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.

Designation: A480/A480M – 22a

Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip[1]

This standard is issued under the fixed designation A480/A480M; 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[2] covers a group of general requirements that, unless otherwise specified in the purchase order or in an individual specification, shall apply to rolled steel plate, sheet, and strip, under each of the following specifications issued by ASTM: Specifications A240/A240M, A263, A264, A265, A666, A693, A793, and A895.

1.2 In the case of conflict between a requirement of a product specification and a requirement of this specification, the product specification shall prevail. In the case of conflict between a requirement of the product specification or a requirement of this specification and a more stringent requirement of the purchase order, the purchase order shall prevail. The purchase order requirements shall not take precedence if they, in any way, violate the requirements of the product specification or this specification; for example, by waiving a test requirement or by making a test requirement less stringent.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The SI units are shown in brackets, except that when A480M is specified, Annex A3 shall apply for the dimensional tolerances and not the bracketed SI values in Annex A2. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.4 This specification and the applicable material specifications are expressed in both inch-pound and SI units. However, unless the order specifies the applicable "M" specification designation [SI units], the material shall be furnished in inch-pound units.

1.5 *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:*[3]

A240/A240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

A263 Specification for Stainless Chromium Steel-Clad Plate

A264 Specification for Stainless Chromium-Nickel Steel-Clad Plate

A265 Specification for Nickel and Nickel-Base Alloy-Clad Steel Plate

A342/A342M Test Methods for Permeability of Weakly Magnetic Materials

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A666 Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

A693 Specification for Precipitation-Hardening Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment

A751 Test Methods and Practices for Chemical Analysis of Steel Products

A763 Practices for Detecting Susceptibility to Intergranular Attack in Ferritic Stainless Steels

A793 Specification for Rolled Floor Plate, Stainless Steel

A895 Specification for Free-Machining Stainless Steel Plate, Sheet, and Strip

[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 A01.17 on Flat-Rolled and Wrought Stainless Steel.

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[2] For ASME Boiler and Pressure Vessel Code applications see related Specification SA-480 in Section II of that Code.

[3] 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**

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A923 Test Methods for Detecting Detrimental Intermetallic Phase in Duplex Austenitic/Ferritic Stainless Steels
A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys
A1084 Test Method for Detecting Detrimental Phases in Lean Duplex Austenitic/Ferritic Stainless Steels
E140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

2.2 *AIAG Standard:*[4]
B-5 Primary Metals Identification Tag Application Standard

2.3 *ASME Document:*[5]
ASME BPVC.IX Boiler and Pressure Vessel Code, Section IX: Welding, Brazing, and Fusing Qualifications

2.4 *Federal Standard:*[6]
Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

2.5 *Military Standards:*[6]
MIL-STD-129 Marking for Shipment and Storage
MIL-STD-163 Steel Mill Products, Preparation for Shipment and Storage

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms pertaining to this standard, not otherwise listed in 3.2, reference should be made to Terminology A941.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cold work, n*—the changing of mechanical properties by work hardening.

3.2.2 *plate, n*—material 3⁄16 in. [5.00 mm] and over in thickness and over 10 in. [250 mm] in width; finishes for *plate* are shown in Section 13.

3.2.3 *sheet, n*—material under 3⁄16 in. [5.00 mm] in thickness and 24 in. [600 mm] and over in width; finishes for *sheet* are shown in Section 11.

3.2.4 *strip, n*—cold-rolled material under 3⁄16 in. [5.00 mm] in thickness and under 24 in. [600 mm] in width; finishes are detailed in Section 12 for *strip*, and strip edges in Section 14 for cold-rolled strip.

4. Ordering Information

4.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Such requirements may include, but are not limited to, the following:

4.1.1 Quantity (weight and number of pieces),

4.1.2 Name of material (stainless steel),

4.1.3 Condition (hot-rolled, cold-rolled, annealed, heat-treated),

4.1.4 Finish (see Section 11 for sheet, Section 12 for strip, and Section 13 for plates); in the case of polished finishes, specify whether one or both sides are to be polished,

4.1.5 Temper (if the applicable material specification requires this detail),

4.1.6 Form (plate, sheet, or strip),

4.1.7 Dimensions (thickness, width, and length),

4.1.7.1 Thickness shall be ordered to decimal or fractional thickness. The use of the gauge number is discouraged as being an archaic term of limited usefulness not having general agreement on meaning. The gauge number shall not be a basis for rejection.

4.1.7.2 Thickness, width, and length, when applicable, should be ordered in the same units, for example, 0.060 by 48 by 120 in. [1.52 by 1219 by 3048 mm].

4.1.8 Edge, strip only (see Section 14 for cold-rolled strip),

4.1.9 Type or UNS designation, refer to the applicable material specification,

4.1.10 Specification designation and date of issue,

4.1.11 Additions to specification or special requirements,

4.1.12 Restrictions (if desired) on methods for determining yield strength (see appropriate footnote to mechanical properties table of the basic material specification),

4.1.13 Marking requirements (see Section 25),

4.1.14 Preparation for delivery (see Section 25), and

4.1.15 Magnetic permeability test (when required). Refer to Section 19.

5. Process

5.1 The steel shall be manufactured/produced by the following or as specified in the applicable material specification.

5.1.1 The steel shall be made by electric-arc, electric-induction, or other suitable processes.

5.1.2 If a specific type of melting is required by the purchaser, it shall be so specified on the purchase order.

6. Heat Analysis

6.1 Methods and practices relating to chemical analysis shall be in accordance with Test Methods, Practices, and Terminology A751.

6.2 An analysis of each heat shall be made by the steel producer to determine the percentages of the elements specified in the applicable material specification. This analysis shall be made from a test sample taken during the pouring of the melt, or from the in-process product later in the manufacturing flow.

6.2.1 The heat analysis shall conform to the chemical requirements for each of the specified elements for the grade ordered, as listed in the applicable product specification.

6.2.2 All commercial metals contain small amounts of elements other than those which are specified. It is neither practical nor necessary to specify limits for unspecified elements that can be present. The producer is permitted to analyze for unspecified elements and is permitted to report such analyses. The presence of an unspecified element and the reporting of an analysis for that element shall not be a basis for rejection, unless the presence of that element causes the loss of a property typically expected for that metal, for the type and quality ordered.

[4] Available from Automotive Industry Action Group (AIAG), 26200 Lahser Rd., Suite 200, Southfield, MI 48033-7156, http://www.aiag.org.

[5] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

[6] Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

6.2.3 The purchaser is permitted to require in the purchase order a maximum limit for an individual element not specified in the product specification. Such a requirement for an element not listed in the product specification, when acknowledged in the order acceptance, shall be treated as a specified element, with determination of chemical analysis and reporting of that analysis.

6.2.4 The purchaser is permitted to make the requirements for any element more stringent; that is, require higher minimums for elements having minimum requirements or ranges with minimum requirements, or requiring lower maximums for elements having specified maximums, or ranges with maximums. The purchaser is not permitted to make chemical requirements less stringent.

6.2.5 Analysis limits shall be established for specific elements rather than groups of elements, including but not limited to *all others*, *rare earths*, and *balance*, unless all elements in such a group are similar in technical effect and are associated in typical methods of chemical analysis.

6.3 Except as permitted in 6.3.1, the steel shall not contain an unspecified element for the ordered grade to the extent that the steel conforms to the requirements of another grade for which that element is a specified element having a required minimum content. For this requirement, a grade is defined as an alloy described individually and identified by its own UNS designation in a table of chemical requirements within this specification or any specification listed within the scope as being covered by the specification.

6.3.1 Unless otherwise specified to lower maximum limits on the purchase order, maximum allowances for unspecified elements will be established for Cu, Mo, Ti, and Nb for the specified grade if the amount of that element present in the material conforms with composition limits for that element in another grade. These allowances are Cu, 0.75 %; Mo, 0.75 %; Ti, 0.10 %; and Nb, 0.10 %.

6.3.2 If any allowance in 6.3.1 is used to demonstrate non-substitution, then the element involved shall be reported as if it were a specified element.

6.4 The producer is not permitted to certify that material is in compliance with an ASTM product specification when the purchase order has required that the material contain as a minimum or range an element that is neither a specified element nor an intentionally added unspecified element for the ordered grade in accordance with the definitions of Test Methods, Practices, and Terminology A751.

6.5 The names columbium (Cb) and niobium (Nb) both refer to element 41. The name Niobium is preferred, but either is acceptable for reporting composition.

7. Product Analysis

7.1 The purchaser is permitted to perform a product analysis (formerly check analysis) to verify the identity of the finished material representing each heat or lot. Such analysis shall be made by any of the commonly accepted methods that will positively identify the material.

7.2 The chemical composition determined in accordance with 7.1 shall conform to the limits of the material specification within the tolerances of Table A1.1, unless otherwise specified in the applicable material specification or the purchase order. The allowable variation of a particular element in a single sample for product analysis is permitted to be either above or below the specified range. However, percentages must exhibit the same tendencies in all samples; that is, the several determinations of any individual element in a heat shall not vary both above and below the specified range.

8. Material Test Report and Certification

8.1 A report of the results of all tests required by the product specification shall be supplied to the purchaser. This material test report shall reference the product specification designation and year date indicating that the material was manufactured, sampled, tested, and inspected in accordance with requirements of the product specification and has been found to meet those requirements. The material test report shall report the melting process when the purchase order requires either a specific type of melting or requires that the melting process used is to be reported.

8.1.1 The report shall indicate the type of steel. If certifying that the material conforms to the requirements for more than one type of steel, the manufacturer may indicate each type of steel on the report, or may issue a separate report for each type of steel.

8.2 A signature is not required on the report. However, the document shall clearly identify the organization submitting the report. Not withstanding the absence of a signature, the organization submitting the document is responsible for its content.

8.3 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 certifiers' facility. The content of the EDI transmitted document must meet the requirements of the invoked ASTM 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 content of the report.

8.4 When finished material is supplied to a purchase order specifying the product specification, the organization supplying that material shall provide the purchaser with a copy of the original manufacturer's test report.

NOTE 1—Notwithstanding the absence of a signature, the organization submitting the report is responsible for the content of the report.

NOTE 2—The industry definition of EDI invoked herein is the computer-to-computer exchange of business information in a standard format such as ANSI ASC X12.

8.4.1 When the original manufacturer's test report was provided by EDI to the organization supplying the finished material to the purchaser, the organization supplying the finished material shall provide to the purchaser a printed form of the original test report or shall retransmit the test report by EDI to the purchaser. In either case, the test report shall be complete with the full identification of the original manufacturer and with all data provided on the test report of the original manufacturer.

9. Permitted Variations in Dimensions and Weight

9.1 Sheet, strip, and plate shall conform to the permitted variations in thickness, width, length and flatness, and other properties when specified, as listed in Annex A2 and Annex A3 for A480 and A480M respectively, for the ordered product form, or as agreed upon by seller and user and specified in the purchase order.

10. Workmanship

10.1 The material shall be of uniform quality consistent with good manufacturing and inspection practices. The steel shall have no imperfections of a nature or degree, for the type and quality ordered, that will adversely affect the stamping, forming, machining, or fabrication of finished parts.

10.2 *Sheet, Strip, and Plate*—For sheet and strip, restricted only to material ordered to have a No. 1 finish in accordance with 11.1.1 and 12.1.1 respectively, and for plate restricted to material ordered to hot-rolled and annealed or hot-rolled, annealed, and pickle finish in accordance with 13.1.1 and 13.1.2 respectively, it is permitted to grind to remove surface imperfections, provided such grinding does not reduce the thickness or width at any point beyond the permissible variations in dimensions. An iron free abrasive wheel shall be used for such grinding and shall be operated at a speed ample to ensure that defective areas are cleanly cut out.

11. Finish for Sheet

11.1 The types of finish available on sheet products are:

11.1.1 *No. 1 Finish*—Hot-rolled, annealed, and descaled.

11.1.2 *No. 2D Finish*—Cold-rolled, dull finish.

11.1.3 *No. 2B Finish*—Cold-rolled, bright finish.

11.1.3.1 *Bright Annealed Finish*—A bright cold-rolled finish retained by final annealing in a controlled atmosphere furnace.

11.1.4 *No. 3 Finish*—Intermediate polished finish, one or both sides.

11.1.5 *No. 4 Finish*—General purpose polished finish, one or both sides.

11.1.6 *No. 6 Finish*—Dull satin finish, Tampico brushed, one or both sides.

11.1.7 *No. 7 Finish*—High luster finish.

11.1.8 *No. 8 Finish*—Mirror finish.

11.1.9 *TR Finish*—Cold-worked to obtain specified properties.

NOTE 3—*Explanation of Sheet Finishes:*

No. 1—Commonly referred to as hot-rolled annealed and pickled or descaled. This is a dull, nonreflective finish.

No. 2D—A smooth, nonreflective cold-rolled annealed and pickled or descaled finish. This nondirectional finish is favorable for retention of lubricants in deep drawing applications.

No. 2B—A smooth, moderately reflective cold-rolled annealed and pickled or descaled finish typically produced by imparting a final light cold-rolled pass using polished rolls. This general-purpose finish is more readily polished than No. 1 or 2D finishes. Product with 2B finish is normally supplied in the annealed plus lightly cold-rolled condition unless a tensile-rolled product is specified.

Bright Annealed Finish—A smooth, bright, reflective finish typically produced by cold rolling followed by annealing in a protective atmosphere so as to prevent oxidation and scaling during annealing.

No. 3—A linearly textured finish that may be produced by either mechanical polishing or rolling. Average surface roughness (R_a) may generally be up to 40 µin. A skilled operator can generally blend this finish. Surface roughness measurements differ with different instruments, laboratories, and operators. There may also be overlap in measurements of surface roughness for both Nos. 3 and 4 finishes.

No. 4—A linearly textured finish that may be produced by either mechanical polishing or rolling. Average surface roughness (R_a) may generally be up to 25 µin. A skilled operator can generally blend this finish. Surface roughness measurements differ with different instruments, laboratories, and operators. There may also be overlap in measurements of surface roughness for both Nos. 3 and 4 finishes.

No. 6—This finish has a soft, satin appearance typically produced by tampico brushing a No. 4 finish.

No. 7—Has a high degree of reflectivity. It is produced by buffing a finely ground surface, but the grit lines are not removed. It is chiefly used for architectural or ornamental purposes.

No. 8—This is a highly reflective, smooth finish typically produced by polishing with successively finer grit abrasives, then buffing. Typically, very faint buff of polish lines may still be visible on the final product. Blending after part assembly may be done with buffing.

TR Finish—The finish resulting from the cold-rolling of an annealed and descaled or bright annealed product to obtain mechanical properties higher than that of the annealed condition. Appearance will vary depending upon the starting finish, amount of cold work, and the alloy.

Architectural Finishes—Sometimes described as a No. 5 finish, these are a separate category and may be negotiated between buyer and seller, as there are many techniques and finish variations available throughout the world.

11.1.10 Architectural finish, No. 5, or other proprietary names are special finishes.

11.1.11 Note 3 is not meant to be restrictive or to be used as a basis for rejection but is intended to give general guidelines. Various production methods may be used to obtain these finishes.

11.1.12 Sheets can be produced with one or two sides polished. When polished on one side only, it is permitted to rough grind the other side in order to obtain the necessary flatness.

12. Finish for Strip

12.1 The various types of finish procurable on cold-rolled strip products are:

12.1.1 *No. 1 Finish*—Cold-rolled to specified thickness, annealed, and descaled.

12.1.2 *No. 2 Finish*—Same as No. 1 finish, followed by a final light cold-roll pass, generally on highly polished rolls.

12.1.3 *Bright Annealed Finish*—A bright cold-rolled finish retained by final annealing in a controlled atmosphere furnace.

12.1.4 *TR Finish*—Cold-worked to obtain specified properties.

12.1.5 *Polished Finish*—Stainless steel strip is also available in polished finishes such as Nos. 3 and 4, which are explained in Note 3.

NOTE 4—*Explanation of Strip Finishes:*

No. 1—Appearance of this finish varies from dull gray matte finish to a fairly reflective surface, depending largely upon composition. This finish is used for severely drawn or formed parts, as well as for applications where the brighter No. 2 finish is not required, such as parts for heat resistance.

No. 2—This finish has a smoother and more reflective surface, the appearance of which varies with composition. This is a general purpose finish, widely used for household and automotive trim, tableware, utensils, trays, and so forth.

Bright Annealed Finish—See Note 3.

TR Finish—See Note 3.

13. Finish for Plates

13.1 The types of finish available on plates are:

13.1.1 *Hot-rolled or Cold-rolled, and Annealed or Heat Treated*—Scale not removed, an intermediate finish. Use of plates in this condition is generally confined to heat-resisting applications. Scale impairs corrosion resistance.

13.1.2 *Hot-rolled or Cold-rolled, and Annealed or Heat Treated, and Blast Cleaned or Pickled*—Condition and finish commonly preferred for corrosion-resisting and most heat-resisting applications, essentially a No. 1 finish.

13.1.3 *Hot-rolled or Cold-rolled, and Annealed or Heat Treated, and Surface Cleaned and Polished*—Polish finish is generally No. 4 finish.

13.1.4 *Hot-rolled or Cold-rolled, and Annealed or Heat Treated, and Descaled, and Temper Passed*—Smoother finish for specialized applications.

13.1.5 *Hot-rolled or Cold-rolled, and Annealed or Heat Treated, and Descaled; and Cold-rolled, and Annealed or Heat Treated, and Descaled, and Optionally Temper Passed*—Smooth finish with greater freedom from surface imperfections than in 13.1.4.

14. Edges for Cold-rolled Strip

14.1 The types of edges available on strip products are:

14.1.1 *No. 1 Edge*—A rolled edge, either round or square as specified.

14.1.2 *No. 3 Edge*—An edge produced by slitting.

14.1.3 *No. 5 Edge*—An approximately square edge produced by rolling or filing after slitting.

15. Heat Treatment

15.1 The heat treatments shown in this section are to be followed unless otherwise specified in the applicable material specification. Heat treatment thermal cycles shall be separate from other thermal processing cycles; for example, in-process thermal cycles are not permitted as a substitute for the separate annealing cycle.

15.2 *Austenitic Types:*

15.2.1 The austenitic types shall be annealed in accordance with Table A1.2.

15.2.2 The material shall be annealed to meet the mechanical property requirements of the applicable material specification unless otherwise stated in the material specification.

15.2.3 Except as indicated in Table A1.2, Series 300, XM-15, N08800, S30415, S30815, S31725, S31726, and S32615 austenitic chromium-nickel steels, when specified on the purchase order, shall be capable of meeting the test for resistance to intergranular corrosion specified in 18.2.

15.2.4 For grades stabilized with titanium or niobium, refer to Note 5.

NOTE 5—Solution-annealing temperatures above 1950 °F [1066 °C] can impair the resistance to intergranular corrosion after subsequent exposure to sensitizing conditions in the stabilized grades, types 309Cb, 309HCb, 310Cb, 310HCb, 316Ti, 316Cb, 321, 321H, 347, 347H, 348, 348H, S21640, S33425, S35140, S35135, and S35125. When intergranular corrosion is of concern, the purchaser should specify the corrosion test of 18.2 (to be conducted on sensitized specimens). The manufacturer is permitted, if necessary, use a lower temperature resolution anneal or a stabilization anneal after a high temperature solution anneal in order to meet corrosion test requirements. Consideration should be given to the corrosive media before using a stabilization anneal at less than 1800 °F [982 °C], as such treatment is not equally effective for all media.

15.2.5 For the stabilized H types, it is noted that the heat treatment requirements shown in Table A1.2 differ as a function of whether the material was cold worked or hot finished.

15.2.6 The chromium-manganese-nickel types (201, 202, S20103, S20400, S20153, S21800, S21640, XM-11, XM-17, XM-18, XM-19, XM-29, and XM-31) shall be solution annealed to meet the mechanical property requirements of the applicable material specification and to exhibit adequate resistance to intergranular corrosion (see 18.2). For S20161, the heat treatment is specified in Table A1.2. For S21640, see Note 5.

15.2.6.1 Note that some of these types contain high carbon content that can adversely affect resistance to intergranular corrosion.

15.3 *Duplex Types*—The duplex types shall be solution annealed in accordance with Table A1.2.

15.4 *Martensitic and Ferritic Types:*

15.4.1 The chromium steels (S32803, 400 Series, S40945, S41045, S41050, S41500, S43932, S44400, S44537, S44635, S44660, S44700, S44735, S44800, XM-27, and XM-33) shall be heat treated in such a manner as to satisfy all the requirements for mechanical and bending properties specified in the applicable material specification and (except for 400 Series, S41050, and S41500) to provide for adequate resistance to intergranular attack.

15.4.2 For S41500, heat to 1750 °F [955 °C] minimum, air cool to 200 °F [93 °C] or lower prior to any optional intermediate temper and prior to final temper. The final temper shall be between 1050 and 1150 °F [566 and 621 °C].

16. Number of Tests

16.1 Unless otherwise specified by the applicable material specification or by agreement between the seller and the purchaser to perform a greater number of tests, the following number of tests are to be performed.

16.1.1 In the case of plate, sheet, and strip produced in coil form, two or more hardness tests (one from each end of the coil); one bend test, when required; one permeability test, when required; and one or more tension tests shall be made on specimens taken from each coil. If the hardness difference between the two ends of the coil exceeds 5 HRB, or equivalent, or if the material is temper rolled, tensile properties must be determined on both coil ends.

16.1.2 In the case of plate, sheet, or strip produced in cut lengths, one tension test; two tension tests if the material is temper rolled (one tension test for single piece lots); one bend test when required, and one or more hardness tests shall be made on each 100 or less pieces of the same heat and nominal thickness rolled separately or continuously and heat treated within the same operating period, either as a lot or continuously.

NOTE 6—The term continuously, as applied to heat treatment, is meant to describe a heat-treating operation in which one cut length follows

another through the furnace. Interspersement of different melts is permissible if they are of approximately the same nominal thickness and are heat treated in the same operating period and under the same conditions (time and temperature).

16.1.3 One intergranular corrosion test, when required, shall be selected from each heat and thickness subjected to the same heat treatment practice. It is permitted to obtain such specimens from specimens selected for mechanical testing.

17. Test Specimens

17.1 *Tension Test:*

17.1.1 Tension test specimens shall be taken from finished material and shall be selected in either or both longitudinal and transverse direction. The tension test specimen shall conform to the appropriate sections of Test Methods and Definitions A370, unless otherwise specified in the applicable material specification or agreed upon by the seller and the purchaser.

17.1.2 The testing speed between the yield strength and the fracture of the specimen, shall be conducted at a constant strain rate between ⅛ and ½ in. [3.18 and 12.70 mm] inclusive, per in. [25.40 mm] of gauge length per minute, or at a crosshead speed that will give a strain rate within this range. For the purposes of this specification, the rate of strain shall be determined by a strain-rate pacer, indicator, or controller, or by dividing the unit elongation by the elapsed time from yield strength to fracture.

17.2 *Hardness Test*—It is permitted to perform hardness tests on the grip ends of the tension specimens before they are subjected to the tension test.

17.2.1 Unless otherwise specified in the purchase order, the manufacturer may use an alternate hardness test procedure when material size or form dictates. Hardness conversion shall be done using the applicable tables in Test Methods and Definitions A370. When the material is too thin to allow hardness testing using any of the Rockwell superficial hardness tests, the hardness requirement is waived.

17.3 *Bend Test:*

17.3.1 Bend test specimens (when required) shall be taken from finished material and shall be selected in the transverse direction or as indicated in the applicable material specification or as agreed upon by the seller and the purchaser. In the case of transverse bend test specimens, the axis of bend shall be parallel to the direction of rolling.

17.3.2 Bend test specimens from sheet and strip product shall be the full thickness of the material and approximately 1 in. [25.4 mm] in width. It is permitted to round the edges of the test specimen to a radius equal to one half the specimen thickness.

17.3.3 The width of strip for which bend tests can be made is subject to practical limitations on the length of the bend test specimen. For narrow strip, the following widths can be tested:

Strip Thickness, in. [mm]	Minimum Strip Width and Minimum Specimen Length for Bend Tests, in. [mm]
0.100 [2.5] and under	½ [12.7]
Over 0.100 to 0.140 [2.5 to 3.5], excl	1 [25.4]
0.140 [3.5] and over	1½ [38.1]

Bend test specimens shall be of any suitable length over the specified minimum length.

17.3.4 Bend test specimens taken from plates shall be in full thickness of the material up to and including ½ in. [12.7 mm] in thickness, of suitable length, and between 1 and 2 in. [25.4 and 50.8 mm] in width. It is permitted to remove the sheared edges to a depth of at least ⅛ in. [3.2 mm] and it is permitted to smooth the sides with a file. It is permitted to break the corners of the cross section of the specimen with a file, but no appreciable rounding of the corners is permitted.

17.3.5 In the case of plates over ½ in. [12.7 mm] in thickness, it is permitted to use bend test specimens, machined to 1 in. [25.4 mm] nominal width by ½ in. [12.7 mm] nominal thickness and at least 6 in. [152.4 mm] in length. One surface, to be the outside surface in bending, shall be the original surface of the plate; however, surface preparation by light grinding is permitted. It is permitted to round the edges to a 1/16 in. [1.6 mm] radius. When agreed by the seller and the purchaser, it is permitted to modify the cross section to ½ in. [12.7 mm] nominal square.

17.3.6 In the case of plates over 1 in. [25.4 mm] in thickness, bend tests must be agreed upon between the seller and the purchaser.

17.3.7 The bend test specimen shall withstand cold bending through the angle specified in the applicable material specification without cracking on the outside of the bent portion.

17.4 The bend shall be made over a diameter equal to the number of thicknesses of flat stock shown in the applicable material specification or over a single piece of flat stock equal to the number of thicknesses shown in the applicable material specification; or as follows:

17.4.1 Material up to and including ⅜ in. [9.5 mm] in thickness shall be bent over a piece (or pieces) of flat stock that has the same nominal thickness of the material being tested (1T), allowing the test material to form its natural curvature.

17.4.2 Material over ⅜ in. [9.5 mm] and up to and including 1 in. [25.4 mm] in thickness shall be bent over a piece (or pieces) of flat stock equalling two times the thickness of the material being tested (2T), allowing the test material to form its natural curvature.

18. Special Tests

18.1 If other tests are required, the methods and acceptance criteria shall be agreed upon between the seller and the purchaser and specified on the purchase order.

18.2 *Resistance to Intergranular Corrosion:*

18.2.1 The intergranular corrosion test, Practice E of Practices A262, is not required unless it is specified on the purchase order. All austenitic chromium-nickel types except the H types are expected to be capable of passing this test. However, it is not necessary to actually run the test unless it is specified on the purchase order. Note that Practices A262 requires the test to be performed on sensitized specimens in the low-carbon and stabilized types and on specimens representative of the as-shipped condition for other types. In the case of low-carbon types containing 3 % or more molybdenum in their specified composition, the applicability of the sensitizing treatment prior to testing shall be a matter for negotiation between the seller and the purchaser. When specified, all flat rolled products of the chromium-nickel series (300 series) in thickness up to and

including 2 in. [50.8 mm] nominal size shall be capable of passing the intergranular corrosion test in the as shipped condition. In the case of heavier plates of types other than 304L, 304LN, 309Cb, 310Cb, 316Cb, 316L, 316LN, 316Ti, 317L, 321, 347, 348, S31725, and S31726, the applicability of this test shall be a matter for negotiation between the seller and the purchaser.

18.2.2 The H types are not normally subject to intergranular corrosion tests. However, it is permitted to specify Practice E of Practices A262 for Type 321H when intergranular corrosion is of concern. In this case, the purchaser shall inform the seller and agree upon the requirements and these requirements shall be so stated on the purchase order.

18.2.3 Austenitic chromium-manganese-nickel types (201, 202, XM-17, XM-18, XM-19, XM-29, XM-31, S20400, S21640, and S21800) are to be heat treated for intergranular corrosion resistance. When intergranular corrosion tests are required, they shall be as agreed upon between the seller and the purchaser.

18.2.4 N08800 shall be heat treated for intergranular corrosion resistance. When intergranular corrosion tests are required, they shall be as agreed upon between the seller and purchaser.

18.2.5 Corrosion tests are not normally required for the 400 series types. Lower-carbon corrosion-resistant types (S44400, S44635, S44660, S44700, S44800, S44735, XM-27, and XM-33) are heat treated for resistance to corrosion. For S44400, S44635, S44660, S44700, S44800, S44735, XM-27, and XM-33, intergranular corrosion testing of Practices A763, Practice X, Y, or Z shall be specified as agreed upon between the seller and the purchaser.

18.3 *Detrimental Intermetallic Phases in Duplex Stainless Steels*—The tests for detrimental intermetallic phases in wrought duplex stainless steels, Methods A, B, or C of Test Methods A923 or A1084, are not required unless it is specified on the purchase order. All duplex (austenitic-ferritic) types that are listed in Test Methods A923 or A1084 are expected to be capable of passing these tests. However, it is not necessary to actually run the tests unless specified on the purchase order. The applicability of these tests to duplex stainless steels not listed in Test Methods A923 or A1084 shall be a matter for negotiation between the seller and the purchaser.

19. Test Methods

19.1 The properties enumerated in applicable specifications shall be determined in accordance with the following ASTM standards.

19.1.1 *Tension Tests*—Test Methods and Definitions A370.

19.1.2 *Brinell Tests*—Test Methods and Definitions A370.

19.1.3 *Rockwell Hardness*—Test Methods and Definitions A370.

19.1.4 *Hardness Equivalents*—Tables E140.

19.1.5 *Intergranular Corrosion (When Specified)*—Practices A262, Practices A763.

19.1.6 *Permeability Test (When Required)*—Test Methods A342/A342M.

19.1.7 *Charpy Impact Testing (When Required)*—Test Methods and Definitions A370.

19.1.8 *Intermetallic Phases (When Specified)*—Test Methods A923 or A1084.

20. Retests and Retreatment

20.1 Retests are permitted in accordance with the provisions of Test Methods and Definitions A370.

20.2 If any test specimen shows defective machining or develops flaws, it is permitted to discard the flawed specimen and substitute another specimen.

20.2.1 If the percentage of elongation of any tension specimen is less than that specified and any part of the fracture is more than ¾ in. [19.1 mm] from the center of the gauge length of the 2 in. [50.8 mm] specimen or is outside the middle half of the gauge length of an 8-in. [203.2 mm] specimen, as indicated by scribe marks placed on the specimen before testing, a retest shall be allowed.

20.3 If a bend test specimen fails, due to conditions of bending more severe than required by the specification, a retest shall be permitted, either on a duplicate specimen or on a remaining portion of the failed specimen.

20.4 If the results of any test lot are not in conformance with the requirements of the applicable material specification, the producer is permitted the option of retreating such lots. The material shall be accepted if the results of retests on retreated material are within the specified requirements.

20.5 If any specimens selected to represent any heat fail to meet any of the test requirements as specified in the applicable material specification, it is permitted to reheat treat the material represented and resubmit it for testing.

20.6 If the product analysis fails to conform to the specified limits, analysis shall be made on a new sample. The results of this retest shall be within the specified requirements.

21. Repair of Plate by Welding

21.1 Repair of surface defects of plate, by welding, is permitted unless prohibited by other specifications or purchase order requirements.

21.2 Defect depth shall not exceed ⅓ of the nominal thickness, and the total area shall not exceed 1 % of the plate surface area, unless prior approval from the purchaser is obtained.

21.3 Unacceptable imperfections shall be suitably prepared for welding by grinding or machining. Open clean defects, such as pits or impressions, will not necessarily require preparation.

21.4 The welding procedure and the welders or welding operators shall be qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code.

21.5 The welding consumables shall be suitable with the plate.

21.6 After repair welding, the welded area shall be ground smooth and blended uniformly to the surrounding surface.

22. Inspection

22.1 Inspection of the material by the purchaser's representative at the producing plant shall be made as agreed upon between the purchaser and the seller as part of the purchase order.

22.2 Unless otherwise specified in the contract or purchase order, *(1)* the seller is responsible for the performance of all the inspection and test requirements in this specification, *(2)* the seller is permitted to use own or other suitable facilities for the performance of the inspection and testing, and *(3)* the purchaser shall have the right to perform any of the inspection and tests set forth in this specification. The manufacturer shall afford the purchaser's inspector all reasonable facilities necessary to satisfy the inspector that the material is being furnished in accordance with the specification. Inspection by the purchaser shall not interfere unnecessarily with the manufacturer.

23. Rejection

23.1 Unless otherwise specified, any rejection based on tests made in accordance with this specification shall be reported to the seller within 60 working days from the receipt of the material by the purchaser.

23.2 Material that shows injurious imperfections as described in Section 10 subsequent to its acceptance at the purchaser's works will be rejected and the seller shall be notified.

24. Rehearing

24.1 Samples tested in accordance with this specification that represent rejected material shall be retained for three weeks from the date of the notification to the seller of the rejection. In case of dissatisfaction with the results of the test, the seller is permitted to make claim for a rehearing within that time.

25. Packaging, Marking, and Loading

25.1 *For Commercial Procurement:*

25.1.1 *Marking*—Unless otherwise specified in the applicable material specification or the purchase order, marking shall be conducted as follows:

25.1.1.1 Sheet, strip, and plate shall be marked on one face, in the location indicated below with the specification designation number, type of steel (type or UNS designation), material identification number, and the name or mark of the manufacturer. For sheet, strip, and plate whose length and width dimensions are both less than 24 in., each piece shall be marked with the type of steel and material identification number. The specification and designation number, and name or mark of the manufacturer shall be marked on the piece(s) or attached to the item or bundle. The characters shall be of such size as to be clearly legible. The marking shall be sufficiently stable to withstand normal handling. Unless otherwise specified by the purchaser, the marking, at the producers option, is permitted to be done with *(1)* marking fluid (if a specific maximum impurity limit of designated elements in the marking fluid is required by the purchaser, it shall be so stated on the purchase order), *(2)* low-stress blunt-nosed continuous or low-stress blunt-nosed-interrupted-dot die stamp, *(3)* a vibratory tool with a minimum tip radius of 0.005 in. [0.1 mm], or *(4)* electrochemical etching.

25.1.1.2 Flat sheet, strip in cut lengths, and plate shall be marked in two places near the ends or shall be continuously line marked along one edge. For flat sheet, strip in cut lengths, and plate whose length and width dimensions are both less than 48 in., it is permitted to mark such pieces in only one place.

25.1.1.3 Sheet, strip, and plate in coil form shall be marked near the outside end of the coil. The inside of the coil shall also be marked or shall have a tag or label attached and marked with the information of 25.1.1.1.

25.1.1.4 Material less than ¼ in. [6.4 mm] in thickness shall not be marked with die stamps.

25.1.1.5 The manufacturer's test identification number shall be legibly stamped on each test specimen, if to be shipped to the customer.

25.1.1.6 Material that conforms completely with the requirements of two types of steel within the ordering specification is permitted to be marked as both types of steel provided that the manufacturer is certifying the material as meeting the requirements of each of the types of steel. Such marking, if used, shall be part of the same marking as used for a single type of steel, or shall be a separate but similar marking immediately adjacent to the marking used for a single type of steel.

25.1.1.7 The AIAG primary metals identification tag (AIAG B-5) is permitted to be used as an auxiliary method of identification in cases where a bar-coded identification tag is desired. Use of this method shall be by agreement between purchaser and supplier.

25.1.2 *Packaging and Loading*—Unless otherwise specified in the applicable material specification or the purchase order, packaging, and loading shall be in accordance with the procedures recommended by Practices A700.

25.2 *For U.S. Government Procurement:*

25.2.1 When specified in the contract or order, and for direct procurement by or direct shipment to the government, marking for shipment shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

25.2.2 When specified in the contract or order, material shall be preserved, packaged, and packed in accordance with the requirements of MIL-STD-163. The applicable levels shall be as specified in the contract or order.

26. Keywords

26.1 austenitic stainless steel; duplex stainless steel; ferritic stainless steel; martensitic stainless steel; stainless steel; stainless steel plate; stainless steel sheet; stainless steel strip

ANNEXES

(Mandatory Information)

A1. PRODUCT ANALYSIS TOLERANCES AND HEAT TREATMENT REQUIREMENTS

A1.1 Listed in Annex A1 are tables showing the permitted variations of composition for product analysis relative to specified chemical requirements (Table A1.1) and the heat treatment requirements for types of stainless steel covered by product specifications that reference Specification A480/A480M (Table A1.2). When the product requirement includes a ratio requirement that is the quotient of two, or more, elements, the minimum required ratio determined from product analysis shall be at least 0.90× the minimum in the product specification.

TABLE A1.1 Chemical Requirements (Product Analysis Tolerances)[A]

Elements	Limit or Maximum of Specified Range, %	Tolerance Over the Maximum Limit or Under the Minimum Limit
Carbon	to 0.010, incl	0.002
	over 0.010 to 0.030, incl	0.005
	over 0.030 to 0.20, incl	0.01
	over 0.20 to 0.60, incl	0.02
	over 0.60 to 1.20, incl	0.03
Manganese	to 1.00, incl	0.03
	over 1.00 to 3.00, incl	0.04
	over 3.00 to 6.00, incl	0.05
	over 6.00 to 10.00, incl	0.06
	over 10.00 to 15.00, incl	0.10
	over 15.00 to 20.00, incl	0.15
Phosphorus	to 0.040, incl	0.005
	over 0.040 to 0.20, incl	0.010
Sulfur	to 0.040, incl	0.005
	over 0.040 to 0.20, incl	0.010
	over 0.20 to 0.50, incl	0.020
Silicon	to 1.00, incl	0.05
	over 1.00 to 3.00, incl	0.10
	over 3.00 to 7.00, incl	0.15
Chromium	over 4.00 to 10.00, incl	0.10
	over 10.00 to 15.00, incl	0.15
	over 15.00 to 20.00, incl	0.20
	over 20.00 to 30.00, incl	0.25
Nickel	to 1.00, incl	0.03
	over 1.00 to 5.00, incl	0.07
	over 5.00 to 10.00, incl	0.10
	over 10.00 to 20.00, incl	0.15
	over 20.00 to 30.00, incl	0.20
	over 30.00 to 40.00	0.25
	over 40.00	0.30
Molybdenum	over 0.20 to 0.60, incl	0.03
	over 0.60 to 2.00, incl	0.05
	over 2.00 to 8.00, incl	0.10
Titanium	to 1.00, incl	0.05
	over 1.00 to 3.00, incl	0.07
Cobalt	over 0.05 to 0.50, incl	0.01[B]
	over 0.50 to 2.00, incl	0.02
	over 2.00 to 5.00, incl	0.05
Niobium[C]	to 1.50, incl	0.05
Tantalum	to 0.10, incl	0.02
Copper	to 0.50, incl	0.03
	over 0.50 to 1.00, incl	0.05
	over 1.00 to 3.00, incl	0.10
	over 3.00 to 5.00, incl	0.15
	over 5.00 to 10.00, incl	0.20
Aluminum	to 0.15, incl	–0.005, +0.01
	over 0.15 to 0.50, incl	0.05
	over 0.50 to 2.00, incl	0.10
Nitrogen	to 0.02, incl	0.005
	over 0.02 to 0.19, incl	0.01
	over 0.19 to 0.25, incl	0.02
	over 0.25 to 0.35, incl	0.03
	over 0.35 to 0.45, incl	0.04
	over 0.45 to 0.55, incl	0.05
Tungsten	to 1.00, incl	0.03
	over 1.00 to 2.00, incl	0.05
	over 2.00 to 5.00, incl	0.07
	over 5.00 to 10.00, incl	0.10
	over 10.00 to 20.00, incl	0.15
Vanadium	to 0.50, incl	0.03
	over 0.50 to 1.50, incl	0.05
Selenium	all	0.03

[A] This table does not apply to heat analysis.
[B] Product analysis limits for cobalt under 0.05 % have not been established, and the manufacturer should be consulted for those limits.
[C] Columbium (Cb) and niobium (Nb) are considered interchangeable names for element 41 in the periodic table and both names are acceptable for use.

TABLE A1.2 Heat Treatment Requirements

Designation/Type	Temperature[A]	Cooling/Testing Requirements
Austenitic (Chromium-Nickel) (Chromium-Nickel-Manganese)		
All Cr-Ni steels except as listed below	1900 °F [1040 °C]	[B]
302, 308, 309, 309Cb, 310, 310Cb, S21640, S30215, S30452, S30615, S32615, S33228, S33425, S35140, S38100, S38815	1900 °F [1040 °C]	[C]
304H, 309H, 310H, 316H 309HCb, 310HCb, 321H, 347H, 348H	1900 °F [1040 °C]	[C]
Cold Worked	2000 °F [1095 °C]	[C]
Hot Finished	1925 °F [1050 °C]	[C]
N08020	1700 to 1850 °F [925 to 1010 °C]	[C]
N08367	2025 °F [1105 °C]	[C]
N08700, N08904, S35115	2000 °F [1095 °C]	[C]
N08810, S31277	2050 °F [1120 °C]	[C]
N08811, N08925, S31254, S31266, S32050, S32654	2100 °F [1150 °C]	[C]
N08926, S35315	2010 °F [1100 °C]	[C]
S20161	1900 to 2000 °F [1040 to 1095 °C]	[C]
S20431, S20432, S20433, S30530	1900 to 2010 °F [1040 to 1100 °C]	[C]
S30600, S30601	2010 to 2140 °F [1100 to 1170 °C]	[C]
S30616	1920 to 2100 °F [1050 to 1150 °C]	[C]
S31060	1975 to 2160 °F [1080 to 1180 °C]	[C]
S31727, S32053	1975 to 2155 °F [1080 to 1180 °C]	[C]
S33228	2050 to 2160 °F [1120 to 1180 °C]	[C]
S33426	1925 to 2100 °F [1050 to 1150 °C]	[C]
S33550	2065 to 2155 °F [1130 to 1180 °C]	[C]
S34565	2050 to 2140 °F [1120 to 1170 °C]	[C]
S34752	1940 to 2140 °F [1060 to 1170 °C]	[C]
Duplex (Austenitic-Ferritic)		
S31200, S31803, S32001, S32550	1900 °F [1040 °C]	[C]
S31260	1870 to 2010 °F [1020 to 1100 °C]	[C]
S32003, S82011	1850 °F [1010 °C]	[C]
S32101	1870 °F [1020 °C]	[C]
S32202	1800 to 1975 °F [980 to 1080 °C]	[C]
S32205	1900 °F [1040 °C]	[D]
S32304	1800 °F [980 °C]	[C]
S32506	1870 to 2050 °F [1020 to 1120 °C]	[C]
S32520	1975 to 2050 °F [1080 to 1120 °C]	[C]
S32750[E]	1880 to 2060 °F [1025 to 1125 °C]	[C]
S32760	2010 °F [1100 °C]	[C]
S32808, S39274	1925 to 2100 °F [1050 to 1150 °C]	[C]
S32900	1750 ± 25 °F [955 ± 15 °C]	[C]
S32906	1900 to 2100 °F [1040 to 1150 °C]	[C]
S32950	1850 ± 25 °F [1010 ± 15 °C]	[C]
S44537	1922 °F [1050 °C]	[C]
S81921	1760 to 2010 °F [960 to 1100 °C]	[C]
S82012, S82031, S82441	1830 °F [1000 °C]	[C]
S82013, S82121	1830 to 2010 °F [1000 to 1100 °C]	[C]
S82122	1725 °F [940 °C]	[C]

[A] Minimum, unless otherwise indicated.
[B] Quenched in water or rapidly cooled by other means at a rate sufficient to prevent reprecipitation of carbides, as demonstrable by the capability of passing the test for resistance to intergranular corrosion specified in 18.2.
[C] Quenched in water or rapidly cooled by other means.
[D] Quenched in water, except that coiled product heat treated in a continuous annealing line shall be water quenched or rapidly cooled by other means.
[E] Temperatures above 2060 °F are permissible if the resulting microstructure provides the properties required by this specification or any additional requirements of the purchase order.

A2. PERMITTED VARIATIONS IN DIMENSIONS—INCH-POUND UNITS

A2.1 Listed in Annex A2 are tables showing the permissible variations in dimensions expressed in inch-pound units of measurement. These requirements, including the SI units shown in brackets within Annex A2, shall apply to A480, but shall not apply to A480M. Requirements for A480M are given in Annex A3.

A2.1.1 The dimensional tolerances are grouped by production method (hot rolling or cold rolling, with or without coiling), product width (narrow (<24 in. [610 mm]) or wide (≥24 in. [610 mm])), and by product dimension addressed.

A2.2 *Cold-rolled Narrow (<24 in. [610 mm] Width) Coil-processed Product*—For thickness, width, length, and flatness tolerance tables, refer to Tables A2.1-A2.4.

A2.3 *Cold-rolled Wide (≥24 in. [610 mm] Width) Coil-processed Product*—For thickness, width, length, and flatness tolerance tables, refer to Tables A2.5-A2.8.

A2.4 *Hot-rolled Narrow (<24 in. [610 mm] Width) Coil-processed Product*—For thickness, width, length, and flatness tolerance tables, refer to Tables A2.9-A2.12.

A2.5 *Hot-rolled Wide (≥24 in. [610 mm] Width) Coil-processed Product*— For thickness, width, length, and flatness tolerance tables, refer to Tables A2.13-A2.16.

A2.6 *Hot-rolled Product Processed Without Coiling*—For thickness, width, length, and flatness tolerance tables, refer to Tables A2.17-A2.20.

A2.7 *Cold-rolled Product Processed Without Coiling*—For thickness, width, length, and flatness tolerance tables, refer to Table A2.21.

A2.8 *Tolerances for Other Dimensional Characteristics*—For other tolerance tables, refer to Tables A2.22-A2.30.

TABLE A2.1 Permitted Variations in Thickness for Cold-rolled, Narrow, Coil-processed Product as Coils and Cut Lengths

NOTE 1—Thickness measurements are taken at least ⅜ in. [9.52 mm] in from the edge of the product, except on widths less than 1 in. [25.4 mm] the measurements should be taken at least ⅛ in. [3.18 mm] from the product edge.

NOTE 2—The tolerances in this table include crown tolerances.

Specified Thickness, in. [mm]	Thickness Tolerances, for the Thickness and Widths Given, Over and Under, in. [mm]		
	Width (*w*), in. [mm]		
	3/16 to 6 [4.76 to 152], incl $w \le 6$ [152]	Over 6 to 12 [152 to 305], incl 6 [152] < $w \le 12$ [305]	Over 12 to 24 [305 to 610], excl 12 [305] < $w \le 24$ [610]
	Thickness Tolerances[A]		
0.002 to 0.005 [0.05 to 0.13], excl	10 %	10 %	10 %
0.005 to 0.010 [0.13 to 0.25] , incl.	0.0006 [0.015]	0.0008 [0.020]	0.001 [0.025]
Over 0.010 to 0.012 [0.25 to 0.30], incl	0.001 [0.025]	0.001 [0.025]	0.001 [0.025]
Over 0.012 to 0.015 [0.30 to [0.40], incl	0.001 [0.025]	0.0015 [0.04]	0.0015 [0.04]
Over 0.015 to 0.020 [0.40 to 0.50], incl	0.001 [0.025]	0.0015 [0.04]	0.0015 [0.04]
Over 0.020 to 0.029 [0.50 to 0.74], incl	0.0015 [0.04]	0.0015 [0.04]	0.002 [0.050]
Over 0.029 to 0.035 [0.74 to 0.89], incl	0.0015 [0.04]	0.002 [0.050]	0.002 [0.050]
Over 0.035 to 0.050 [0.89 to [1.27], incl	0.0025 [0.060]	0.003 [0.070]	0.003 [0.070]
Over 0.050 to 0.069 [1.27 to 1.75], incl	0.003 [0.070]	0.003 [0.070]	0.003 [0.070]
Over 0.069 to 0.100 [1.75 to 2.54], incl	0.003 [0.070]	0.003 [0.070]	0.004 [0.10]
Over 0.100 to 0.125 [2.54 to 2.98], incl	0.004 [0.10]	0.004 [0.10]	0.005 [0.12]
Over 0.125 to 0.161 [2.98 to 4.09], incl	0.005 [0.12]	0.005 [0.12]	0.005 [0.12]
Over 0.161 to under 3/16 [4.09 to under 4.76]	0.005 [0.12]	0.005 [0.12]	0.006 [0.15]

[A] Thickness tolerances given in inches [millimetres] unless otherwise indicated.

TABLE A2.2 Permitted Variations in Width for Cold-rolled, Narrow, Coil-processed Product as Coils and Cut Lengths for Edge No. 3[A]

Specified Thickness,[B] in. [mm]	Width Tolerance, Over and Under, for Thickness and Width Given, in. [mm]			
	$w \leq 1.60$ [40]	1.60 [40] < $w \leq 6$ [150]	6 [150] < $w \leq 12$ [305]	12 [300] < $w \leq 24$ [610]
0.010 [0.25]	0.003 [0.085]	0.004 [0.10]	0.005 [0.125]	0.020 [0.50]
0.020 [0.50]	0.005 [0.125]	0.005 [0.125]	0.010 [0.25]	0.020 [0.50]
0.040 [1.00]	0.005 [0.125]	0.005 [0.125]	0.010 [0.25]	0.020 [0.50]
0.060 [1.50]	0.005 [0.125]	0.006 [0.15]	0.010 [0.25]	0.020 [0.50]
0.100 [2.50]	. . .	0.010 [0.25]	0.016 [0.40]	0.020 [0.50]
0.120 [3.00]	. . .	0.010 [0.25]	0.016 [0.40]	0.024 [0.60]
0.160 [4.00]	. . .	0.016 [0.40]	0.016 [0.40]	0.024 [0.60]
0.200 [4.99]	. . .	0.030 [0.80]	0.030 [0.80]	0.030 [0.80]

[A] For tolerances applicable to narrow product with Edge No. 1 or No. 5, see Table A3.22.
[B] For specified thickness other than those shown, the tolerances for the next higher thickness shall apply.

TABLE A2.3 Permitted Variations in Length for Cold-rolled, Narrow, Coil-processed Product as Cut Lengths

Specified Length, ft [mm]	Tolerances, in. [mm]
≤6 [1830]	+⅛ [3], −0
>6 to ≤12 [1830 to 3660]	+0.2 [5], −0
>12 to ≤20 [3660 to 6096]	+0.3 [8], −0

TABLE A2.4 Permitted Variations in Flatness of Cold-rolled, Narrow, Coil-processed Product as Cut Lengths

Tolerances for variations of flatness cold-rolled products, narrow, coil-processed product as cut lengths shall be identical to the tolerances for cold-rolled, wide, coil-processed product as listed in Table A2.8 unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A2.5 Permitted Variations in Thickness of Cold-rolled, Wide, Coil-processed Product as Coil and Cut Lengths

Specified Thickness,[A,B] in. [mm]	Permitted Variation, Over and Under, in. [mm], for Specified Width (w), w, in.		
	$w \leq 40$ [1000]	40 [1000] < $w \leq$ 50 [1300]	50 [1300] < $w \leq$ 84 [2100]
0.012 [0.30]	0.001 [0.030]	. . .	. . .
0.016 [0.40]	0.0015 [0.04]	0.0015 [0.04]	. . .
0.020 [0.50]	0.0015 [0.04]	0.0015 [0.04]	. . .
0.024 [0.60]	0.002 [0.05]	0.002 [0.05]	. . .
0.032 [0.80]	0.002 [0.05]	0.002 [0.05]	. . .
0.040 [1.00]	0.0025 [0.06]	0.0025 [0.06]	0.003 [0.08]
0.047 [1.20]	0.003 [0.08]	0.003 [0.08]	0.003 [0.08]
0.059 [1.50]	0.003 [0.08]	0.003 [0.08]	0.004 [0.10]
0.079 [2.00]	0.004 [0.10]	0.004 [0.10]	0.0045 [0.11]
0.098 [2.50]	0.004 [0.10]	0.004 [0.10]	0.005 [0.13]
0.118 [3.00]	0.005 [0.13]	0.005 [0.13]	0.006 [0.15]
0.157 [4.00]	0.007 [0.17]	0.007 [0.17]	0.007 [0.17]
0.197 [5.00]	0.007 [0.17]	0.007 [0.17]	0.0075 [0.19]
0.236 [6.00]	0.007 [0.17]	0.008 [0.20]	0.009 [0.23]
0.3125 [8.00]	0.007 [0.17]	0.009 [0.23]	0.010 [0.25]

[A] Thickness measurements are taken at least ⅜ in. [9.52 mm] from the edge of the sheet.
[B] For specified thicknesses other than those shown, the tolerances for the next higher thickness shall apply.

TABLE A2.6 Permissible Variations in Width for Cold-rolled Wide, Coil-processed Product as Cut Lengths (Not Resquared) and Coil

Specified Thickness,[A] in. [mm]	Permitted Variation in Width (w), in. [mm], for Specified Width (w), in. [mm]				
	$w \leq 6$ [150]	6 [125] < $w \leq 12$ [300]	12 [300] < $w \leq 24$ [600]	24 [600] < $w < 48$ [1200]	48 [1000] $\geq w$
0.040 [1.00]	+0.02 [0.5], –0	+0.02 [0.5], –0	+0.03 [0.7], –0	+1/16 [1.6], –0	+1/8 [3.2], –0
0.059 [1.50]	+0.03 [0.7], –0	+0.03 [0.7], –0	+0.04 [1.0], –0	+1/16 [1.6], –0	+1/8 [3.2], –0
0.098 [2.50]	+0.04 [1.0], –0	+0.04 [1.0], –0	+0.05 [1.2], –0	+1/16 [1.6], –0	+1/8 [3.2], –0
0.138 [3.50]	+0.05 [1.2], –0	+0.05 [1.2], –0	+0.06 [1.5], –0	+1/16 [1.6], –0	+1/8 [3.2], –0
0.3125 [8.00]	+0.08 [2.0], –0	+0.08 [2.0], –0	+0.08 [2.0], –0	+0.16 [4.0], –0	+0.16 [4.0], –0

[A] For specified thicknesses and other than those shown, the tolerances for the next higher thickness shall apply.

TABLE A2.7 Permitted Variations in Length for Cold-rolled, Wide, Coil-processed Product as Cut Lengths Not Resquared

Specified Length (L), ft [mm]	Tolerances, in. [mm]	
	Over	Under
Up to 6 [1830], incl	3/16 [4.8]	0
Over 6 [1830]	0.03 × L [0.0025 × L]	0

TABLE A2.8 Permitted Variations in Flatness of Cold-rolled, Wide, Coil-processed Product as Cut Lengths

Not Specified to Stretcher-Leveled Standard of Flatness[A]		
Specified Thickness, in. [mm]	Width, in. [mm]	Flatness Tolerance,[B] in. [mm]
<0.062 [1.57]	≤60 [1524]	0.40 [10]
	>60 [1524]	0.50 [12]
≥0.062 [1.57]	≤60 [1524]	0.40 [10]
	>60 [1524]	0.50 [12]

Stretcher-Leveled Standard of Flatness[C]			
Specified Thickness, in. [mm]	Width, in. [mm]	Length, in. [mm]	Flatness Tolerance,[B] in. [mm]
<3/16 [4.76]	<48 [1219]	<96 [2438]	1/8 [3.2]
	<48 [1219]	≥96 [2438]	1/4 [6.4]
<3/16 [4.76]	≥48 [1219]	<96 [2438]	1/4 [6.4]
	≥48 [1219]	≥96 [2438]	1/4 [6.4]

2xx and 3xx Series Specified to 1/4 and 1/2 Hard Tempers			
Specified Thickness, in. [mm]	Width, in. [mm]	Flatness Tolerance[B] in. [mm]	
		1/4 Hard	1/2 Hard
<0.016 [0.41]	24 to <36 [610 to 914]	1/2 [12.70]	3/4 [19.05]
0.016 to 0.030 [0.41 to 0.76]		5/8 [15.88]	7/8 [22.22]
>0.030 [0.76]		3/4 [19.05]	7/8 [22.22]
≤0.016 [0.41]	36 to <48 [914 to 1219]	5/8 [15.88]	1 [25.40]
>0.016 to 0.030 [0.41 to 0.76]		3/4 [19.05]	1 1/8 [28.58]
>0.030 [0.76]		1 [25.40]	1 1/8 [28.58]

[A] Not specified to stretcher-leveled standard of flatness, and not including hard tempers of 2xx and 3xx Series, dead-soft sheets, and deep-drawing sheets.
[B] Maximum deviation from a horizontal flat surface.
[C] Not including hard tempers of 2xx and 3xx Series, dead-soft sheets, and deep-drawing sheets.

TABLE A2.9 Permitted Variations in Thickness of Hot-rolled, Narrow, Flat-rolled, Coil-processed Product as Cut Lengths and Coil

Tolerances for variations of thickness of hot-rolled, narrow, coil-processed product as cut lengths and coil shall be identical to the tolerances for hot-rolled, wide, coil-processed product as listed in Table A2.13, unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A2.10 Permitted Variations in Width of Hot-rolled, Narrow, Flat-rolled, Coil-processed Product as Cut Lengths and Coil

Tolerances for variations of width of hot-rolled, narrow, coil-processed product as cut lengths and coil shall be identical to the tolerances for hot-rolled, wide, coil-processed product as listed in Table A2.14 unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A2.11 Permitted Variations in Length of Hot-rolled, Narrow, Coil-processed Product as Cut Lengths

Tolerances for variations of length of hot-rolled, narrow, coil-processed product as cut lengths shall be identical to the tolerances for hot-rolled, wide, coil-processed product as listed in Table A2.15 unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A2.12 Permitted Variations in Flatness of Hot-rolled, Narrow, Coil-processed Product as Cut Lengths

Tolerances for variations of flatness of hot-rolled, narrow, coil-processed product as cut lengths shall be identical to the tolerances for hot-rolled, wide, coil-processed product as listed in Table A2.16 unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A2.13 Permitted Variations in Thickness of Hot-rolled, Wide, Coil-processed Product as Coil and Cut Lengths

Specified Thickness,[A] in. [mm]	Permitted Variations, in. [mm], Over and Under, Except as Indicated Otherwise, for Specified Width (w) in. [mm]	
	$w \leq 60$ [1525]	$w > 60$ [1525]
0.072 [1.83]	0.006 [0.15]	0.009 [0.22]
>0.072 to 0.083 [1.83 to 2.11]	0.007 [0.18]	0.010 [0.25]
>0.083 to 0.098 [2.11 to 2.49]	0.008 [0.20]	0.011 [0.27]
>0.098 to 0.114 [2.49 to 2.90]	0.009 [0.23]	0.012 [0.30]
>0.114 to 0.130 [2.90 to 3.30]	0.011 [0.27]	0.013 [0.33]
>0.130 to 0.145 [3.30 to 3.68]	0.012 [0.30]	0.013 [0.33]
>0.145 to 0.1875 [3.68 to 4.76]	0.013 [0.33]	0.014 [0.35]
>0.1875 to 0.250 [4.76 to 6.35]	–0.010 [0.25], +0.020 [0.50]	–0.010 [0.25], +0.020 [0.50]
>0.250 to 0.3125 [6.35 to 7.94]	–0.010 [0.25], +0.022 [0.55]	–0.010 [0.25], +0.022 [0.55]
>0.3125 [7.94]	–0.010 [0.25], +0.030 [0.75]	–0.010 [0.25], +0.030 [0.75]

[A] Thickness measurements are taken at least ⅜ in. [9.52 mm] from the edge of the sheet.

TABLE A2.14 Permitted Variations in Width of Hot-rolled, Wide, Coil-processed Product as Cut Lengths (Not Resquared) and Coil

Specified Thickness, t, in. [mm]	Width (w), in. [mm]	Tolerances on Width, in. [mm], for Trimmed Edges
$t <$ 3/16 [4.76]	$w <$ 48 [1219]	+1/16 [1.59], –0
	$w \geq$ 48 [1219]	+¼ [6.35], –0
3/16 [4.76] $\leq t <$ ⅜ [9.5]	$w <$ 48 [1219]	+5/32 [3.97], –0
	$w \geq$ 48 [1219]	+⅜ [9.5], –0
$t \geq$ ⅜ [9.5]	$w <$ 48 [1219]	+¼ [6.35], –0
	$w \geq$ 48 [1219]	+7/16 [11.1], –0

TABLE A2.15 Permitted Variations in Length of Hot-rolled, Wide, Coil-processed Product as Cut Lengths Not Resquared

Specified Thickness, t, in. [mm]	Length (L), ft [mm]	Tolerances, in. [mm], Over and Under
t < 3/16 [4.76]	$L \leq$ 10 [3048]	+¼ [6.35], –0
	10 [3048] < $L \leq$ 20 [6096]	½ [12.7] , –0
t ≥ 3/16 [4.76]	$L \leq$ 10 [3048]	+½ [12.7], –0
	10 [3048] < $L \leq$ 20 [6096]	+⅝ [15.9], –0

TABLE A2.16 Permitted Variations in Flatness of Hot-rolled, Wide, Coil-processed Product as Cut Lengths

Not Specified to Stretcher-Leveled Standard of Flatness		
Specified Thickness (t), in. [mm]	Width (w), in. [mm]	Flatness Tolerance,[A] in. [mm]
t < 3⁄16 [4.76]	$w \leq$ 36 [914]	0.50 [12.7]
	36 [914] < $w \leq$ 60 [1524]	
	w > 60 [1524]	
$t \geq$ 3⁄16 [4.76]	$w \leq$ 60 [1524]	0.90 [23]
	60 [1524] < $w \leq$ 72 [1829]	1.20 [30]
	w > 72 [1829]	1.50 [38]

Stretcher-Leveled Standard of Flatness			
Specified Thickness (t), in. [mm]	Specified Width (w), in. [mm]	Specified Length (L), in. [mm]	Flatness Tolerance,[A] in. [mm]
t < 3⁄16 [4.76]	$w \leq$ 48 [1219]	$L \leq$ 96 [2438]	1⁄8 [3.18]
	$w \leq$ 48 [1219]	L > 96 [2438]	1⁄4 [6.35]
t < 3⁄16 [4.76]	w > 48 [1219]	$L \leq$ 96 [2438]	1⁄4 [6.35]
	w > 48 [1219]	L > 96 [2438]	1⁄4 [6.35]

[A] Maximum deviation from a horizontal flat surface.

TABLE A2.17 Permitted Variations in Thickness of Hot-rolled Mill Plate (Quarto Plate)[A,B]

Specified Thickness (t), in. [mm]	Width (w), in. [mm]			
	$w \leq$ 84 [2134]	84 [2134] < $w \leq$ 120 [3048]	120 [3048] < $w \leq$ 144 [3658]	w > 144 [3658]
	Tolerance Over Specified Thickness,[C,D] in. [mm]			
t < 3⁄16 [4.76]	0.055 [1.35]	0.070 [1.78]	. . .	. . .
3⁄16 [4.76] ≤ t < 3⁄8 [9.52]	0.045 [1.14]	0.050 [1.27]	0.085 [2.16]	. . .
3⁄8 [9.52] ≤ t < 3⁄4 [19.05]	0.055 [1.40]	0.060 [1.52]	0.085 [2.16]	0.090 [2.29]
3⁄4 [19.05] ≤ t < 1 [25.40]	0.060 [1.52]	0.065 [1.65]	0.085 [2.16]	0.100 [2.54]
1 [25.40] ≤ t < 2 [50.80]	0.070 [1.78]	0.075 [1.90]	0.095 [2.41]	0.115 [2.92]
2 [50.80] ≤ t < 3 [76.20]	0.125 [3.20]	0.150 [3.80]	0.175 [4.45]	0.200 [5.08]
3 [76.20] ≤ t < 4 [101.6]	0.150 [3.81]	0.160 [4.06]	0.200 [5.08]	0.225 [5.72]
4 [101.6] ≤ t < 6 [152.4]	0.180 [4.57]	0.200 [5.08]	0.335 [8.50]	0.355 [9.02]
6 [152.4] ≤ t < 8 [203.2]	0.235 [6.00]	0.255 [6.48]	0.355 [9.02]	0.435 [11.0]
8 [203.2] ≤ t < 10 [254.0]	0.315 [8.00]	0.335 [8.50]	0.435 [11.0]	0.550 [14.0]

[A] Thickness is measured along the original longitudinal edges of the as-produced plate at least 3⁄8 in. [9.52 mm], but not more than 3 in. [76.20 mm], from the edge.
[B] For plates up to 10 in. [254.0 mm], excl, in thickness, the tolerance under the specified thickness is 0.010 in. [0.25 mm].
[C] For circles, the over thickness tolerances in this table apply to the diameter of the circle corresponding to the width ranges shown. For plates of irregular shape, the over thickness tolerances apply to the greatest width corresponding to the width ranges shown.
[D] The tolerance over specified thickness in the area more than 3 in. in from the longitudinal edges of the plate at the mill produced width shall not exceed twice the tabular tolerance.

TABLE A2.18 Permitted Variations in Width for Hot-rolled Rectangular Sheared Plate Mill Plates (Quarto Plates)

Specified Width (w), in. [mm]	Tolerances, Over Specified Width, in. [mm][A]
$w \leq$ 84 [2135]	5⁄8 [15.9]
84 [2135] < $w \leq$ 108 [2745]	3⁄4 [19.1]
w > 108 [2745]	1 [25.4]

[A] The tolerance under specified width is 1⁄4 in. [6.35 mm].

TABLE A2.19 Permitted Variations in Length for Hot-rolled Sheared Rectangular Plate Mill Plates (Quarto Plates)

Nominal Length (L), in. [mm]	Tolerances, Over and Under, in. [mm][A]
L < 160 [4064]	3⁄4 [19.1]
160 [4064] ≤ L < 240 [6096]	1 1⁄4 [31.8]
240 [6000] ≤ L < 315 [8000]	1 5⁄8 [41.3]
315 [8000] ≤ L < 394 [10 008]	2 [50.8]
394 [10 008] ≤ L < 590 [15 000]	2 1⁄4 [57.2]
590 [15 000] ≤ L < 790 [20 066]	2 1⁄4 [57.2]

[A] The tolerance under specified length is 1⁄4 in. [6.35 mm].

TABLE A2.20 Permitted Variations in Flatness of Plate Mill Plate (Quarto Plate)

NOTE 1—Tolerances in this table apply to any length, not necessarily the rolling direction, up to 36 in. [914 mm] and to any 36 in. [914 mm] of longer lengths in the plane of the plate measured while the plate rests on a flat surface with the concavity of the curvature upward.

NOTE 2—If the longer dimension is under 36 in. [914 mm], the tolerance is not greater than ¼ in. [6.4 mm].

NOTE 3—For plates with specified minimum yield strengths of 35 ksi [240 MPa] or more, the permitted variations are increased to 1½ times the amounts shown.

Specified Thickness (t), in. [mm]	Flatness Tolerance for Thicknesses Given, in. [mm]
t < ¼ [6.35]	7/16 [11]
¼ [6.35] ≤ t < ⅜ [9.52]	⅜ [9.5]
⅜ [9.52] ≤ t < ½ [12.70]	5/16 [7.9]
½ [12.70] ≤ t < ¾ [19.05]	5/16 [7.9]
¾ [19.05] ≤ t < 1 [25.40]	5/16 [7.9]
1 [25.40] ≤ t < 1½ [38.10]	¼ [6.4]
1½ [38.10] ≤ t < 4 [101.60]	¼ [6.4]
t ≥ 4 [101.60]	¼ [6.4]

TABLE A2.21 Cold-rolled Products, Processed Without Coiling

Tolerances for cold-rolled products processed without coiling shall be identical to the tolerances for hot-rolled products processed without coiling as listed in Table A2.17, Table A2.18, Table A2.19, and Table A2.20 unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A2.22 Permitted Variations in Width for Cold-rolled Narrow, Coil-processed Product in Coils and Cut Lengths for Edge No. 1 or 5

Specified Edge No.	Width, in. [mm]	Thickness, in. [mm]	Width Tolerance for Thickness and Width Given in. [mm]	
			Over	Under
1 and 5	9/32 [7.14] and under	1/16 [1.59] and under	0.005 [0.13]	0.005 [0.13]
1 and 5	over 9/32 to ¾ [7.14 to 19.05], incl	3/32 [2.38] and under	0.005 [0.13]	0.005 [0.13]
1 and 5	over ¾ to 5 [19.05 to 127.00], incl	⅛ [3.18] and under	0.005 [0.13]	0.005 [0.13]
5	over 5 to 9 [127.00 to 228.60], incl	0.008 to ⅛ [0.20 to 3.18], incl	0.010 [0.25]	0.010 [0.25]
5	over 9 to 20 [228.60 to 508.00], incl	0.015 to 0.105 [0.38 to 2.67]	0.010 [0.25]	0.010 [0.25]
5	over 20 to 24 [508.00 to 610], excl	0.023 to 0.080 [0.58 to 2.03]	0.015 [0.38]	0.015 [0.38]

TABLE A2.23 Permitted Variations in Width and Length for Hot-rolled and Cold-rolled Resquared Coil-processed Product (Stretcher Leveled Standard of Flatness)

Specified Dimensions, in. [mm]	Tolerances		
	Over		Under
	in.	mm	
For thicknesses under 0.131 [3.33]:			
Widths up to 48 [1219], excl	1/16	1.59	0
Widths 48 [1219] and over	⅛	3.18	0
Lengths up to 120 [3048], excl	1/16	1.59	0
Lengths 120 [3048] and over	⅛	3.18	0
For thicknesses 0.131 [3.33] up to 3/16, excl:			
All widths and lengths	¼	6.35	0

TABLE A2.24 Permitted Variations in Width and Length for Hot-rolled Product by Abrasive Cutting

Specified Thickness, in. [mm]	Tolerance over Specified Width and Length[A]	
	Width	Length
Up to 1 [25.40], incl	⅛ [3.18]	⅛ [3.18]
1 to 2 [25.40 to 50.80], incl	3/16 [4.76]	3/16 [4.76]
2 to 3 [50.80 to 76.20], incl	¼ [6.35]	¼ [6.35]
3 to 4 [76.20 to 101.6], incl[B]	5/16 [7.94]	5/16 [7.94]

[A] The tolerances under specified width and length are ⅛ in. [3.18 mm].
[B] Width and length tolerances for abrasive cut plates over 4 in. [101.6 mm] thick are not included in the table; consult producer.

TABLE A2.25 Permitted Variations in Diameter for Hot-rolled and Cold-rolled Coil-processed Product as Sheared Circles

Specified Thickness, in. [mm]	Tolerance Over Specified Diameter (No Tolerance Under), in. [mm]		
	Diameters Under 30 in. [762 mm]	Diameters 30 to 48 in. [762 to 1219 mm]	Diameters Over 48 in. [1219 mm]
Up to 0.0567 [1.45], include	1/16 [1.59]	1/8 [3.18]	3/16 [4.76]
0.0568 to 0.0971 [1.45 to 2.46], incl	3/32 [2.38]	5/32 [3.97]	7/32 [5.56]
0.0972 up to 3/16 [2.46 up to 4.76], excl	1/8 [3.18]	3/16 [4.76]	1/4 [6.35]

TABLE A2.26 Permitted Variations in Diameter for Hot-rolled and Cold-rolled Coil-processed Product as Sheared Circles

Specified Thickness, in. [mm]	Tolerance Over Specified Diameter (No Tolerance Under), in. [mm]		
	Diameter and Thickness,[A] in. [mm]		
	To 3/8 in. [9.52 mm], excl, in Thickness	3/8 to 5/8 in. [9.52 to 15.88 mm], excl, in Thickness	5/8 in. [15.88 mm] and Over in Thickness[B]
To 60 [1524], excl	1/4 [6.35]	3/8 [9.52]	1/2 [12.70]
60 to 84 [1524 to 2134], excl	5/16 [7.94]	7/16 [11.11]	9/16 [14.29]
84 to 108 [2134 to 2743], excl	3/8 [9.52]	1/2 [12.70]	5/8 [15.88]
108 to 180 [2743 to 4572], excl	7/16 [11.11]	9/16 [14.29]	11/16 [17.46]

[A] No tolerance under.
[B] Circular and sketch plates over 5/8 in. [15.88 mm] in thickness are not commonly sheared but are machined or flame cut.

TABLE A2.27 Torch Cutting Tolerances[A] and Recommended Cleanup Allowance for Rectangular Plates, Circles, Rings, and Sketches

Specified Thickness, in.	Tolerance, in.		Cleanup Allowance[B] per Edge, in.
	Outside Dimension	Inside Dimension	
2 and under	+3/8 , –0	–3/8 , +0	±1/4
Over 2 to 3, incl	+1/2 , –0	–1/2 , +0	±3/8
Over 3 to 6, incl	+3/4 , –0	–3/4 , +0	±1/2

[A] Tolerances to apply unless otherwise agreed. Note that for some applications user may wish to specify minus rather than plus tolerance or vice versa.
[B] Recommended cleanup allowance which, unless otherwise specified, will be applied by supplier to purchasers ordered size.

TABLE A2.28 Permitted Variations in Weight for Hot-rolled or Cold-rolled Coil Processed Product With Thickness Less Than 3/16 in. [4.76 mm]

Any item of five sheets or less, or any item estimated to weigh 200 lb [90.72 kg] or less, may actually weigh as much as 10 % over the theoretical weight	weigh 200 lb [90.72 kg] or less
Any item of more than five sheets and estimated to weigh more than 200 lb [90.72 kg], may actually weigh as much as 7½ % over the theoretical weight	weigh more than 200 lb [90.72 kg]
Chromium-manganese-nickel	40.7 lb/ft^2·in. thickness [7.82 kg/m^2·mm thick]
Chromium-nickel	42.0 lb/ft^2·in. thickness [8.07 kg/m^2·mm thick]
Chromium	41.2 lb/ft^2·in. thickness [7.92 kg/m^2·mm thick]

TABLE A2.29 Permitted Variations in Camber for Cold-rolled Coil Processed Product in Coils and Cut Lengths[A]

Specified Width, in. [mm]	Tolerance per Unit Length of Any 8 ft [2438 mm], in. [mm]
To 1½ [38.10], incl	½ [12.70]
Over 1½ to 24 [38.10 to 609.60], excl	¼ [6.35]

[A] Camber is the deviation of a side edge from a straight line and measurement is taken by placing an 8-ft [2438 mm] straightedge on the concave side and measuring the greatest distance between the strip edge and the straightedge.

TABLE A2.30 Permitted Variations in Camber for Sheared Mill and Universal Mill Plates[A]

maximum camber	=	⅛ inches in any 5 ft
	=	3.18 mm in any 1.524 m

[A] Camber is the deviation of a side edge from a straight line, and measurement is taken by placing a 5-ft straightedge on the concave side and measuring the greatest distance between the plate and the straightedge.

A3. PERMITTED VARIATIONS IN DIMENSIONS—SI UNITS

A3.1 Listed in Annex A3 are tables showing the permitted variations in dimensions expressed in SI units of measurement. These requirements shall apply to A480M but shall not apply to A480. Requirements for A480 are given in Annex A2.

A3.1.1 The dimensional tolerances are grouped by production method (hot rolling or cold rolling, with or without coiling), product width (narrow (<600 mm) or wide (≥600 mm)), and by product dimension addressed.

A3.2 *Cold-rolled Narrow (<600 mm Width) Coil-processed Product*—For thickness, width, length, and flatness tolerance tables, refer to Tables A3.1-A3.4.

A3.3 *Cold-rolled Wide (≥600 mm Width) Coil-processed Product*—For thickness, width, length, and flatness tolerance tables, refer to Tables A3.5-A3.8.

A3.4 *Hot-rolled Narrow (<600 mm Width) Coil-processed Product*—For thickness, width, length, and flatness tolerance tables, refer to Tables A3.9-A3.12.

A3.5 *Hot-rolled Wide (≥600 mm Width) Coil-processed Product*—For thickness, width, length, and flatness tolerance tables, refer to Tables A3.13-A3.16.

A3.6 *Hot-rolled Product Processed Without Coiling*—For thickness, width, length, and flatness tolerance tables, refer to Tables A3.17-A3.20.

A3.7 *Cold-rolled Product Processed Without Coiling*—For thickness, width, length, and flatness tolerance tables, refer to Table A3.21.

A3.8 *Tolerances for Other Dimensional Characteristics*—For other tolerance tables, refer to Tables A3.22-A3.30.

TABLE A3.1 Permitted Variations in Thickness of Cold-rolled, Narrow, Coil-processed Product as Coil and Cut Lengths

NOTE 1—Thickness measurements are taken at least 10 mm in from the edge of the product, except that on widths less than 26 mm, the tolerances are applicable for measurements at all locations.

NOTE 2—The tolerances in this table include crown tolerances.

NOTE 3—For specified thicknesses other than those shown, the tolerances for the next higher thickness shall apply.

Specified Thickness, mm	Thickness Tolerances, for the Thickness and Widths Given, Over and Under, mm		
	Width (w), mm		
	50 to 150, incl $w \leq 125$	Over 150 to 300, incl $125 < w \leq 250$	Over 300 to 600, excl $250 < w < 600$
	Thickness Tolerances[A]		
0.15	0.010	0.015	0.020
0.25	0.015	0.020	0.025
0.50	0.025	0.030	0.035
0.75	0.030	0.040	0.050
1.00	0.030	0.040	0.050
1.25	0.035	0.045	0.050
1.50	0.040	0.050	0.060
1.75	0.050	0.060	0.070
2.00	0.050	0.060	0.070
2.50	0.050	0.070	0.080
3.00	0.060	0.070	0.090
4.00	0.070	0.070	0.090
4.99	0.070	0.070	0.090

[A] Thickness tolerances given in mm unless otherwise indicated.

TABLE A3.2 Permitted Variations in Width of Cold-rolled, Narrow, Coil-processed Product in Coils and Cut Lengths for Edge No. 3[A]

Specified Thickness, [B] mm	Width Tolerance, Over and Under, for Thickness and Width Given, mm			
	$w \leq 40$	$40 < w \leq 125$	$125 < w \leq 250$	$250 < w \leq 600$
0.25	0.085	0.10	0.125	0.50
0.50	0.10	0.125	0.15	0.50
1.00	0.125	0.125	0.20	0.50
1.50	0.125	0.15	0.25	0.50
2.50	. . .	0.20	0.30	0.50
3.00	. . .	0.25	0.30	0.60
4.00	. . .	0.25	0.40	0.60
4.99	. . .	0.40	0.50	0.60

[A] For tolerances applicable to narrow product with Edge No. 1 or No. 5, see Table A3.22.
[B] For specified thickness other than those shown, the tolerances for the next higher thickness shall apply.

TABLE A3.3 Permitted Variations in Length of Cold-rolled, Narrow, Coil-processed Products as Cut Lengths

Specified Length, mm	Tolerances, mm
≤1500	+3, −0
>1500, ≤4000	+5, −0
>4000, ≤6000	+8, −0

TABLE A3.4 Permitted Variations in Flatness of Cold-rolled, Narrow, Coil-processed Product as Cut Lengths

Tolerances for variations of flatness cold-rolled products, narrow, coil-processed product as cut lengths shall be identical to the tolerances for cold-rolled, wide, coil-processed product as listed in Table A3.8, unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A3.5 Permitted Variations in Thickness of Cold-rolled, Wide, Coil-processed Product as Coil and Cut Lengths

NOTE 1—Thickness measurements are taken at least 15 mm from the edge of the product in the case of slit edges and at least 25 mm from the edge of the product in the case of mill edges.

NOTE 2—Cold-rolled sheets in cut lengths and coils are produced in some type numbers and some widths and thickness to tolerances less than those shown in the table.

NOTE 3—For specified thicknesses other than those shown, the tolerances for the next higher thickness shall apply.

Specified Thickness, mm	Permitted Variation, Over and Under, mm, for Specified Width (w), w in mm		
	$w \leq 1000$	$1000 < w \leq 1300$	$1300 < w \leq 2100$
0.30	0.03	. . .	. . .
0.40	0.04	0.04	. . .
0.50	0.045	0.05	. . .
0.60	0.05	0.05	. . .
0.80	0.05	0.05	. . .
1.00	0.055	0.06	0.07
1.20	0.08	0.08	0.08
1.50	0.08	0.08	0.10
2.00	0.10	0.10	0.11
2.50	0.10	0.11	0.13
3.00	0.13	0.13	0.15
4.00	0.17	0.17	0.17
5.00	0.17	0.17	0.19
6.00	0.17	0.20	0.23
8.00	0.17	0.22	0.25

TABLE A3.6 Permitted Variations in Width of Cold-rolled, Wide, Coil-processed Product as Cut Lengths (Not Resquared) and Coil

Specified Thickness, mm[A]	Permitted Variation in Width, mm, for Specified Width (w), mm				
	$w \leq 125$	$125 < w \leq 250$	$250 < w \leq 600$	$600 < w \leq 1000$	$1000 < w \leq 2100$
1.00	+0.5, –0	+0.5, –0	+0.7, –0	+1.5, –0	+2.0, +0
1.50	+0.7, –0	+0.7, –0	+1.0, –0	+1.5, –0	+2.0, +0
2.50	+1.0, –0	+1.0, –0	+1.2, –0	+2.0, –0	+2.5, –0
3.50	+1.2, –0	+1.2, –0	+1.5, –0	+3.0, –0	+3.0, –0
8.00	+2.0, –0	+2.0, –0	+2.0, –0	+4.0, –0	+4.0, –0

[A] For specified thicknesses other than those shown, the tolerances for the next higher thickness shall apply.

TABLE A3.7 Permitted Variations in Length of Cold-rolled, Wide, Coil-processed Product as Cut Lengths Not Resquared

Specified Length (L), mm	Tolerance, mm	
	Over	Under
≤2000	5	0
>2000	0.0025 × L	0

TABLE A3.8 Permitted Variations in Flatness of Cold-rolled, Wide, Coil-processed Product as Cut Lengths

Not Specified to Stretcher-Leveled Standard of Flatness[A]		
Specified Thickness, mm	Specified Width, mm	Flatness Tolerance[B], mm
<1.50	<1500	10
	≥1500	12
≥1.50	<1500	10
	≥1500	12

Stretcher-Leveled Standard of Flatness[C]			
Specified Thickness, mm	Specified Width, mm	Specified Length, mm	Flatness Tolerance,[B] mm
≤4.99	<1200	<2400	4
		≥2400	7
	≥1200	<2400	7
		≥2400	7

2xx and 3xx Series Specified to ¼ and ½ Hard Tempers			
Specified Thickness, mm	Specified Width, mm	Flatness Tolerance,[B] mm	
		¼ Hard	½ Hard
≤0.04	600 to 900, excl	19	23
>0.04 to ≤0.80		16	23
>0.80		13	19
≤0.04	900 to 1200, incl	26	29
>0.04 to ≤0.80		19	29
>0.80		16	26

[A] Not specified to stretcher-leveled standard of flatness, and not including hard tempers of 2xx and 3xx series, dead-soft sheets, and deep-drawing sheets.
[B] Maximum deviation from a horizontal flat surface.
[C] Not including hard tempers of 2xx and 3xx series, dead-soft sheets, and deep-drawing sheets.

TABLE A3.9 Permitted Variations in Thickness of Hot-rolled, Narrow, Flat-rolled, Coil-processed Product as Cut Lengths and Coil

Tolerances for variations of thickness of hot-rolled, narrow, coil-processed product as cut lengths and coil shall be identical to the tolerances for hot-rolled, wide, coil-processed product as listed in Table A3.13, unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A3.10 Permitted Variations in Width of Hot-rolled, Narrow, Flat-rolled, Coil-processed Product as Cut Lengths and Coil

Tolerances for variations of width of hot-rolled, narrow, coil-processed product as cut lengths and coil shall be identical to the tolerances for hot-rolled, wide, coil-processed product as listed in Table A3.14, unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A3.11 Permitted Variations in Length of Hot-rolled, Narrow, Coil-processed Product as Cut Lengths

Tolerances for variations of length of hot-rolled, narrow, coil-processed product as cut lengths shall be identical to the tolerances for hot-rolled, wide, coil-processed product as listed in Table A3.15, unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A3.12 Permitted Variations in Flatness of Hot-rolled, Narrow, Flat-rolled, Coil-processed Product as Cut Lengths

Tolerances for variations of flatness of hot-rolled, narrow, coil-processed product as cut lengths shall be identical to the tolerances for hot-rolled, wide, coil-processed product as listed in Table A3.16, unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A3.13 Permitted Variations in Thickness of Hot-rolled, Wide, Coil-processed Product as Coil and Cut Lengths

NOTE 1—Thickness measurements are taken at least 10 mm from the edge of the product.

NOTE 2—For specified thicknesses other than those shown, the tolerances for the next higher thickness shall apply.

Specified Thickness, mm	Permitted Variations of Thickness, mm, Over and Under, Except as Indicated Otherwise, for Specified Width (w)	
	$w \le 1500$	$w > 1500$
2.0	0.18	0.25
2.25	0.20	0.27
2.5	0.23	0.30
3.0	0.25	0.33
3.5	0.30	0.33
5.0	–0.25, +0.47	–0.25, +0.51
6.0	–0.25, +0.51	–0.25, +0.51
8.0	–0.25, +0.75	–0.25, +0.75
>8.0	–0.25, +0.75	–0.25, +0.75

TABLE A3.14 Permitted Variations in Width of Hot-rolled, Wide, Coil-processed Product as Cut Lengths (Not Resquared) and Coil

Specified Dimension, mm		Tolerance on Width, mm, for Trimmed Edges	
Thickness (t), mm	Width (w), mm	Over	Under
<5.00	$w < 1200$	2	0
	$w \ge 1200$	6	0
$5.00 < t \le 10.00$	$w < 1200$	4	0
	$w \ge 1200$	9	0
>10.00	$w < 1200$	6	0
	$w \ge 1200$	12	0

TABLE A3.15 Permitted Variations in Length of Hot-rolled, Wide, Coil-processed Product as Cut Lengths Not Resquared

Specified Length (L), mm	Tolerance, mm	
	Over	Under
$L < 3000$	$(0.005 \times L)$	0
$3000 \le L \le 6000$		0

TABLE A3.16 Permitted Variations in Flatness of Hot-rolled, Wide, Coil-processed Product as Cut Lengths

Not Specified to Stretcher-Leveled Standard of Flatness		
Specified Thickness (t), mm	Specified Width (w), mm	Flatness Tolerance,[A] mm
$t < 5$	$w < 900$	13
	$900 \le w < 1500$	19
	$w \ge 1500$	26
$t \ge 5$	$w < 1500$	23
	$1500 \le w < 1800$	30
	$w \ge 1800$	38

Stretcher-Leveled Standard of Flatness			
Specified Thickness (t), mm	Specified Width (w), mm	Specified Length (L), mm	Flatness Tolerance,[A] mm
$t \le 13$	$w < 1200$	$L < 2400$	4
		$L \ge 2400$	7
	$w \ge 1200$	$L < 2400$	7
		$L \ge 2400$	7

[A] Maximum deviation from a horizontal flat surface.

TABLE A3.17 Permitted Variations in Thickness of Hot-rolled Plate Mill Plate (Quarto Plate)[A,B]

NOTE 1—For specified thicknesses other than those shown, the tolerances for the next higher thickness shall apply.

Specified Thickness, mm	Width (w), mm			
	$w < 2100$	$2100 \le w < 3000$	$3000 \le w < 3600$	$w \ge 3600$
	Tolerance Over Specified Thickness,[C] mm			
5	1.35	1.75	. . .	. . .
8	1.15	1.30	2.15	. . .
10	1.15	1.30	2.15	. . .
20	1.40	1.55	2.15	2.30
25	1.55	1.65	2.15	2.55
50	1.80	1.90	2.40	2.95
75	3.20	3.80	4.45	5.10
100	3.75	4.00	5.00	5.70
150	4.50	5.00	8.50	9.00
200	6.00	6.50	9.00	11.0
250	8.00	8.50	11.0	14.0

[A] Thickness is measured along the original longitudinal edges of the as-produced plate at least 10 mm but not more than 75 mm from the edge.
[B] For circles, the over thickness tolerances in this table apply to the diameter of the circle corresponding to the width ranges shown. For plates of irregular shape, the over thickness tolerances apply to the greatest width corresponding to the width ranges shown. For plates up to 250 mm, incl, in thickness, the tolerance under the specified thickness is 0.30 mm.
[C] The tolerance over specified thickness in the area more than 75 mm in from the longitudinal edges of the plate at the mill produced width shall not exceed twice the tabular tolerance.

TABLE A3.18 Permitted Variations in Width for Hot-rolled Rectangular Sheared Plate Mill Plates (Quarto Plates)

Specified Width (w), mm	Tolerances, Over and Under, mm
$w < 2000$	+15, –0
$2000 \le w < 3000$	+20, –0
$w \ge 3000$	+25, –0

TABLE A3.19 Permitted Variations in Length for Hot-rolled Sheared Rectangular Plate Mill Plates (Quarto Plates)

Nominal Length (L), mm	Tolerances, Over and Under, mm
$L < 4000$	+20, –0
$4000 \le L < 6000$	+30, –0
$6000 \le L < 8000$	+40, –0
$8000 \le L < 10\,000$	+50, –0
$10\,000 \le L < 15\,000$	+75, –0
$15\,000 \le L < 20\,000$	+100, –0

TABLE A3.20 Permitted Variations in Flatness of Plate Mill Plate (Quarto Plate)

NOTE 1—Tolerances in this table apply to any length, not necessarily the rolling direction, up to 36 in. [914 mm] and to any 36 in. [914 mm] of longer lengths in the plane of the plate measured while the plate rests on a flat surface with the concavity of the curvature upward.

NOTE 2—If the longer dimension is under 36 in. [914 mm], the tolerance is not greater than ¼ in. [6.4 mm].

NOTE 3—For plates with specified minimum yield strengths of 35 ksi [240 MPa] or more, the permitted variations are increased to 1½ times the amounts shown.

NOTE 4—For specified thicknesses other than those shown, the tolerances for the next higher thickness shall apply.

Specified Thickness (t), in. [mm]	Flatness Tolerance for Thicknesses Given, in. [mm]
5	0.40 [10]
10	⅜ [9.5]
15	5⁄16 [7.9]
20	5⁄16 [7.9]
25	5⁄16 [7.9]
50	¼ [6.4]
150	¼ [6.4]
>150	¼ [6.4]

TABLE A3.21 Cold-rolled Products, Processed Without Coiling

Tolerances for cold-rolled products processed without coiling shall be identical to the tolerances for hot-rolled products processed without coiling as listed in Table A3.17, unless otherwise agreed upon by seller and purchaser and specified in the purchase order.

TABLE A3.22 Permitted Variations in Width for Cold-rolled Narrow, Coil-processed Product in Coils and Cut Lengths for Edge No. 1 or 5

Specified Edge No.	Width, mm	Thickness, mm	Width Tolerance for Thickness and Width Given, mm	
			Over	Under
1 and 5	under 10	1.50 and under	0.13	0.13
1 and 5	10 to 20, excl	2.50 and under	0.13	0.13
1 and 5	20 to 100, excl	3.00 and under	0.13	0.13
5	100 to 300, excl	0.20 to 3.00, incl	0.25	0.25
5	300 to 600, excl	0.40 to 2.60, incl	0.25	0.25
5	600 and over	0.60 to 2.00, incl	0.40	0.40

TABLE A3.23 Permitted Variations in Width and Length for Hot-rolled and Cold-rolled Resquared Coil-processed Product (Stretcher Leveled Standard of Flatness)

NOTE 1—Polished sheets with Finishes No. 4 and higher are produced to tolerances given in this table.

Specified Dimensions, mm			Width and Length Tolerance, mm	
Thickness	Width	Length	Over	Under
Under 3.30	Up to 1200	Up to 3000	2	0
	1200 and over	3000 and over	3	0
3.30 and over	All	All	7	0

TABLE A3.24 Permitted Variations in Abrasive Cutting Width and Length for Plates

Specified Thickness, [mm]	Tolerance over Specified Width and Length,[A] mm	
	Width	Length
Up to 25, incl	3.2	3.2
25 to 50, incl	4.8	4.8
50 to 75, incl	6.4	6.4
75 to 100, incl[B]	7.9	7.9

[A] The tolerances under specified width and length are 3.2 mm.
[B] Width and length tolerances for abrasive cut plates over 100 mm thick are not included in the table; consult producer.

TABLE A3.25 Permitted Variations in Diameter for Hot-rolled and Cold-rolled Coil-processed Product as Sheared Circles

Specified Thickness, mm	Tolerance Over Specified Diameter (No Tolerance Under), mm		
	Diameters Under 600	Diameters 600 to 1200 incl	Diameters Over 1200
Under 1.50	2	3	5
1.50 to 2.50 excl	3	4	6
2.50 and thicker	4	5	7

TABLE A3.26 Permitted Variations in Diameter for Circular Plates Taken From Hot-rolled Product Processed With or Without Coiling

NOTE 1—For specific diameters other than those shown, the tolerance for the next higher diameter shall apply.

Specified Diameter, mm	Tolerance Over Specified Diameter for Given Diameter and Thickness,[A] mm		
	Thickness of Plate		
	To 10, excl	10 to 15, excl	15 and over
1500 and under	7	10	13
2100	8	13	16
2700	10	11	15
4500	11	15	18

[A] No tolerance under.

TABLE A3.27 Torch Cutting Tolerances[A] and Recommended Cleanup Allowance for Rectangular Plates, Circles, Rings, and Sketches

Specified Thickness, mm	Tolerance, mm		Cleanup Allowance[B]
	Outside Diameter	Inside Diameter	Per Edge, mm
51 and under	+10, –0	–10, +0	±6
Over 51 to 76 incl	+13, –0	–13, +0	±10
Over 76 to 152 incl	+19, –0	–19, +0	±13

[A] Tolerances to apply unless otherwise agreed. Note that for some applications user may wish to specify minus rather than plus tolerance or vice versa.
[B] Recommended cleanup allowance which, unless otherwise specified, will be applied by supplier to purchasers ordered size.

TABLE A3.28 Permitted Variations in Weight for Hot-rolled and Cold-rolled Sheets

Any item of five sheets or less, and estimated to weigh 100 kg or less, may actually weigh 10 % over the theoretical weight	weigh 100 kg or less
Any item of more than five sheets and estimated to weigh more than 100 kg, may actually weigh 7½ % over the theoretical weight	weigh more than 100 kg
Chromium-manganese-nickel	7.82 kg/m^2/mm thick
Chromium-nickel	8.07 kg/m^2/mm thick
Chromium	7.92 kg/m^2/mm thick

TABLE A3.29 Permitted Variations in Camber for Cold-rolled Narrow Coil-processed Product in Coils and Cut Lengths[A]

Specified Width, mm	Tolerance Per Unit Length of Any 2400 mm
To 40, incl	13
Over 40 to 600, incl	7

[A] Camber is the deviation of a side edge from a straight line and measurement is taken by placing a 2400 mm straightedge on the concave side and measuring the greatest distance between the strip edge and the straightedge.

TABLE A3.30 Permitted Variations in Camber for Hot-rolled and Cold-rolled Wide Coil-processed Product as Cut Lengths Not Resquared and Cold-rolled Wide Coil-processed Product as Coils[A]

Specified Width, mm	Tolerance per Unit Length of Any 2400 mm, mm
600 to 900, excl	4
900 and over	3

[A] Camber is the greatest deviation of a side edge from a straight line and measurement is taken by placing an 8-ft [2438 mm] straightedge on the concave side and measuring the greatest distance between the sheet edge and the straightedge.

A4. REQUIREMENTS FOR INTRODUCTION OF NEW MATERIALS

A4.1 New materials may be proposed for inclusion in specifications referencing this specification subject to the following conditions:

A4.1.1 Application for the addition of a new grade to a specification shall be made to the chair of the subcommittee that has jurisdiction over that specification.

A4.1.2 The application shall be accompanied by a statement from at least one user indicating that there is a need for the new grade to be included in the applicable specification.

A4.1.3 The application shall be accompanied by test data as required by the applicable specification. Test data from a minimum of three test lots, as defined by the specification, each from a different heat, shall be furnished.

A4.1.4 The application shall provide recommendations for all requirements appearing in the applicable specification.

A4.1.5 The application shall state whether the new grade is covered by patent.

A5. REQUIREMENTS FOR INTRODUCTION OF MATERIALS FROM OTHER A01 OR B02.07 SPECIFICATIONS

A5.1 Wrought materials that are already covered by another A01 or B02.07 specification may be proposed for inclusion in specifications referencing this specification of general requirements subject to the following conditions:

A5.1.1 Application for the addition of a grade that is already covered in another A01 or A01.17 specification shall be made to the chair of the subcommittee that has jurisdiction over that the specification to which the grade is to be added.

A5.1.2 The chemical requirements, the specified mechanical properties, and the heat treatment requirements of the grade being added shall be the same as those for the grade in the A01 or A01.17 specification in which the grade is presently covered.

A5.1.3 The application shall provide recommendations for all requirements appearing in the applicable specification.

A5.1.4 The application shall state whether or not the grade is covered by patent.

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A480/A480M – 22) that may impact the use of this standard. (Approved Sept. 1, 2022.)

(1) Revised Terminology (Section 3) to comply with Form and Style Manual.

Committee A01 has identified the location of selected changes to this standard since the last issue (A480/A480M – 20a) that may impact the use of this standard. (Approved May 1, 2022.)

(1) Added reference to A1084 in 2.1, 18.3, and 19.1.8.

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