet and strip.

10.4 *Cold-Rolled Strip:*

10.4.1 *No. 1 Edge*—Prepared edge of a specified round or square contour that is produced when a very accurate width is required.

10.4.2 *No. 2 Edge*—Natural mill edge carried through the cold rolling from the hot-rolled strip without additional processing of the edge.

10.4.3 *No. 3 Edge*—Approximately square edge produced by slitting.

10.4.4 *No. 4 Edge*—Rounded edge produced by edge rolling either the natural edge of hot-rolled strip or slit-edge strip. Used when an approximately round edge is desired and when the finish of the edge is not important.

10.4.5 *No. 5 Edge*—Square edge produced by edge rolling or filing for the purpose of eliminating burr.

10.4.6 *No. 6 Edge*—Square edge produced by edge rolling the natural edge of hot-rolled strip or slit-edge strip, when the width tolerances and finish required are not as exacting as for the No. 1 Edge.

11. Permissible Variations in Dimensions

11.1 The permissible variations in dimensions (see Table 3) for hot-rolled and cold-rolled alloy steel sheet and strip shall be in accordance with Tables 4-22.

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

12. Identification of Product

12.1 As a minimum, the material shall be identified with the manufacturer's name or brand, the specification designation, weight, purchaser's order number, and material identification which is traceable to the heat or cast.

12.2 The identification shall be legibly stenciled on top of each lift or shown on a tag attached to each coil or shipping unit.

12.3 When specified on the order, each sheet shall be identified as agreed upon.

13. Retests

13.1 The retest provisions of Test Methods and Definitions A370 shall apply.

13.2 If the results of any tests do not conform to the specified requirements, (unless otherwise specified in the individual material specification), retests may be made on double the original number of specimens from the same lot, each of which must conform to the requirements specified. If the results of the retests do not conform to the specified requirements, the lot shall be rejected.

14. Inspection and Testing

14.1 When the order specifies that the purchaser will inspect the material and witness testing, the inspector representing the purchaser shall have entry at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy the inspector that the material is being furnished in accordance with the specification.

14.2 All tests (except product analysis) and inspection shall be made at the place of manufacture before shipment, unless otherwise specified on the order, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

15. Rework and Retreatment

15.1 If inspection and test results fail to conform to the specified requirements, the material may be reworked or retreated, if the manufacturer can assure that the cause of failure is curable and that the quality of the material shall conform to the specified requirements. After retreatment, testing shall be done in accordance with the material specification requirements.

16. Rejection Subsequent to Shipment

16.1 Material that shows characteristics not in conformance with the material specification subsequent to its initial acceptance may be rejected. In such cases, the manufacturer should be notified in a timely manner.

17. Certification

17.1 When specified on the order, a certification of compliance shall be furnished that the material was manufactured, sampled, tested, and inspected in accordance with the requirements of the applicable specification.

17.2 When specified on the order, a report of the test results shall be furnished.

17.3 A signature is not required on the certification of compliance or the report of test results. 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.

18. Packaging, Marking, and Loading for Shipment

18.1 Packaging, marking, and loading for shipment shall be in accordance with those procedures recommended in Practices A700.

18.2 *For Government Procurement*—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.

TABLE 1 (a) Classification of Hot-Rolled Sheet and Strip

Thickness, in. (mm)[A]	Width, in. (mm)[A]			
	Up to 6 (150), incl	Over 6 to 23 15/16 (150 to 608), incl	24 to 48 (610 to 1220), incl	Over 48 (1220)
0.2299 to 0.2031 (5.84 to 5.16), incl	. . .	strip	sheet	. . .
0.2030 to 0.1800 (5.15 to 4.57), incl	strip	strip	sheet	. . .
0.1799 (4.56) and thinner	strip	strip	sheet	sheet

TABLE 1 (b) Classification of Cold-Rolled Sheet and Strip

Thickness, in. (mm)[A]	Width, in. (mm)[A]		
	Up to 23 15/16 (608), incl	24 to 48 (610 to 1220), incl	24 to 48 (610 to 1220), incl
0.2499 to 0.2300 (5.84 to 5.15), incl	strip	. . .	. . .
0.2299 to 0.1800 (5.84 to 4.57), incl	strip	sheet	. . .
0.1799 (4.56) and thinner	strip	sheet	sheet

[A] 1 in. = 25.4 mm.

TABLE 2 Product Analysis Tolerances Over or Under Specified Range or Limit

Element	Limit or Maximum of Specified Element, %	Tolerance Over Maximum Limit or Under Minimum Limit
Carbon	to 0.30, incl	0.01
	over 0.30–0.75, incl	0.02
	over 0.75	0.03
Manganese	to 0.90, incl	0.03
	over 0.90–2.10, incl	0.04
Phosphorus	over max only	0.005
Sulfur	over max only	0.005
Silicon	to 0.35, incl	0.02
	over 0.35–2.20, incl	0.05
Copper	to 1.00, incl	0.03
	over 1.00–2.00, incl	0.05
Nickel	to 1.00, incl	0.03
	over 1.00–2.00, incl	0.05
	over 2.00–5.30, incl	0.07
	over 5.30–10.00, incl	0.10
Chromium	to 0.90, incl	0.03
	over 0.90–2.10, incl	0.05
	over 2.10–3.99, incl	0.10
Molybdenum	to 0.20, incl	0.01
	over 0.20–0.40, incl	0.02
	over 0.40–1.15, incl	0.03
Vanadium	to 0.10, incl	0.01
	over 0.10–0.25, incl	0.02
	over 0.25–0.50, incl	0.03
	minimum value specified, check under minimum limit	0.01
Tungsten	to 1.00, incl	0.04
	over 1.00–4.00, incl	0.08
Aluminum	to 0.10, incl	0.03
	over 0.10–0.20, incl	0.04
	over 0.20–0.30, incl	0.05
	over 0.30–0.80, incl	0.07
	over 0.80–1.80, incl	0.10

TABLE 3 Dimensional Tolerance Tables

NOTE 1— The following table shows the dimensional tolerance table number applicable to the different product classification and rolling methods. Continuous mill tolerances apply unless otherwise specified.

	Hot-Rolled					Cold-Rolled							
	Sheet		Strip			Sheet		Strip					
	Hand Mill		Continuous Mill					Continuous Mill					
	Mill Edge	Cut Edge	Mill Edge	Cut Edge		Mill Edge	Cut Edge	Edges					
								1	2	3	4	5	6
								Mill	Slit				
Thickness	5	5	4	4	13	6	6	18	18	18	18	18	18
Width	7	8	7	8	15	7	8	21	19	20	21	21	21
Length	9	9	9	9	16	9	9	22	22	22	22	22	22
Flatness for cut lengths	10	10	10	10	17	10	10	. . .	. . .	. . .	. . .	. . .	. . .
Camber	11	11	11	11	11	11	11	11	11	11	11	11	11
Out-of-square	. . .	12	. . .	12	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Crown	. . .	. . .	. . .	. . .	14	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .

TABLE 4 Thickness[A] Tolerances for Hot-Rolled Sheet (Continuous Mill Product), Coils, or Cut Lengths

Width, in. (mm)	Thickness, in. (mm)				
	0.2299 to 0.1800 (5.84 to 4.57), incl	0.1799 to 0.0972 (4.56 to 2.47), incl	0.0971 to 0.0822 (2.46 to 2.09), incl	0.0821 to 0.0710 (2.08 to 1.80), incl	0.0709 to 0.0568 (1.79 to 1.44), incl
	Thickness Tolerances, Over and Under, in. (mm), for Specified Widths and Thicknesses				
24 to 32 (610 to 810), incl	0.009 (0.23)	0.008 (0.20)	0.007 (0.18)	0.007 (0.18)	0.006 (0.15)
Over 32 to 40 (810 to 1020), incl	0.009 (0.23)	0.009 (0.23)	0.008 (0.20)	0.007 (0.18)	0.006 (0.15)
Over 40 to 48 (1020 to 1220), incl	0.010 (0.25)	0.010 (0.25)	0.008 (0.20)	0.007 (0.18)	0.006 (0.15)
Over 48 to 60 (1220 to 1520), incl	. . .	0.010 (0.25)	0.008 (0.20)	0.007 (0.18)	0.007 (0.18)
Over 60 to 70 (1520 to 1780), incl	. . .	0.011 (0.28)	0.009 (0.23)	0.008 (0.20)	0.007 (0.18)
Over 70 to 80 (1780 to 2030), incl	. . .	0.012 (0.30)	0.009 (0.23)	0.008 (0.20)	. . .
Over 80 to 90 (2030 to 2290), incl	. . .	0.012 (0.30)	0.010 (0.25)	. . .	. . .
Over 90 (2290)	. . .	0.012 (0.30)	. . .	. . .	. . .

[A] Thickness is measured at any point on the sheet not less than ⅜ in. (9.5 mm) from a cut edge and not less than ¾ in. (19 mm) from a mill edge.

TABLE 5 Thickness[A] Tolerances, Hot-Rolled Sheet, Hand Mill Product

Thickness, in. (mm)[B]	Tolerance, in. (mm)[B] Over and Under
0.229 to 0.188 (5.82 to 4.78), incl	0.015 (0.38)
Under 0.188 to 0.146 (4.78 to 3.71), incl	0.014 (0.36)
Under 0.146 to 0.131 (3.71 to 3.33), incl	0.012 (0.30)
Under 0.131 to 0.115 (3.33 to 2.92), incl	0.010 (0.25)
Under 0.115 to 0.099 (2.92 to 2.54), incl	0.009 (0.23)
Under 0.099 to 0.084 (2.54 to 2.13), incl	0.008 (0.20)
Under 0.084 to 0.073 (2.13 to 1.85), incl	0.007 (0.18)
Under 0.073 to 0.059 (1.85 to 1.50), incl	0.006 (0.15)
Under 0.059 to 0.041 (1.50 to 1.04), incl	0.005 (0.13)
Under 0.041 to 0.027 (1.04 to 0.69), incl	0.004 (0.10)
Under 0.027 to 0.019 (0.69 to 0.48), incl	0.003 (0.08)

[A] Thickness is measured at any point on the sheet not less than ⅜ in. (9.5 mm) from a cut edge and not less than ¾ in. (19 mm) from a mill edge.
[B] 1 in. = 25.4 mm.

TABLE 6 Thickness[A] Tolerances for Cold-Rolled Sheet, Coils, or Cut Lengths

Specified Width, in. (mm)[A]	Thickness, in. (mm)[A]								
	0.0313 to 0.0195 (0.79 to 0.50), incl	0.0508 to 0.0314 (1.29 to 0.80), incl	0.0567 to 0.0509 (1.43 to 1.30), incl	0.0709 to 0.0568 (1.79 to 1.44), incl	0.0821 to 0.0710 (2.08 to 1.80), incl	0.0971 to 0.0822 (2.46 to 2.09), incl	0.1419 to 0.0972 (3.60 to 2.47), incl	0.1799 to 0.1420 (4.56 to 3.61), incl	0.2299 to 0.1800 (5.84 to 4.57), incl
	Thickness Tolerances, Over and Under, in. (mm)[A] , for Specified Widths and Thicknesses								
24 to 32 (610 to 810), incl	0.003 (0.08)	0.004 (0.10)	0.005 (0.13)	0.005 (0.13)	0.005 (0.13)	0.006 (0.15)	0.007 (0.18)	0.008 (0.20)	0.008 (0.20)
Over 32 to 48 (810 to 1020), incl	0.003 (0.08)	0.004 (0.10)	0.005 (0.13)	0.005 (0.13)	0.006 (0.15)	0.007 (0.18)	0.008 (0.20)	0.009 (0.23)	0.009 (0.23)
Over 40 to 48 (1020 to 1220), incl	0.003 (0.08)	0.004 (0.10)	0.005 (0.13)	0.005 (0.13)	0.006 (0.15)	0.007 (0.18)	0.009 (0.23)	0.010 (0.25)	0.010 (0.25)
Over 48 to 60 (1220 to 1520), incl	0.003 (0.08)	0.004 (0.10)	0.005 (0.13)	0.006 (0.15)	0.006 (0.15)	0.008 (0.20)	0.010 (0.25)	0.010 (0.25)	. . .
Over 60 to 70 (1520 to 1780), incl	. . .	0.005 (0.13)	0.006 (0.15)	0.006 (0.15)	0.007 (0.18)	0.009 (0.23)	0.010 (0.25)	0.011 (0.28)	. . .
Over 70 to 80 (1780 to 2030), incl	. . .	. . .	. . .	. . .	0.007 (0.18)	0.009 (0.23)	0.011 (0.28)	0.012 (0.30)	. . .
Over 80 to 90 (2030 to 2290), incl	. . .	. . .	. . .	. . .	. . .	. . .	0.012 (0.30)	0.012 (0.30)	. . .
Over 90 (2290)	. . .	. . .	. . .	. . .	. . .	. . .	0.012 (0.30)	0.012 (0.30)	. . .

[A] Thickness is measured at any point on the sheet not less than ⅜ in. from a cut edge and not less than ¾ in. (19 mm) from a mill edge.

TABLE 7 Width Tolerances for Mill Edge of Hot-Rolled or Cold-Rolled Sheet, Coils, or Cut Lengths

Specified Widths, in. (mm)[A]	Tolerances Over Specified Width, in. (mm),[A] No Tolerance Under
24 to 26 (610 to 660), excl	13/16 (20.6)
26 to 28 (660 to 710), excl	15/16 (23.8)
28 to 3 (710 to 890), excl	1⅛ (28.6)
35 to 50 (890 to 1270), excl	1¼ (31.8)
50 to 60 (1270 to 1520), excl	1½ (38.1)
60 to 65 (1520 to 1650), excl	1⅝ (41.3)
65 to 70 (1650 to 1780), excl	1¾ (44.4)
70 to 80 (1780 to 2030), excl	1⅞ (47.6)
80 (2030) and over	2

[A] 1 in. = 25.4 mm.

TABLE 8 Width Tolerances for Cut Edge of Hot-Rolled or Cold-Rolled Sheet, Coils, or Cut Lengths

Specified Width, in. (mm)[A]	Tolerance Over Specified Width, in. (mm)[A] ,No Tolerance Under
24 to 30 (610 to 760), incl	3/16 (4.8)
Over 30 to 50 (760 to 1270), incl	¼ (6.35)
Over 50 to 80 (1270 to 2030), incl	5/16 (7.9)
Over 80 (2030)	⅜ (9.5)

[A] 1 in. = 25.4 mm.

TABLE 9 Length Tolerances for Hot-Rolled or Cold-Rolled Sheet

Specified Length, in. (mm)	Tolerance Over Specified Length, in. (mm), No Tolerance Under
24 to 30 (610 to 760), incl	¼ (6.35)
Over 30 to 60 (760 to 1520), incl	½ (12.7)
Over 60 to 120 (1520 to 3050), incl	¾ (19)
Over 120 to 156 (3050 to 3960), incl	1 (25.4)
Over 156 to 192, (3960 to 4880), incl	1¼ (31.8)
Over 192 to 240 (4880 to 6100), incl	1½ (38.1)
Over 240 (6100)	1¾ (44)

TABLE 10 Flatness Tolerances for Cut Lengths of Hot-Rolled or Cold-Rolled Sheet[A]

Specified Thickness, in. (mm)[B]	Specified Width, in. (mm)[B]	Flatness Tolerance, in. (mm)[B,C]
From 0.0195 to 0.0567 (0.50 to 1.43), incl	24 to 36 (610 to 915), incl	½ (12.7)
	Over 36 to 60 (915 to 1520), incl	¾ (19)
	Over 60 (152)	1 (25.4)
From 0.0568 to 0.2299 (1.44 to 5.84), incl	24 to 60 (610 to 1520), incl	½ (12.7)
	Over 60 to 72 (1520 to 1780), incl	¾ (19)
	Over 72 (1780)	1 (25.4)

[A] Rolled or thermally treated and flattened.
[B] 1 in. = 25.4 mm.
[C] Deviations from flatness are measured by laying the sheet on a horizontal flat surface and measuring the maximum elevation above that surface to any point on the bottom surface of the sheet.

TABLE 11 Camber[A] Tolerances for Hot-Rolled or Cold-Rolled Sheet and Strip

For sheet	¼ in. (6.35 mm) in any 8 ft (2440 mm)
For strip to 1½ in. (38.1 mm) in width, incl	½ in. (12.7 mm) in any 8 ft (2440 mm)
For strip over 1½ to 23 15/16 in. (38.1 to 608.0 mm) in width, incl	¼ in. (6.35 mm) in any 8 ft (2440 mm)

[A] Camber is determined by placing an 8-ft straightedge on the concave edge of the sheet or strip and measuring the greatest distance between the sheet edge or strip edge and the straightedge. When the camber shown in Table 11 is not suitable for a particular purpose, hot-rolled strip is sometimes machine straightened to a specified camber. For that requirement, the producer should be consulted.

TABLE 12 Out-Of-Square Tolerance for Hot-Rolled or Cold-Rolled Sheet (Cut Edge Not Resquared)

Out-of-square is the greatest deviation of an end edge from a straight line at a right angle to a side and touching one corner. The tolerance for sheets of all gages and all sizes is 1/16 in./6 in., 10.5 mm/m or fraction thereof, of width.

It is also obtained by measuring the difference between the diagonals of the sheet. The out-of-square deviation is one half of that difference.

TABLE 13 Thickness Tolerances for Hot-Rolled Strip Coils, or Cut Lengths[A,B]

Specified Width, in. (mm)[C]	Thickness, in. (mm)[C]							
	0.2299 to 0.2031 (5.84 to 5.16), incl	0.2030 to 0.1875 (5.15 to 4.76), incl	0.1874 to 0.1719 (4.75 to 4.37), incl	0.1718 to 0.1420 (4.36 to 3.61), incl	0.1419 to 0.1121 (3.60 to 2.85), incl	0.1120 to 0.0972 (2.84 to 2.47), incl	0.0971 to 0.0710 (2.46 to 1.80), incl	0.0709 to 0.0568 (1.79 to 1.44), incl
	Thickness Tolerances, in.[C], Over and Under for Specified Widths and Thicknesses							
To 6 (150), incl	. . .	0.006 (0.15)	0.006 (0.15)	0.005 (0.13)	0.005 (0.13)	0.005 (0.13)	0.005 (0.13)	0.005 (0.13)
Over 6 to 12 (150 to 305), incl	0.007 (0.18)	0.006 (0.15)	0.006 (0.15)	0.006 (0.15)	0.006 (0.15)	0.005 (0.13)	0.005 (0.13)	0.005 (0.13)
Over 12 to 15 (305 to 380), incl	0.008 (0.20)	0.008 (0.20)	0.007 (0.18)	0.007 (0.18)	0.007 (0.18)	0.007 (0.18)	0.006 (0.15)	0.006 (0.15)
Over 15 to 20 (380 to 510), incl	0.009 (0.23)	0.009 (0.23)	0.009 (0.23)	0.008 (0.20)	0.008 (0.20)	0.008 (0.20)	0.007 (0.18)	0.006 (0.15)
Over 20 to 23 5/16 (510 to 608), incl	0.009 (0.23)	0.009 (0.23)	0.009 (0.23)	0.009 (0.23)	0.008 (0.20)	0.008 (0.20)	0.007 (0.18)	0.006 (0.15)

[A] Thickness measurements are taken 3/8 in. (19 mm) from edge of strip on 1 in. (25.4 mm) or wider; and at any place on the strip when narrower than 1 in. (25.4 mm).
[B] See Table 16 for applicable crown tolerances.
[C] 1 in. = 25.4 mm.

TABLE 14 Crown Tolerances for Hot-Rolled Strip, Coils, or Cut Lengths[A]

Specified Widths, in. (mm)[B]	Additional Thickness at Center, in. (mm)[B]
Over 1 to 3½ (25 to 90), incl	0.002 (0.05)
Over 3½ to 6 (90 to 150), incl	0.003 (0.08)
Over 6 to 12 (150 to 305), incl	0.004 (0.10)
Over 12 to 15 (305 to 380), incl	0.005 (0.13)
Over 15 to 23 15/16 (380 to 608), incl	0.006 (0.15)

[A] Hot-rolled alloy strip may be thicker at the center than at a point 3/8 in. (19 mm) from the edge as shown in this table.
[B] 1 in. = 25.4 mm.

TABLE 15 Width Tolerances for Hot-Rolled Strip, Coils, or Cut Lengths

Specified Width, in. (mm)	Mill Edge	Cut Edge[A]		Sheared Edge
		Slit Edge		
		Thickness, in. (mm)		
		To 0.109 (2.77), incl	Over 0.109 (2.77)	
	Width Tolerance, in. (mm), Over and Under	Width Tolerance, in. (mm), Over and Under		Width Tolerance, in. (mm), Over Width No Tolerance Under
To 2 (50), incl	1/32 (0.79)	0.010 (0.25)	0.016 (0.41)	1/8 (3.2)
Over 2 to 5 (50 to 130), incl	1/16 (1.59)	0.010 (0.25)	0.020 (0.51)	1/8 (3.2)
Over 5 to 9 (130 to 230), incl	3/32 (2.38)	0.016 (0.41)	0.024 (0.61)	1/8 (3.2)
Over 9 to 12 (230 to 3005), incl	1/8 (3.20)	0.016 (0.41)	0.031 (0.79)	1/8 (3.2)
Over 12 to 20 (305 to 510), incl	1/4 (6.35)	0.020 (0.51)	0.031 (0.79)	1/8 (3.2)
Over 20 to 23 15/16 (510 to 608), incl	3/8 (9.50)	0.031 (0.79)	0.031 (0.79)	1/8 (3.2)

[A] Some alloy grades require annealing before cutting because of their high hardenability.

TABLE 16 Length Tolerances for Hot-Rolled Strip

Specified Widths, in. (mm)[A]	Length, in. (mm)[A]					
	To 60 (1520), incl	Over 60 to 120 (1520 to 3050), incl	Over 120 to 240 (3050 to 6100), incl	Over 240 to 360 (6100 to 9150), incl	Over 360 to480 (9150 to 12 200), incl	Over 480 (12 200)
	Length Tolerances, in. (mm)[A], Over Specified Length, No Tolerance Under					
To 3 (75), incl	1/4 (6.35)	3/8 (9.5)	1/2 (12.7)	3/4 (19)	1 (25.4)	1 1/2 (38.1)
Over 3 to 6 (75 to 150), incl	3/8 (9.5)	1/2 (12.7)	5/8 (15.8)	3/4 (19)	1 (25.4)	1 1/2 (38.1)
Over 6 to 23 15/16 (150 to 608), incl	1/2 (12.7)	3/4 (19)	1 (25.4)	1 1/4 (31.8)	1 1/2 (38.1)	1 3/4 (44.4)

[A] 1 in. = 25.4 mm.

TABLE 17 Flatness Tolerances for Cut Lengths of Hot-Rolled Strip As-Rolled or Thermally Treated and Flattened

1/2 in., max, in 8 ft (5.2 mm/m) of length

TABLE 18 Thickness Tolerances for Cold-Rolled Strip[A]

Specified Thickness, in. (mm)	Width, in. (mm)							
	3/16 to 1 (4.8 to 25), excl	1 to 3 (25 to 75), excl	3 to 6 (75 to 150), incl	Over 6 to 9 (150 to 230), incl	Over 9 to 12 (230 to 300), incl	Over 12 to 16 (300 to 410), incl	Over 16 to 20 (410 to 510), incl	Over 20 to 23 15/16 (510 to 610), incl
	Thickness Tolerances, in. (mm) Over and Under for Specified Thicknesses and Widths							
Under 0.010 (0.25)	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
0.010 (0.25)	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)	0.0015 (0.04)	0.0015 (0.04)
0.011 (0.28)	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)	0.0015 (0.04)	0.0015 (0.04)	0.0015 (0.04)
0.012 (0.30)	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)	0.0015 (0.04)	0.0015 (0.04)	0.0015 (0.04)	0.0015 (0.04)
Over 0.012 to 0.016 (0.30 to 0.41), incl	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)	0.0015 (0.04)	0.0015 (0.04)	0.0015 (0.04)	0.002 (0.05)	0.002 (0.05)
Over 0.016 to 0.019 (0.41 to 0.48), incl	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)	0.0015 (0.04)	0.0015 (0.04)	0.002 (0.05)	0.002 (0.05)	0.002 (0.05)
Over 0.019 to 0.025 (0.48 to 0.64), incl	0.001 (0.03)	0.001 (0.03)	0.0015 (0.04)	0.002 (0.05)	0.002 (0.05)	0.002 (0.05)	0.0025 (0.06)	0.0025 (0.06)
Over 0.025 to 0.028 (0.64 to 0.71), incl	0.001 (0.03)	0.0015 (0.04)	0.0015 (0.04)	0.002 (0.05)	0.002 (0.05)	0.002 (0.05)	0.0025 (0.06)	0.003 (0.08)
Over 0.028 to 0.034 (0.71 to 0.86), incl	0.0015 (0.04)	0.0015 (0.04)	0.002 (0.05)	0.0025 (0.06)	0.0025 (0.06)	0.0025 (0.06)	0.003 (0.08)	0.003 (0.08)
Over 0.034 to 0.039 (0.86 to 0.99), incl	0.002 (0.05)	0.002 (0.05)	0.0025 (0.06)	0.003 (0.08)	0.003 (0.08)	0.003 (0.08)	0.003 (0.08)	0.003 (0.08)
Over 0.039 to 0.049 (0.99 to 1.25), incl	0.002 (0.05)	0.002 (0.05)	0.0025 (0.06)	0.003 (0.08)	0.003 (0.08)	0.003 (0.08)	0.004 (0.10)	0.004 (0.10)
Over 0.049 to 0.068 (1.25 to 1.73), incl	0.002 (0.05)	0.002 (0.05)	0.003 (0.08)	0.003 (0.08)	0.003 (0.08)	0.003 (0.08)	0.004 (0.10)	0.004 (0.10)
Over 0.068 to 0.099 (1.73 to 2.52), incl	0.002 (0.05)	0.002 (0.05)	0.003 (0.08)	0.003 (0.08)	0.003 (0.08)	0.004 (0.10)	0.004 (0.10)	0.004 (0.10)
Over 0.099 to 0.160 (2.52 to 4.06), incl	0.002 (0.05)	0.003 (0.08)	0.003 (0.08)	0.004 (0.10)	0.004 (0.10)	0.004 (0.10)	0.005 (0.13)	0.005 (0.13)
Over 0.160 to 0.187 (4.06 to 4.75), incl	0.002 (0.05)	0.0035 (0.09)	0.004 (0.10)	0.004 (0.10)	0.004 (0.10)	0.005 (0.13)	0.006 (0.15)	0.006 (0.15)
Over 0.187 to 0.2499 (4.75 to 6.35), incl	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .

[A] Thickness measurements are taken 3/8 in. (9.5 mm) in from edge of strip, except that on widths less than 1 in. (25 mm), the tolerances are applicable for measurements at all locations.

TABLE 19 Width Tolerances for No. 2 Edge (Mill Edge) Cold-Rolled Strip

Specified Width, in. (mm)[A]	Tolerances for Specified Width, ±, in. (mm)[A]
To 2 (50), incl	1/32 (0.8)
Over 2 to 5 (50 to 130), incl	1/16 (1.6)
Over 5 to 9 (130 to 230), incl	3/32 (2.4)
Over 9 to 12 (230 to 305), incl	1/8 (3.2)
Over 12 to 20 (305 to 510), incl	1/4 (6.35)
Over 20 to 23 15/16 (510 to 608), inc	3/8 (9.5)

[A] 1 in. = 25.4 mm.

TABLE 20 Width Tolerances for No. 3 Edge (Slit Edge) of Cold-Rolled Strip

Specified Thickness, in. (mm)[A]		Width, in. (mm)[A]					
Over	To and incl	3/16 to 1/2 (5 to 12.7), excl	1/2 to 6 (12.7 to 150), incl	Over 6 to 9 (150 to 230), incl	Over 9 to 12 (230 to 305), incl	Over 12 to 20 (305 to 510), incl	Over 20 to 23 15/16 (510 to 608), incl
		Width Tolerances, in. (mm)[A], Over and Under for Indicated Thicknesses and Widths					
0.187 (4.75)	0.2499 (6.35)	. . .	. . .	. . .	. . .	. . .	. . .
0.160 (4.06)	0.187 (4.75)	. . .	0.016 (0.41)	0.020 (0.51)	0.020 (0.51)	0.031 (0.79)	0.031 (0.79)
0.099 (2.51)	0.160 (4.06)	0.010 (0.25)	0.010 (0.25)	0.016 (0.41)	0.016 (0.41)	0.020 (0.51)	0.020 (0.51)
0.068 (1.73)	0.099 (2.51)	0.008 (0.20)	0.008 (0.20)	0.010 (0.25)	0.010 (0.25)	0.016 (0.41)	0.020 (0.51)
0.0099 (0.25)	0.068 (1.73)	0.005 (0.13)	0.005 (0.13)	0.005 (0.13)	0.010 (0.25)	0.016 (0.41)	0.020 (0.51)
0.0099 (0.25) and under	. . .	. . .	. . .	. . .	. . .	. . .	. . .

[A] 1 in. = 25.4 mm.

TABLE 21 Width Tolerances for Edge Nos. 1, 4, 5, and 6 for Cold-Rolled Strip

Edge No.	Width, in. (mm)	Thickness, in. (mm)	Tolerances for Specified Width, ±, in. (mm)
1	To 3/4 (19)	0.0938 (2.38) and thinner	0.005 (0.13)
1	Over 3/4 to 5 (19 to 130), incl	0.125 (3.2) and thinner	0.005 (0.13)
4	To 1 (25.4), incl	0.1875 (4.8) to 0.025 (0.64), incl	0.015 (0.38)
4	Over 1 to 2 (25 to 50), incl	0.2499 to 0.025 (6.35 to 0.64), incl	0.025 (0.64)
4	Over 2 to 4 (50 to 100), incl	0.2499 to 0.035 (6.35 to 0.89), incl	0.047 (1.19)
4	Over 4 to 6 (100 to 150), incl	0.2499 to 0.035 (6.35 to 0.89), incl	0.047 (1.19)
5	To 3/4 (19), incl	0.0938 (2.38) and thinner	0.005 (0.13)
5	Over 3/4 to 5 (19 to 130), incl	0.125 (3.2) and thinner	0.005 (0.13)
5	Over 5 to 9 (130 to 230), incl	0.125 to 0.008 (3.2 to 0.203), incl	0.010 (0.25)
5	Over 9 to 20 (230 to 510), incl	0.105 to 0.015 (2.67 to 0.38), incl	0.010 (0.25)
5	Over 20 to 23 15/16 (510 to 610), incl	0.080 to 0.023 (2.03 to 0.58), incl	0.015 (0.38)
6	To 1 (25.4), incl	0.1875 (4.8) to 0.025 (0.64), incl	0.015 (0.38)
6	Over 1 to 2 (25 to 50), incl	0.2499 to 0.025 (6.35 to 0.64), incl	0.025 (0.64)
6	Over 2 to 4 (50 to 100), incl	0.2499 to 0.035 (6.35 to 0.89), incl	0.047 (1.19)
6	Over 4 to 6 (100 to 150), incl	0.2499 to 0.047 (6.35 to 1.19), incl	0.047 (1.19)

TABLE 22 Length Tolerances for Cold-Rolled Strip

Specified Width, in. (mm)	Length, in. (mm)		
	24 to 60 (610 to 1520), incl	Over 60 to 120 (1520 to 3050), incl	Over 120 to 240 (3050 to 6100), incl
	Length Tolerance, in. (mm), Over Specified Length, No Tolerance Under		
To 12 (305), incl	1/4 (6.35)	1/2 (12.7)	3/4 (19)
Over 12 to 23 15/16 (305 to 608), incl	1/2 (12.7)	3/4 (19)	1 (25.4)

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A505 – 12) that may impact the use of this standard. (March 1, 2016.)

(1) Added Practice A1073/A1073M to Referenced Documents subsection 2.1.

(2) Added subsection 11.1.1.