



Standard Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and N08332) Plate, Sheet, and Strip¹

This standard is issued under the fixed designation B 536; 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.

1. Scope

1.1 This specification covers nickel-iron-chromium silicon alloys (UNS N08330 and UNS N08332)* plate, sheet, and strip intended for heat resisting applications and general corrosive service.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to become familiar with all hazards including those identified in the appropriate Material Safety Data Sheet for this product/material as provided by the manufacturer, to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

B 880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys, and Cobalt Alloys²

E 8 Test Methods for Tension Testing of Metallic Materials³

E 10 Test Method for Brinell Hardness of Metallic Materials³

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials³

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁴

E 112 Test Methods for Determining the Average Grain Size³

E 140 Hardness Conversion Tables for Metals³

E 1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys⁵

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *plate*—material $\frac{3}{16}$ in. (4.76 mm) and over in thickness and over 10 in. (254 mm) in width.

3.1.2 *sheet*—material under $\frac{3}{16}$ in. (4.76 mm) in thickness and 24 in. (610 mm) and over in width.

3.1.3 *strip*—material under $\frac{3}{16}$ in. (4.76 mm) in thickness and under 24 in. (610 mm) in width.

4. Ordering Information

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

4.1.1 *Quantity* (weight or number of pieces),

4.1.2 *Alloy* (Table 1),

4.1.3 *Form* (plate, sheet, or strip),

4.1.4 ASTM designation and year of issue,

4.1.5 *Dimensions*—Thickness, width, and length,

4.1.6 *Edge* (for strip only),

4.1.7 *Finish* (Appendix) for sheet specify whether one or both sides are to be polished,

4.1.8 *Certification*—State if certification is required (Section 15),

4.1.9 *Samples for Product (Check) Analysis*—State whether samples for product (check) analysis should be furnished, and

4.1.10 *Purchaser Inspection*—If purchaser wishes to witness tests or inspections of material at place of manufacture, the purchase order must so state indicating which tests or inspections are to be witnessed.

5. Chemical Composition

5.1 The material shall conform to the requirements as to chemical composition specified in Table 2.

5.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis variations in Specification B 880.

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

² *Annual Book of ASTM Standards*, Vol 02.04.

³ *Annual Book of ASTM Standards*, Vol 03.01.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

⁵ *Annual Book of ASTM Standards*, Vol 03.05.

TABLE 1 Mechanical Properties

Alloy	Condition	Tensile Strength, min, psi (MPa)	Yield Strength, 0.2 % offset, min, psi (MPa)	Elongation in 2 in. or 50 mm, or 4D, min, %	Hardness ^A
UNS N08330	annealed	70 000 (483)	30 000 (207)	30	70 to 90 HRB
UNS N08332	annealed	67 000 (462)	27 000 (186)	30	65 to 88 HRB

^AHardness values are informative only and not to be constructed as the basis for acceptance.

TABLE 2 Chemical Requirements

Element	Composition Limits, %
C	... ^A
Mn	2.00 max
P	0.03 max
S	0.03 max
Si	0.75–1.50
Cr	17.0–20.0
Ni	34.0–37.0
Cu	1.00 max
Pb	0.005 max
Sn	0.025 max
Fe	remainder ^B

^A Alloy UNS N08330: 0.08 max

Alloy UNS N08332: 0.05–0.10

^BElement shall be determined arithmetically by difference.

TABLE 4 Permissible Variations in Width and Length for Hot-Rolled and Cold-Rolled Resquared Sheets (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	1.6	0
Widths 48 (1219) and over	1/8	3.2	0
Lengths up to 120 (3048) excl	1/16	1.6	0
Lengths 120 (3048) and over	1/8	3.2	0
For thicknesses 0.131 (3.33) and over:			
All widths and lengths	1/4	6.4	0

TABLE 5 Width, Length, and Camber Tolerances for Hot-Rolled and Cold-Rolled Sheets not Resquared or Stretcher Leveled
Width Tolerances

Specified Thickness, in. (mm)	Tolerance for Specified Width, in. (mm)	
	24 to 48 (610 to 1220), excl	48 in., (1220) and over
Less than 3/16 in. (4.76)	1/16 (1.6) over, 0 under	1/8 in. (3.2) over, 0 under
Length Tolerances		
Specified Length, ft (cm)	Tolerance, in. (mm)	
Up to 10 (305), incl	1/4 (6.4)	0 (0)
Over 10 to 20 (305 to 610), incl	1/2 (12.7)	0 (0)
Camber Tolerances ^A		
Specified Width, in. (mm)	Tolerance per Unit Length of any 8 ft (244 cm), in. (mm)	
24 to 36 in. (610 to 914), incl	1/8 (3.2)	
Over 36 in. (914)	3/32 (2.4)	

^ACamber is the greatest deviation of a side edge from a straight line, and measurement is taken by placing an 8-ft (2440-mm) straightedge on the concave side and measuring the greatest distance between the sheet edge and the straightedge.

6. Mechanical and Other Properties

6.1 The tensile properties of the material at room temperature shall conform to those shown in Table 1.

6.2 *Grain Size*—Annealed alloy UNS N08332 shall conform to an average grain size of ASTM No. 5 or coarser.

6.3 *Annealing Temperature*—Alloy UNS N08330 shall be annealed at 1900°F (1040°C) minimum. Alloy UNS N08332 shall be annealed at 2100°F (1150°C) minimum.

7. Permissible Variations in Dimensions and Weight

7.1 *Sheet*, shall conform to the variations in dimensions specified in Tables 3-8, inclusive.

7.2 *Cold-Rolled Strip*, shall conform to the permissible variations in dimensions as specified in Tables 9-13, inclusive.

7.3 *Plate*, shall conform to the permissible variations in dimensions specified in Tables 14-20, inclusive.

TABLE 3 Thickness Tolerances for Hot-Rolled and Cold-Rolled Sheets

Specified Thickness, in. (mm)	Tolerance Over and Under, in. (mm)
Over 0.145 to less than 3/16 (3.68 to less than 4.76)	0.014 (0.36)
Over 0.130 to 0.145 (3.30 to 3.68), incl	0.012 (0.30)
Over 0.114 to 0.130 (2.90 to 3.30), incl	0.010 (0.25)
Over 0.098 to 0.114 (2.49 to 2.90), incl	0.009 (0.23)
Over 0.083 to 0.098 (2.11 to 2.49), incl	0.008 (0.20)
Over 0.072 to 0.083 (1.83 to 2.11), incl	0.007 (0.18)
Over 0.058 to 0.072 (1.47 to 1.83), incl	0.006 (0.15)
Over 0.040 to 0.058 (1.02 to 1.47), incl	0.005 (0.13)
Over 0.026 to 0.040 (0.66 to 1.02), incl	0.004 (0.10)
Over 0.016 to 0.026 (0.41 to 0.66), incl	0.003 (0.08)
Over 0.007 to 0.016 (0.18 to 0.41), incl	0.002 (0.05)
Over 0.005 to 0.007 (0.13 to 0.18), incl	0.0015 (0.04)
0.005 (0.13)	0.001 (0.03)

7.4 *Sheet, Strip, and Plate*—Material with No. 1 finish may be ground to remove surface defects, provided such grinding does not reduce the thickness, width or length at any point beyond the permissible variations in dimensions.

8. Workmanship, Finish, and Appearance

8.1 The material shall be uniform in quality and temper, smooth, commercially straight or flat and free of injurious imperfections.

9. Sampling

9.1 *Lot*—Definition:

9.1.1 A lot for chemical analysis shall consist of one heat.

TABLE 6 Flatness Tolerances for Hot-Rolled and Cold-Rolled Sheets

Sheets not Specified to Stretcher Level Standard of Flatness			
Specified Thickness, in. (mm)	Width, in. (mm)		Flatness Tolerance (max Deviation from a Horizontal Flat Surface), in. (mm)
0.062 (1.57) and over	To 60 (1524), incl		1/2 (12.7)
	Over 60 to 72 (1524 to 1829), incl		3/4 (19.1)
	Over 72 (1829)		1 (25.4)
Under 0.062 (1.57)	To 36 (914), incl		1/2 (12.7)
	Over 36 to 60 (914 to 1524), incl		3/4 (19.1)
	Over 60 (1524)		1 (25.4)
Sheets Specified to Stretcher Level Standard of Flatness			
Specified Thickness in. (mm)	Width, in. (mm)	Length, in. (mm)	Flatness tolerance in. (mm)
Under 3/16 (4.76)	To 48 (1220), incl	To 96 (2440), incl	1/8 (3.2)
Under 3/16 (4.76)	To 48 (1220), incl	Over 96 (2440)	1/4 (6.4)
Under 3/16 (4.76)	Over 48 (1220)	To 96 (2440), incl	1/4 (6.4)
Under 3/16 (4.76)	Over 48 (1220)	Over 96 (2440)	1/4 (6.4)

TABLE 7 Diameter Tolerances for Hot-Rolled and Cold-Rolled Sheets, Sheared Circles

Specified Thickness, in. (mm)	Tolerance Over Specified Diameter (No Tolerance Under) in. (mm)		
	Under 30 (760)	30 to 48 (760 to 1220), incl	Over 48 (1220)
Over 0.097 (2.46)	1/8 (3.2)	3/16 (4.8)	1/4 (6.4)
Over 0.057 to 0.097 (1.45 to 2.46), incl	3/32 (2.4)	5/32 (4.0)	7/32 (5.6)
0.057 (1.45) and under	1/16 (1.6)	1/8 (3.2)	3/16 (4.8)

TABLE 8 Weight Tolerances for Hot-Rolled and Cold-Rolled Sheets

It is not practicable to produce hot-rolled and cold-rolled sheets to exact theoretical weight. Sheets of any one item of a specified thickness and size in any finish may be overweight to the following extent:

- (1) An item of five sheets or less, or an item estimated to weigh 200 lb (90 kg) or less, may actually weigh as much as 10 percent over the theoretical weight.
- (2) An item of more than five sheets and estimated to weigh more than 200 lb (90 kg) may actually weigh as much as 7 1/2 percent over the theoretical weight.
- (3) The underweight variations for sheets are limited by the under thickness tolerances shown in Table 3.

For determining theoretical weight the factor, 42 lb/ft²-in. (0.0008 kg/cm²-mm) thickness may be used.

9.1.2 A lot for mechanical properties, hardness, and grain size testing shall consist of all material from the same heat, nominal thickness, and condition.

9.1.2.1 Where material cannot be identified by heat, a lot shall consist of not more than 500 lb (227 kg) of material in the same thickness and condition, except that for plates weighing over 500 lb only one specimen shall be taken.

9.2 Test Material Selection:

9.2.1 *Chemical Analysis*—Representative samples from each lot shall be taken during pouring or subsequent processing.

9.2.1.1 Product (check) analysis shall be wholly the responsibility of the purchaser.

9.2.2 *Mechanical Properties and Grain Size*—Samples of the material to provide specimens for mechanical properties and grain size shall be taken from such locations in each lot as to be representative of that lot.

10. Number of Tests

10.1 *Chemical Analysis*—One test per lot.

10.2 *Grain Size*—One test per lot.

10.3 *Tensile Properties and Hardness Test*—One test per lot.

11. Specimen Preparation

11.1 Tension test, hardness test, and grain size specimens shall be taken from material in the final condition (temper). Tension tests shall be transverse to the direction of rolling, where width will permit.

11.2 Tension test specimens shall be any of the standard or subsize specimens shown in Test Methods E 8.

11.3 In the event of disagreement, referee specimens shall be as follows:

11.3.1 Full thickness of the material, machine to the form and dimensions shown for the sheet-type specimen in Test Methods E 8 for material under 1/2 in. (12.7 mm) in thickness.

11.3.2 The largest possible round specimen shown in Test Methods E 8 for material 1/2 in. (12.7 mm) and over.

12. Methods of Test

12.1 *Chemical Composition*—In case of disagreement, the chemical composition shall be determined in accordance with Test Methods E 1473.

12.2 *Tension Test*—Tension testing shall be conducted in accordance with Test Methods E 8.

12.3 *Grain Size*—The measurement of average grain size may be carried out by the planimetric method, the comparison method, or the intercept method described in Test Methods E 112. In case of dispute, the “referee” method for determining average grain size shall be the planimetric method.

12.4 *Rockwell Hardness*—Test Methods E 18.

12.5 *Brinell Hardness*—Test Method E 10.

TABLE 9 Thickness Tolerances for Cold-Rolled Strip in Coils and Cut Lengths

NOTE 1—Thickness measurements are taken at least 3/8 in. (9.5 mm) in from edge of the strip, except that on widths less than 1 in. (25.4 mm) the tolerances are applicable for measurements at all locations.

NOTE 2—Above tolerances include crown.

Specified thickness, in. (mm), incl	Thickness Tolerances, in. (mm), for the Thicknesses and Widths given, over and under		
	Width, in. (mm)		
	3/16 (4.8) to 6 (152), incl	Over 6 (152) to 12 (305), incl	Over 12 (305) to 24 (610), excl
0.005 (0.13) to 0.010 (0.25)	10 %	10 %	10 %
Over 0.010 (0.25) to 0.011 (0.28)	0.0015 (0.04)	0.0015 (0.04)	0.0015 (0.04)
Over 0.011 (0.28) to 0.013 (0.33)	0.0015 (0.04)	0.0015 (0.04)	0.002 (0.05)
Over 0.013 (0.33) to 0.017 (0.43)	0.0015 (0.04)	0.002 (0.05)	0.002 (0.05)
Over 0.017 (0.43) to 0.020 (0.51)	0.0015 (0.04)	0.002 (0.05)	0.0025 (0.06)
Over 0.020 (0.51) to 0.029 (0.74)	0.002 (0.05)	0.0025 (0.06)	0.0025 (0.06)
Over 0.029 (0.74) to 0.035 (0.89)	0.002 (0.05)	0.003 (0.08)	0.003 (0.08)
Over 0.035 (0.89) to 0.050 (1.27)	0.0025 (0.06)	0.0035 (0.09)	0.0035 (0.09)
Over 0.050 (1.27) to 0.069 (1.75)	0.003 (0.08)	0.0035 (0.09)	0.0035 (0.09)
Over 0.069 (1.75) to 0.100 (2.54)	0.003 (0.08)	0.004 (0.10)	0.005 (0.13)
Over 0.100 (2.54) to 0.125 (3.18)	0.004 (0.10)	0.0045 (0.11)	0.005 (0.13)
Over 0.125 (3.18) to 0.161 (4.09)	0.0045 (0.11)	0.0045 (0.11)	0.005 (0.13)
Over 0.161 (4.09) to 3/16 (4.76) excl	0.005 (0.13)	0.005 (0.13)	0.006 (0.15)

TABLE 10 Width Tolerances Cold-Rolled Strip in Coils and Cut Lengths, Edge Numbers 1 and 5

Specified Edge No.	Width, in. (mm)	Thickness, in. (mm)	Width Tolerance, in. (mm) for Thickness and Width given over and under
1 and 5	3/32 (7.1) and under	1/16 (1.6) and under	0.005 (0.13)
1 and 5	Over 3/32 (7.1) to 3/4 (19.1) incl	3/32 (2.4) and under	0.005 (0.13)
1 and 5	Over 3/4 (19.1) to 5 (127) incl	1/8 (3.2) and under	0.005 (0.13)
5	Over 5 (127) to 9 (229) incl	1/8 (3.2) to 0.008 (0.20) incl	0.010 (0.25)
5	Over 9 (229) to 20 (508) incl	0.105 (2.67) to 0.015 (0.38) incl	0.010 (0.25)
5	Over 20 (508) to 24 (610) excl	0.080 (2.03) to 0.023 (0.58) incl	0.015 (0.38)

TABLE 11 Width Tolerances Cold-Rolled Strip in Coils and Cut Lengths Edge Number 3

Specified Thickness in. (mm)	Width Tolerance, in. (mm) Over and Under, for Thickness and Width Given					
	Under 1/2 (12.7) to 3/16 (4.8)	1/2 (12.7) to 6 (152)	Over 6 (152) to 9 (229)	Over 9 (229) to 12 (305)	Over 12 (305) to 20 (508)	Over 20 (508) to 24 (610)
0.068 (1.73) and under	0.005 (0.13)	0.005 (0.13)	0.005 (0.13)	0.010 (0.25)	0.016 (0.41)	0.020 (0.51)
Over 0.068 (1.75) to 0.099 (2.51), incl	0.008 (0.20)	0.008 (0.20)	0.010 (0.25)	0.010 (0.25)	0.016 (0.41)	0.020 (0.51)
Over 0.099 (2.51) to 0.160 (4.06), incl	0.010 (0.25)	0.010 (0.25)	0.016 (0.41)	0.016 (0.41)	0.020 (0.51)	0.020 (0.51)
Over 0.160 (4.06) to under 3/16 (4.76) excl	...	0.016 (0.41)	0.020 (0.51)	0.020 (0.51)	0.031 (0.79)	0.031 (0.79)

TABLE 12 Length Tolerances Cold-Rolled Strip in Cut Lengths

Specified Length, in. (mm)	Tolerance, in. (mm) over Specified Length, No Tolerance Under,
Up to 60 (1524) incl	3/8 (9.5)
Over 60 (1524) to 120 (3048) incl	1/2 (12.7)
Over 120 (3048) to 240 (6096) incl	5/8 (15.9)

TABLE 13 Camber Tolerances Cold-Rolled Strip in Coils and Cut Lengths

NOTE 1—Camber is the deviation of a side edge from a straight line, and measurement is taken by placing an 8-ft (24-mm) straight edge on the concave side and measuring the greatest distance between the strip edge and the straight edge.

Specified Width, in. (mm)	Tolerance in. (mm) per unit length of any 8 ft. (2440 mm)
Up to 1 1/2 (38.1) incl	1/2 (12.7)
Over 1 1/2 (38.1) to 24 (609.6) excl	1/4 (6.4)

12.6 *Hardness Conversion*—Hardness Conversion Tables E 140.

12.7 *Rounding Method*—For purposes of determining compliance with the limits in this specification, an observed value or a calculated value shall be rounded off as indicated below, in accordance with the rounding-off method of Practice E 29:

TABLE 14 Permissible Variations in Thickness for Plates^A

Specified Thickness, in. (mm)	Width, in. (mm)			
	To 84 (2134), incl	Over 84 (2134) to 120 (3048), incl	Over 120 (3048) to 144 (3658), incl	Over 144 (3658)
Tolerance Over Specified Thickness, ^B in. (mm)				
1/16 (4.76) to 3/8(9.52), excl	0.045 (1.14)	0.050 (1.27)
3/8 (9.52) to 3/4 (19.05), excl	0.055 (1.40)	0.060 (1.52)	0.075 (1.90)	0.090 (2.29)
3/4 (19.05) to 1 (25.40), excl	0.060 (1.52)	0.065 (1.65)	0.085 (2.16)	0.100 (2.54)
1 (25.40) to 2 (50.80), excl	0.070 (1.78)	0.075 (1.90)	0.095 (2.41)	0.115 (2.92)
2 (50.80) to 3 (76.20), excl	0.125 (3.18)	0.150 (3.81)	0.175 (4.44)	0.200 (5.08)
3 (76.20) to 4 (101.6), excl	0.175 (4.44)	0.210 (5.33)	0.245 (6.22)	0.280 (7.11)

^AThickness is measured along the longitudinal edges of the plate at least 3/8 in. (9.52 mm), but not more than 3 in. (76.20 mm), from the edge.

^BFor 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 10 in. (254.0 mm), incl, in thickness, the tolerance under the specified thickness is 0.010 in. (0.25 mm).

Requirements	Rounded-Off Unit for Observed or Calculated Value
Chemical composition and tolerances (when expressed in decimals)	nearest unit in the last right-hand place of figures of the specified limit. If two choices are possible, as when the digits dropped are exactly a 5, or a 5 followed only by zeros, choose the one ending in an even digit, with zero defined as an even digit
Tensile strength and yield strength	nearest 1000 psi (6.9 MPa)
Elongation	nearest 1 %
Grain size: 0.0024 in. (0.060 mm) or larger	nearest multiple of 0.0002 in. (0.005 mm)
Less than 0.0024 in. (0.060 mm)	nearest multiple of 0.0001 in. (0.002 mm)

13. Inspection

13.1 Inspection of the material shall be made as agreed upon between the manufacturer and the purchaser as part of the purchase contract.

14. Rejection and Reheating

14.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of

dissatisfaction with the results of the test, the producer or supplier may make claim for a reheating.

15. Certification

15.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser that the material was manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

16. Product Marking

16.1 The following information shall be marked on the material: The name of the material or UNS number, heat number, the letters ASTM, the specification number, the year of issue, the size, and other such information as may be defined in the contract or order.

17. Keywords

17.1 N08330; N08332; plate; sheet; strip

TABLE 15 Width and Length Tolerances for Plates^{A,B}

Width, in.	Length, in.	Tolerance Over Specified Width and Length for Given Width, Length, and Thickness, in.					
		Under 3/8 in.		3/8 to 1/2 in., incl, in Thickness		Over 1/2 in. in Thickness	
		Width	Length	Width	Length	Width	Length
48 and under	144 and under	1/8	3/16	3/16	1/4	5/16	3/8
Over 48 to 60, incl		3/16	1/4	1/4	5/16	3/8	7/16
Over 60 to 84, incl		1/4	5/16	5/16	3/8	7/16	1/2
Over 84 to 108, incl		5/16	3/8	3/8	7/16	1/2	9/16
Over 108		3/8	7/16	7/16	1/2	5/8	11/16
48 and under	over 144 to 240	3/16	3/8	1/4	1/2	5/16	5/8
Over 48 to 60, incl		1/4	7/16	5/16	5/8	3/8	3/4
Over 60 to 84, incl		3/8	1/2	7/16	11/16	1/2	3/4
Over 84 to 108, incl		7/16	9/16	1/2	3/4	5/8	7/8
Over 108		1/2	5/8	5/8	7/8	11/16	1
48 and under	over 240 to 360	1/4	1/2	5/16	5/8	3/8	3/4
Over 48 to 60, incl		5/16	5/8	3/8	3/4	1/2	3/4
Over 60 to 84, incl		7/16	11/16	1/2	3/4	5/8	7/8
Over 84 to 108, incl		9/16	3/4	5/8	7/8	3/4	1
Over 108		5/8	7/8	11/16	1	7/8	1
60 and under	over 360 to 480	7/16	11/16	1/2	11/16	5/8	13/16
Over 60 to 84, incl		1/2	11/16	5/8	13/16	3/4	11/16

TABLE 15 *Continued*

		Tolerance Over Specified Width and Length for Given Width, Length, and Thickness, in.					
Width, in.	Length, in.	Under 3/8 in.		3/8 to 1/2 in., incl, in Thickness		Over 1/2 in. in Thickness	
		Width	Length	Width	Length	Width	Length
Over 84 to 108, incl		9/16	1 1/4	3/4	1 3/8	7/8	1 1/2
Over 108		3/4	1 3/8	7/8	1 1/2	1	1 5/8
60 and under	over 480 to 600	7/16	1 1/4	1/2	1 1/2	5/8	1 5/8
Over 60 to 84, incl		1/2	1 3/8	5/8	1 1/2	3/4	1 5/8
Over 84 to 108, incl		5/8	1 3/8	3/4	1 1/2	7/8	1 5/8
Over 108		3/4	1 1/2	7/8	1 5/8	1	1 3/4
60 and under	over 600	1/2	1 3/4	5/8	1 7/8	3/4	1 7/8
Over 60 to 84, incl		5/8	1 3/4	3/4	1 7/8	7/8	1 7/8
Over 84 to 108, incl		5/8	1 3/4	3/4	1 7/8	7/8	1 7/8
Over 108		7/8	1 3/4	1	2	1 1/8	2 1/4

		Tolerance Over Specified Width and Length for Given Width, Length, and Thickness, mm					
Width, mm	Length, mm	Under 9.5 mm		9.5 to 12.7 mm, incl in Thickness		Over 12.7 mm in Thickness	
		Width	Length	Width	Length	Width	Length
1219 mm and under	3658 and under	3.2	4.8	4.8	6.4	7.9	9.5
Over 1219 to 1524, incl		4.8	6.4	6.4	7.9	9.5	11.1
Over 1524 to 2134, incl		6.4	7.9	7.9	9.5	11.1	12.7
Over 2134 to 2743, incl		7.9	9.5	9.5	11.1	12.7	14.3
Over 2743		9.5	11.1	11.1	12.7	15.9	17.5
1219 mm and under	over 3658 to 6096	4.8	9.5	6.4	12.7	7.9	15.9
Over 1219 to 1524, incl		6.4	11.1	7.9	15.9	9.5	19.1
Over 1524 to 2134, incl		9.5	12.7	11.1	17.5	12.7	19.1
Over 2134 to 2743, incl		11.1	14.3	12.7	19.1	15.9	22.2
Over 2743		12.7	15.9	15.9	22.2	17.5	25.4
1219 mm and under	over 6096 to 9144	6.4	12.7	7.9	15.9	9.5	19.1
Over 1219 to 1524, incl		7.9	15.9	9.5	19.1	12.7	19.1
Over 1524 to 2134, incl		11.1	17.5	12.7	19.1	15.9	22.2
Over 2134 to 2743, incl		14.3	19.1	15.9	22.2	19.1	25.4
Over 2743		15.9	22.2	17.5	25.4	22.2	25.4
1524 mm and under	over 9144 to 12192	11.1	28.6	12.7	31.8	15.9	34.9
Over 1524 to 2134, incl		12.7	31.8	15.9	34.9	19.1	38.1
Over 2134 to 2743, incl		14.3	31.8	19.1	34.9	22.2	38.1
Over 2743		19.1	34.9	22.2	38.1	25.4	41.3
1524 mm and under	over 12192 to 15240	11.1	31.8	12.7	38.1	15.9	41.3
Over 1524 to 2134, incl		12.7	34.9	15.9	38.1	19.1	41.3
Over 2134 to 2743, incl		15.9	34.9	19.1	38.1	22.2	41.3
Over 2743		19.1	38.1	22.2	41.3	25.4	44.3
1524 mm and under	over 15240	12.7	44.5	15.9	47.6	19.1	47.6
Over 1524 to 2134, incl		15.9	44.5	19.1	47.6	22.2	47.6
Over 2134 to 2743, incl		15.9	44.5	19.1	47.6	22.2	47.6
Over 2743		22.2	44.5	25.4	50.8	28.6	57.2

^AThe tolerance under specified width and length is 1/4 in. (6.4 mm).

^BRectangular plates over 1 in. (25.4 mm) in thickness are not commonly sheared and are machined or otherwise cut to length and width or produced in the size as rolled, uncropped.

TABLE 16 **Camber Tolerance for Plates**

$$\text{Tolerance} = \frac{1}{8} \text{ in. (3.175 mm)} \times [\text{ft (cm) of length}/5 \text{ ft (152.4 cm)}]$$

TABLE 17 **Diameter Tolerance for Circular Plates**

Specified Diameter, in. (mm)	Tolerance over Specified Diameter for Given Diameter and Thickness (No Under Tolerance), in. (mm)		
	Thickness		
	To 3/8 (9.5), excl	3/8 to 5/8 (9.5 to 15.9), excl	5/8 (15.9) and over
To 60 (1524), excl	1/4 (6.4)	3/8 (9.5)	1/2 (12.7)
60 to 84 (1524 to 2134), excl	5/16 (7.9)	7/16 (11.1)	9/16 (14.3)
84 to 108 (2134 to 2743), excl	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)

Specified Diameter, in. (mm)	Tolerance over Specified Diameter for Given Diameter and Thickness (No Under Tolerance), in. (mm)		
	Thickness		
	To $\frac{3}{8}$ (9.5), excl	$\frac{3}{8}$ to $\frac{5}{8}$ (9.5 to 15.9), excl	$\frac{5}{8}$ (15.9) and over
108 to 130 (2743 to 3302), excl	$\frac{7}{16}$ (11.1)	$\frac{9}{16}$ (14.3)	$\frac{11}{16}$ (17.5)

TABLE 18 Flatness Tolerances for Plates

Specified Thickness, in.	Flatness Tolerance (Deviation from a Flat Horizontal Surface) for Thickness and Width Given, in.								
	Width, in.								
	48 and Under	Over 48 to 60, excl	60 to 72, excl	72 to 84, excl	84 to 96, excl	96 to 108, excl	108 to 120, excl	120 to 144, excl	144 and Over
$\frac{3}{16}$ to $\frac{1}{4}$, excl	$\frac{3}{4}$	$1\frac{1}{16}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{5}{8}$	$1\frac{7}{8}$	$1\frac{7}{8}$	2	...
$\frac{1}{4}$ to $\frac{3}{8}$, excl	$1\frac{1}{16}$	$\frac{3}{4}$	$1\frac{5}{16}$	$1\frac{1}{8}$	$1\frac{3}{8}$	$1\frac{7}{16}$	$1\frac{9}{16}$	$1\frac{7}{8}$...
$\frac{3}{8}$ to $\frac{1}{2}$, excl	$\frac{1}{2}$	$\frac{9}{16}$	$1\frac{1}{16}$	$\frac{3}{4}$	$1\frac{5}{16}$	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{7}{16}$	$1\frac{3}{4}$
$\frac{1}{2}$ to $\frac{3}{4}$, excl	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{5}{8}$	$1\frac{3}{16}$	$1\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{3}{8}$
$\frac{3}{4}$ to 1, excl	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{3}{4}$	$1\frac{3}{16}$	$1\frac{9}{16}$	1	$1\frac{1}{8}$
1 to $1\frac{1}{2}$, excl	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{9}{16}$	$\frac{9}{16}$	$1\frac{1}{16}$	$1\frac{1}{16}$	$1\frac{1}{16}$	$\frac{3}{4}$	1
$1\frac{1}{2}$ to 4, excl	$\frac{3}{16}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
4 to 6, excl	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$

Specified Thickness, mm	Flatness Tolerance (Deviation from a Flat Horizontal Surface) for Thickness and Width Given, mm								
	Width, mm								
	1219 and Under	Over 1219 to 1524, excl	1524 to 1829, excl	1829 to 2134, excl	2134 to 2438, excl	2438 to 2743, excl	2743 to 3048, excl	3048 to 3658, excl	3658 and Over
4.8 to 6.4, excl	19.0	27.0	31.8	34.9	41.3	41.3	47.6	50.8	...
6.4 to 9.5, excl	17.5	19.0	23.8	28.6	34.9	36.5	39.7	47.6	...
9.5 to 12.7, excl	12.7	14.3	17.5	19.0	23.8	28.6	31.8	36.5	44.5
12.7 to 19.0, excl	12.7	14.3	15.9	15.9	20.6	28.6	28.6	28.6	34.9
19.0 to 25.4, excl	12.7	14.3	15.9	15.9	19.0	20.6	23.8	25.4	28.6
25.4 to 38.1, excl	12.7	14.3	14.3	14.3	17.5	17.5	17.5	19.0	25.4
38.1 to 102, excl	4.8	7.9	9.5	11.1	12.7	14.3	15.9	19.0	22.2
102 to 152, excl	6.4	9.5	12.7	14.3	15.9	19.0	22.2	25.4	28.6

TABLE 19 Recommended Plate Flame-Cutting Tolerances to Clean up in Machining

Specified Thickness, in. (mm)	Machining Allowance per Edge, in. (mm)
Under 2 (51)	$\frac{1}{4}$ (6.4)
Over 2 to 3 (51 to 76), incl	$\frac{3}{8}$ (9.5)
Over 3 to 6 (76 to 152), incl	$\frac{1}{2}$ (12.7)

TABLE 20 Abrasive-Cutting Width and Length Tolerances

Specified Thickness, in. (mm)	Tolerance Over Specified Width and Length, in. (mm) ^A	
	Width	Length
Up to $1\frac{1}{4}$ (32)	$\frac{1}{8}$ (3.2)	$\frac{1}{8}$ (3.2)
Over $1\frac{1}{4}$ to $2\frac{3}{4}$ (32 to 70)	$\frac{3}{16}$ (4.8)	$\frac{3}{16}$ (4.8)

^AThe tolerance under specified width and length is $\frac{1}{8}$ in. (3.2 mm).

APPENDIX

(Nonmandatory Information)

X1. FINISHES

X1.1 Scope—This appendix lists the finishes in which plate, sheet, and strip are normally supplied. These are subject to change and the manufacturer should be consulted for the latest information available.

X1.2 Sheet—The various types of finish procurable on sheet products are:

X1.2.1 No. 1 Finish—Hot-rolled, annealed, and descaled.

X1.2.2 No. 2D Finish—Dull, cold-rolled finish.

X1.2.3 No. 2B Finish—Bright, cold-rolled finish.

X1.2.3.1 Bright-Annealed Finish—A bright cold-rolled finish retained by final annealing in a controlled atmosphere furnace.

NOTE X1.1—Explanation of Finish:

No. 1—Produced on hand sheet mills by hot rolling to specified thicknesses followed by annealing and descaling. Generally used in industrial applications, such as for heat or corrosion resistance, where smoothness and uniformity of finish is not of particular importance.

No. 2D—Produced on either hand sheet mills or continuous mills by cold rolling to the specified thickness, annealing, and descaling. The dull

finish may result from the descaling or pickling operation or may be developed by a final light cold-rolled pass on dull rolls. The dull finish is favorable for the retention of lubricants on the surface in deep drawing operations. This finish is generally used in forming deep drawn articles which may be polished after fabrication.

No. 2B—Commonly produced the same as No. 2D, except that the annealed and descaled sheet receives a final light cold-rolled pass on polished rolls. This is a general purpose cold-rolled finish. It is commonly used for all but exceptionally difficult deep drawing application. This finish is more readily polished than No. 1 or No. 2D finish.

Bright-Annealed Finish—A bright cold-rolled highly reflective finish retained by final annealing in a controlled atmosphere furnace. The purpose of the atmosphere is to prevent scaling or oxidation during annealing. The atmosphere is usually comprised of either dry hydrogen or a mixture of dry hydrogen and dry nitrogen (sometimes known as dissociated ammonia).

X1.3 *Strip*—The various types of finish procurable on cold-rolled strip products shall be as follows:

X1.3.1 *No. 1 Finish*—Cold-rolled to specified thickness, annealed, and pickled.

X1.3.2 *No. 2 Finish*—Same as No. 1 finish, followed by a final light cold-rolled pass, generally on highly-polished rolls.

X1.3.3 *Bright-Annealed Finish*—A bright cold-rolled finish retained by final annealing in a controlled atmosphere furnace.

NOTE X1.2—Explanation of Finish:

No. 1—Appearance may be dull-gray matte to fairly reflective. 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 in parts for heat resistance.

No. 2—This finish has a smoother and more reflective surface. This is a general purpose finish, widely used for household and automotive trim, tableware, utensils, trays, etc.

Bright-Annealed Finish—A bright cold-rolled highly reflective finish retained by final annealing in a controlled atmosphere furnace. The purpose of the atmosphere is to prevent scaling or oxidation during annealing. The atmosphere is usually comprised of either dry hydrogen or a mixture of dry hydrogen and dry nitrogen (sometimes known as dissociated ammonia).

X1.3.4 The various types of edges obtainable on strip are as follows:

X1.3.5 *No. 1 Edge*—Rolled edge, either round or square as specified.

X1.3.6 *No. 3 Edge*—An edge produced by slitting.

X1.3.7 *No. 5 Edge*—Approximately square edge produced by rolling or filing after slitting.

X1.4 *Plate*—The types of finish obtainable on plate are as follows:

X1.4.1 *Hot-Rolled, Annealed*—Scale not removed. Use of plates in this condition is generally confined to heat-resisting applications.

X1.4.2 *Hot-Rolled, Annealed, Descaled*—Scale removed by a blast-cleaning or pickling operation. Finish commonly preferred for corrosion resisting applications or where non-flux type welding operations will be performed.

X1.4.3 *Cold-Rolled, Annealed*—Bright-annealed finish or scale removed by a blast-cleaning or pickling operation.

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