Designation: B 625 – 99

Standard Specification for UNS N08904, UNS N08925, UNS N08031, UNS N08932, UNS N08926, and UNS R20033 Plate, Sheet, and Strip[1]

This standard is issued under the fixed designation B 625; 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 alloys UNS N08904, UNS N08925,* UNS N08031, UNS N08932, UNS N08926, and UNS R20033 plate, sheet, and strip in the annealed temper.

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 The following safety hazards caveat pertains only to the test methods portion, Section 12, of this specification: *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 establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

E 8 Test Methods for Tension Testing of Metallic Materials[2]

E 10 Test Method for Brinell Hardness of Metallic Materials[2]

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials[2]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[3]

E 38 Methods for Chemical Analysis of Nickel-Chromium and Nickel-Chromium-Iron Alloys[4]

E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition[5]

E 140 Hardness Conversion Tables for Metals[2]

E 353 Test Methods for Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys[5]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *plate*—material 3⁄16 in. (4.76 mm) and over in thickness and over 10 in. (254 mm) in width.

3.1.2 *sheet*—material under 3⁄16 in. (4.76 mm) in thickness and 24 in. (609.6 mm) and over in width. Material under 3⁄16in. (4.75 mm) in thickness and in all widths with No. 4 finish.

3.1.3 *strip*—material under 3⁄16 in. (4.76 mm) in thickness and under 24 in. (609.6 mm) in width.

4. Ordering Information

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

4.1.1 Quantity (weight or number of pieces),

4.1.2 Alloy name or UNS number,

4.1.3 Form, plate, sheet or strip,

4.1.4 Dimensions,

4.1.5 Type edge required, for strip only (see 7.4.1),

4.1.6 Finish (Section 8)—For sheet with No. 4 finish, specify whether one or both sides are to be polished,

4.1.7 ASTM designation,

4.1.8 Additions to the specification or special requirements,

4.1.9 Certification or test reports—State if certification or test reports are required (Section 15), and

4.1.10 Source inspection—State if inspection is required (Section 13).

5. Chemical Composition

5.1 The material sampled, in accordance with 9.2, shall conform to the composition limits specified in Table 1.

5.2 If a product analysis is subsequently made, the material shall conform to the composition limits with the product analysis variation specified in Table 2.

6. Mechanical Properties and Other Requirements

6.1 *Tensile and Hardness Requirements*— The material shall conform to the mechanical property requirements specified in Table 3.

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[1] This specification is under the jurisdiction of ASTM Committee B-2 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.07 on Refined Nickel and Cobalt and Their Alloys.

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

[2] *Annual Book of ASTM Standards*, Vol 03.01.

[3] *Annual Book of ASTM Standards*, Vol 14.02.

[4] Discontinued—See *1989 Annual Book of ASTM Standards*, Vol 03.05.

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

TABLE 1 Chemical Requirements

Elements	Composition,%					
	UNS N08904	UNS N08925	UNS N08932	UNS N08031	UNS N08926	UNS R20033
Carbon, max	0.020	0.020	0.020	0.015	0.020	0.015
Manganese, max	2.00	1.00	2.00	2.0	2.00	2.0
Phosphorus, max	0.045	0.045	0.025	0.020	0.03	0.02
Sulfur, max	0.035	0.030	0.010	0.010	0.01	0.01
Silicon, max	1.00	0.50	0.40	0.3	0.5	0.50
Nickel	23.00–28.00	24.00–26.00	24.0–26.0	30.0–32.0	24.00–26.00	30.0–33.0
Chromium	19.00–23.00	19.00–21.00	24.0–26.0	26.0–28.0	19.00–21.00	31.0–35.0
Molybdenum	4.0–5.0	6.0–7.0	4.5–6.5	6.0–7.0	6.0–7.0	0.50–2.0
Copper	1.0–2.0	0.8–1.5	1.0–2.0	1.0–1.4	0.5–1.5	0.30–1.20
Nitrogen	...	0.10–0.20	0.15–0.25	0.15–0.25	0.15–0.25	0.35–0.60
Iron	balance	balance	balance	balance	balance	balance

TABLE 2 Product Analysis Tolerances

Elements	Tolerances Over the Max Limit or Under the Min Limit, %			
	UNS N08904 UNS N08925 UNS N08932	UNS N08031	UNS N08926	UNS R20033
Carbon	0.005	0.005	0.005	0.005
Manganese	0.04	0.04	0.04	0.04
Phosphorus	0.005	0.005	0.005	0.005
Sulfur	0.005	0.003	0.003	0.003
Silicon	0.05	0.03	0.03	0.05
Chromium	0.20	0.30	0.25	0.30
Nickel	0.20	0.30	0.25	0.30
Molybdenum	0.10	0.15	0.15	0.05
Copper	0.10	0.04	0.04	0.10
Nitrogen	...	0.01	0.01	0.03

7. Dimensions and Permissible Variations

7.1 *Sheet*—The material referred to as sheet shall conform to the variations in dimensions specified in Tables 4-9, inclusive.

7.2 *Cold-Rolled Strip*—The material referred to as cold-rolled strip shall conform to the permissible variations in dimensions specified in Tables 10-13, inclusive.

7.3 *Plate*—The material referred to as plate shall conform to the permissible variations in dimensions specified in Tables 14-19, inclusive.

7.4 *Edges for Cold-Rolled Strip*:

7.4.1 *The various types of edges procurable shall be as follows*:

7.4.1.1 *No. 1 Edge*—Rolled edge, contour as specified.

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

7.4.1.3 *No. 5 Edge*—Approximately square edge produced by rolling or filling, or both, after slitting.

8. Workmanship, Finish, and Appearance

8.1 The material shall be free of injurious imperfections and shall correspond to the designated finish as described below.

8.1.1 *Sheet*—The various types of finish procurable on sheet products shall be as follows:

8.1.1.1 *No. 1 Finish*—Hot rolled, annealed, and descaled; produced by hot rolling to specified thicknesses followed by annealing and descaling (see 8.2).

8.1.1.2 *No. 2D Finish*—Dull, cold-rolled finish; produced by cold rolling to the specified thickness, annealing, and descaling. The dull finish results from the descaling and pickling operations.

8.1.1.3 *No. 2B Finish*—Bright, cold-rolled finish; produced by giving a final light cold-rolled pass with polished rolls, to a sheet which has been annealed and descaled.

8.1.1.4 *No. 4 Finish*—General purpose, polished finish. Following initial grinding with coarser abrasives, sheets are generally finished last with abrasives approximately 120 to 150 mesh. Sheets can be produced with one or two sides polished. When polished on one side only, the other side may be rough ground in order to obtain the necessary flatness.

8.1.1.5 *Bright Annealed*—Bright finish produced by cold rolling to thickness, then annealing in a protective atmosphere.

8.1.2 *Strip*—The type of finish procurable on cold-rolled strip shall be as follows:

8.1.2.1 *No. 1 Finish*—Cold rolled to specified thickness, annealed, and pickled (see 8.2). Appearance of this finish is a dull gray.

8.1.2.2 *Bright Annealed*—Bright finish produced by cold rolling to thickness, then annealing in a protective atmosphere.

8.1.3 *Plate*—The types of finish procurable on plates shall be as follows:

8.1.3.1 *Hot Rolled, Annealed*—Scale not removed.

8.1.3.2 *Hot Rolled, Annealed, Descaled*— Scale removed by a blast cleaning or pickling operation.

8.1.3.3 *Cold Rolled, Annealed*—Scale not removed.

8.1.3.4 *Cold Rolled, Annealed, Descaled*— Scale removed by a blast cleaning or pickling operation.

8.2 *Sheet, Strip, and Plate*—Material may be ground to remove surface imperfections, provided such grinding does not reduce the thickness or width at any point beyond the permissible variations in dimensions.

9. Sampling

9.1 *Lots for Chemical Analysis and Mechanical Testing*:

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

9.1.2 *Plate*—A lot of plate for testing and inspection purposes shall consist of the products resulting from the rolling of one heat of material in the same condition (temper) and specified thickness.

9.1.3 *Sheet and Strip*—A lot of sheet or strip for testing and inspection purposes shall consist of material from one heat in the same form (sheet or strip), condition (temper), finish, and specified thickness but in no case more than 25 000 lb (11 340 kg).

NOTE 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

TABLE 3 Mechanical Property Requirements

Alloy	Form	Tensile Strength, min, ksi (MPa)	Yield Strength (0.2 % offset), min, psi (MPa)	Elongation in 2 in. or 50.8 mm, or 4*D*, min, %	Rockwell Hardness (or equivalent)[A]
UNS N08904	sheet	71 (490)	31 000 (215)	35	70–90 HRB
	strip	71 (490)	31 000 (215)	35	70–90 HRB
	plate	71 (490)	31 000 (215)	35	70–90 HRB
UNS N08925	sheet	87 (600)	43 000 (295)	40	...
	strip	87 (600)	43 000 (295)	40	...
	plate	87 (600)	43 000 (295)	40	...
UNS N08932	plate	87 (600)	44 000 (305)	40	...
UNS N08031	sheet	94 (650)	40 000 (276)	40	...
	strip	94 (650)	40 000 (276)	40	...
	plate	94 (650)	40 000 (276)	40	...
UNS N08926	sheet	94 (650)	43 000 (295)	35	...
	strip	94 (650)	43 000 (295)	35	...
	plate	94 (650)	43 000 (295)	35	...
UNS R20033	sheet	109 (750)	55 000 (380)	40	...
	strip	109 (750)	55 000 (380)	40	...
	plate	109 (750)	55 000 (380)	40	...

[A] Hardness values are shown for information only and shall not constitute a basis for acceptance or rejection as long as the other mechanical properties are met.

TABLE 4 Thickness Tolerances for Hot-Rolled and Cold-Rolled Sheets

Specified Thickness,[A] in. (mm)	Tolerance Over and Under, in. (mm)
Over 0.145 (3.68) to less than 3⁄16 (4.76)	0.014 (0.36)
Over 0.130 (3.30) to 0.145 (3.68), incl	0.012 (0.30)
Over 0.114 (2.89) to 0.130 (3.30), incl	0.010 (0.25)
Over 0.098 (2.49) to 0.114 (2.89), incl	0.009 (0.23)
Over 0.083 (2.10) to 0.098 (2.49), incl	0.008 (0.20)
Over 0.072 (1.83) to 0.083 (2.10), incl	0.007 (0.18)
Over 0.058 (1.47) to 0.072 (1.83), incl	0.006 (0.15)
Over 0.040 (1.02) to 0.058 (1.47), incl	0.005 (0.13)
Over 0.026 (0.66) to 0.040 (1.02), incl	0.004 (0.10)
Over 0.016 (0.41) to 0.026 (0.66), incl	0.003 (0.08)
Over 0.007 (0.18) to 0.016 (0.41), incl	0.002 (0.05)
Over 0.005 (0.13) to 0.007 (0.18), incl	0.0015 (0.04)
0.005 (0.13)	0.001 (0.02)

[A] Thickness measurements are taken at least 3⁄8 in. (9.5 mm) from the edge of the sheet.

TABLE 5 Width and Length Tolerances for Hot-Rolled and Cold-Rolled Resquared Sheets (Stretcher Levelled Standard of Flatness)[A]

Specified Dimensions	Tolerance, in.		Tolerance, mm	
	Over	Under	Over	Under
For thicknesses under 0.131 in. (3.33 mm):				
Widths up to 48 in. (1.22 m), excl	1⁄16	0	1.6	0
Widths 48 in. (1.22 m) and over	1⁄8	0	3.2	0
Lengths up to 120 in. (3.05 m), excl	1⁄16	0	1.6	0
Lengths 120 in. (3.05 m) and over	1⁄8	0	3.2	0
For thicknesses 0.131 in. (3.33 mm) and over:				
All widths and lengths	1⁄4	0	6.4	0

[A] Polished sheets with finishes No. 4 are produced to tolerances given in this table.

TABLE 6 Width, Length, and Camber Tolerances for Hot-Rolled and Cold-Rolled Sheets not Resquared

Width Tolerances		
Specified Thickness	Tolerance for Specified Width	
	24 to 48 in. (0.61 to 1.2 m), excl	48 in. (1.2 m) and over
Less than 3⁄16 in. (4.7 mm)	1⁄16 in. (1.6 mm) over, 0 under	1⁄8in. (3.2 mm) over, 0 under

Length Tolerances		
Specified Length	Tolerance	
	Over	Under
Up to 10 ft (3.0 m), incl	1⁄4 in. (6.4 mm)	0
Over 10 ft (3.0 m) to 20 ft (6.1 m), incl	1⁄2 in. (12.7 mm)	0

Camber Tolerances[A]	
Specified Width	Tolerance per Unit Length of Any 8 ft (2.4 m)
24 in. (0.61 m) to 36 in. (0.9 m), incl	1⁄8 in. (3.17 mm)
Over 36 in. (0.9 m)	3⁄32in. (2.38 mm)

[A] Camber is the greatest deviation of a side edge from a straight line, the measurement being taken on the concave side with a straight edge.

TABLE 7 Flatness Tolerances for Hot-Rolled and Cold-Rolled Sheets

Sheets Not Specified to Stretcher Levelled Standard of Flatness (Exclusive of Dead Soft and Deep Drawing Sheets)		
Specified Thickness	Width	Flatness Tolerance (max deviation from a horizontal flat surface)
0.062 in. (1.57 mm) and over	To 60 in. (1.5 m), incl	½ in. (12.7 mm)
	Over 60 in. (1.5 m) to 72 in. (1.8 m), incl	¾ in. (19.0 mm)
	Over 72 in. (1.8 m)	1 in. (25.4 mm)
Under 0.062 in. (1.57 mm)	To 36 in. (0.9 m), incl	½ in. (12.7 mm)
	Over 36 in. (0.9 m) to 60 in. (1.5 m), incl	¾ in. (19.0 mm)
	Over 60 in. (1.5 m)	1 in. (25.4 mm)

Sheets Specified to Stretcher-Levelled Standard of Flatness			
Specified Thickness	Width	Length	Flatness Tolerance (max deviation from a horizontal flat surface)
Under 3⁄16 in. (4.75 mm)	to 48 in. (1.22 m), incl	to 96 in. (2.44 m), incl	1⁄8 in. (3.17 mm)
Under 3⁄16 in. (4.75 mm)	to 48 in. (1.22 m), incl	Over 96 in. (2.44 m)	1⁄4 in. (6.35 mm)
Under 3⁄16 in. (4.75 mm)	Over 48 in. (1.22 m)	to 96 in. (2.44 m), incl	1⁄4 in. (6.35 mm)
Under 3⁄16 in. (4.75 mm)	Over 48 in. (1.22 m)	Over 96 in. (2.44 m)	1⁄4 in. (6.35 mm)

TABLE 8 Diameter Tolerances for Hot-Rolled and Cold-Rolled Sheets Sheared Circles

Specified Thickness	Tolerance Over Specified Diameter (No Tolerance Under)		
	Diameters Under 30 in. (0.762 m)	Diameters 30 to 48 in (0.762 m to 1.219 m)	Diameters Over 48 in. (1.219 m)
0.0972 in. (2.47 mm) and thicker	1⁄8 in. (3.17 mm)	3⁄16 in. (4.76 mm)	1⁄4 in. (6.35 mm)
0.0971 in. (2.47 mm) to 0.0568 in. (1.443 mm), incl	3⁄32 in. (2.38 mm)	5⁄32 in. (3.97 mm)	7⁄32 in. (5.56 mm)
0.0567 in. (1.440 mm) and thinner	1⁄16in. (1.59 mm)	1⁄8 in. (3.17 mm)	3⁄16 in. (4.75 mm)

TABLE 9 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*) Any item of five sheets or less, or any item estimated to weigh 200 lb (90.7 kg) or less, may actually weigh as much as 10 % over the theoretical weight.

(*2*) Any item of more than five sheets and estimated to weigh more than 200 lb (90.7 kg) may actually weigh as much as 7.5 % over the theoretical weight.

The underweight variations for sheets are limited by the under thickness tolerances shown in Table 4.

For determining estimated weights the following factors are used:

41.9 lb/ft^2·in. thickness or

19.0 kg/cm^2·mm thickness.

condition, except that for plates weighing over 500 lb, only one specimen shall be taken.

9.2 *Sampling for Chemical Analysis*:

9.2.1 A representative sample shall be taken from each heat during pouring or subsequent processing.

9.2.2 If the manufacturer determines that the material meets the chemical requirements during pouring or subsequent processing, he shall not be required to sample and analyze the finished product.

9.2.3 Product analysis, if performed, shall be wholly the responsibility of the purchaser.

9.3 *Sampling for Mechanical Tests*:

9.3.1 A sample of the material to provide test specimens for mechanical tests shall be taken from such a location in each lot as to be representative of that lot.

9.3.2 When samples are to be taken after delivery, the purchaser of material ordered to cut lengths may request on the purchase order additional material of adequate size to provide sample coupons for inspection purposes.

10. Number of Tests

10.1 In the case of sheet or strip supplied in coil form, two or more tension tests (one from each end of each coil) and one or more hardness tests shall be made on specimens taken from each end of the coil. When material is supplied in flat sheet, flat strip, or plate, one tension, and one or more hardness tests, shall be made on each 100 or less sheets, strips, or plates of the same lot.

10.2 If any specimens selected to represent any heat fail to meet any of the test requirements, the material represented by such specimens may be reheat-treated and resubmitted for test.

11. Specimen Preparation

11.1 Tension test specimens from material under ½ in. (12.7 mm) in thickness shall be of the full thickness of the material and machined to the form and dimensions shown for the sheet-type specimen in Test Methods E 8.

11.2 Tension test specimens from material ½ in. (12.7 mm) and over shall be of the full thickness of the material, machined to the form and dimensions shown for the plate-type specimen in Test Methods E 8, or shall be the largest possible round specimen shown in Test Methods E 8. In case of dispute, the referee method shall be to use the plate-type specimen.

11.3 Tension test specimens shall be taken from material after final heat treatment and shall be selected in the transverse direction unless prohibited by width.

12. Test Methods

12.1 The chemical composition and mechanical properties of the material as enumerated in this specification shall, in case of disagreement, be determined in accordance with the following methods:

TABLE 10 Thickness Tolerances for Cold-Rolled Strip

Specified Thickness, in.	Thickness Tolerances for the Thicknesses and Widths Over and Under, in Width, in.							
	¾ to 1, incl	Over 1 to 3, incl	Over 3 to 6, incl	Over 6 to 9, incl	Over 9 to 12, incl	Over 12 to 16, incl	Over 16 to 20, incl	Over 20 to 24, excl
	Thickness Tolerances, in.							
Over 0.160 to less than 3⁄16	0.002	0.003	0.004	0.004	0.004	0.005	0.006	0.006
Over 0.099 to 0.160, incl	0.002	0.002	0.003	0.004	0.004	0.004	0.005	0.005
Over 0.068 to 0.099, incl	0.002	0.002	0.003	0.003	0.003	0.004	0.004	0.004
Over 0.049 to 0.068, incl	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.004
Over 0.039 to 0.049, incl	0.002	0.002	0.0025	0.003	0.003	0.003	0.004	0.004
Over 0.034 to 0.039, incl	0.002	0.002	0.0025	0.003	0.003	0.003	0.003	0.003
Over 0.028 to 0.034, incl	0.0015	0.0015	0.002	0.0025	0.0025	0.0025	0.003	0.003
Over 0.025 to 0.028, incl	0.001	0.0015	0.0015	0.002	0.002	0.002	0.0025	0.003
Over 0.019 to 0.025, incl	0.001	0.001	0.0015	0.002	0.002	0.002	0.0025	0.0025
Over 0.016 to 0.019, incl	0.001	0.001	0.001	0.0015	0.0015	0.002	0.002	0.002
Over 0.012 to 0.016, incl	0.001	0.001	0.001	0.0015	0.0015	0.0015	0.002	0.002
Over 0.011 to 0.012, incl	0.001	0.001	0.001	0.0015	0.0015	0.0015	0.0015	0.0015
Over 0.010 to 0.011, incl	0.001	0.001	0.001	0.001	0.0015	0.0015	0.0015	0.0015
0.010	0.001	0.001	0.001	0.001	0.001	0.001	0.0015	0.0015
Specified Thickness, mm	Thickness Tolerances for the Thicknesses and Widths Given Over and Under, mm Width, mm							
	19.05 to 25.4, incl	Over 25.4 to 76.2, incl	Over 76.2 to 152.4, incl	Over 152.4 to 228.6, incl	Over 228.6 to 304.8, incl	Over 304.8 to 406.4, incl	Over 406.4 to 508.0, incl	Over 508.0 to 609.6, excl
	Thickness Tolerance, mm							
Over 4.06 to less than 4.76	0.05	0.08	0.10	0.10	0.10	0.13	0.15	0.15
Over 2.51 to 4.06, incl	0.05	0.05	0.08	0.10	0.10	0.10	0.13	0.13
Over 1.73 to 2.51, incl	0.05	0.05	0.08	0.08	0.08	0.10	0.10	0.10
Over 1.24 to 1.73, incl	0.05	0.05	0.08	0.08	0.08	0.08	0.10	0.10
Over 0.99 to 1.24, incl	0.05	0.05	0.06	0.08	0.08	0.08	0.10	0.10
Over 0.86 to 0.99, incl	0.05	0.05	0.06	0.08	0.08	0.08	0.08	0.08
Over 0.71 to 0.86, incl	0.04	0.04	0.05	0.06	0.06	0.06	0.08	0.08
Over 0.64 to 0.71, incl	0.02	0.04	0.04	0.05	0.05	0.05	0.06	0.08
Over 0.48 to 0.64, incl	0.02	0.02	0.04	0.05	0.05	0.05	0.06	0.06
Over 0.41 to 0.48, incl	0.02	0.02	0.02	0.04	0.04	0.05	0.05	0.05
Over 0.30 to 0.41, incl	0.02	0.02	0.02	0.04	0.04	0.04	0.05	0.05
Over 0.28 to 0.30, incl	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04
Over 0.25 to 0.28, incl	0.02	0.02	0.02	0.02	0.02	0.04	0.04	0.04
0.25	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.04

TABLE 11 Crown Tolerances for Cold-Rolled Strip

NOTE 1—Cold-rolled strip may be thicker at the middle than at the edges by the amounts given in this table.

Specified Thickness	Additional Thickness, at Middle of Strip Over That Shown in Table 10 for Edge Measurement, for Widths and Thicknesses Given		
	Width		
	To 5 in. (127 mm), incl	Over 5 in. (127 mm) to 12 in. (304.8 mm), incl	Over 12 in. (304.8 mm) to 24 in. (609.6 mm), excl
0.005 in. (0.13 mm) to 0.010 in. (0.25 mm), incl	0.00075 in. (0.02 mm)	0.001 in. (0.02 mm)	0.0015 in. (0.04 mm)
Over 0.010 in. (0.25 mm) to 0.025 in. (0.64 mm), incl	0.001 in. (0.02 mm)	0.0015 in. (0.04 mm)	0.002 in. (0.05 mm)
Over 0.025 in. (0.64 mm) to 0.065 in. (1.65 mm), incl	0.0015 in. (0.04 mm)	0.002 in. (0.05 mm)	0.0025 in. (0.06 mm)
Over 0.065 in. (1.65 mm) to 3⁄16 in. (4.75 mm), excl	0.002 in. (0.05 mm)	0.0025 in. (0.06 mm)	0.003 in. (0.08 mm)

Test	ASTM Designations
Chemical Analysis	E 38, E 353[A,B]
Tension	E 8
Brinell Hardness	E 10
Rockwell Hardness	E 18
Hardness Conversion	E 140
Rounding Procedure	E 29
Method of Sampling	E 55

[A] Iron shall be determined arithmetically by difference.

[B] Methods E 38 are to be used only for elements not covered by Test Methods E 353.

12.2 For purposes of determining compliance with the limits in this specification, an observed value or a calculated value shall be rounded as indicated in accordance with the rounding method of Practice E 29.

Requirements	Rounded Unit for Observed or Calculated Value
Chemical composition hardness and tolerance (when expressed in decimals)	Nearest unit in the last right-hand place of figures of the specified limit
Tensile strength and yield strength	Nearest 1000 psi (7 MPa)
Elongation	Nearest 1

TABLE 12 Width Tolerances for Cold-Rolled Strip of Edge Numbers 1, 3, and 5

Edge Numbers 1 and 5				
Specified Edge No.	Width	Thickness	Width Tolerance for Thickness and Width Given	
			Over	Under
1 and 5	9/32 in. (7.14 mm) and under	1/16 in. (1.59 mm) and under	0.005 in. (0.13 mm)	0.005 in. (0.13 mm)
1 and 5	Over 9/32 in. (7.14 mm) to 3/4 in. (19.050 mm), incl	3/32 in. (2.38 mm) and under	0.005 in. (0.13 mm)	0.005 in. (0.13 mm)
1 and 5	Over 3/4 in. (19.050 mm) to 5 in. (127.0 mm), incl	1/8 in. (3.17 mm) and under	0.005 in. (0.13 mm)	0.005 in. (0.13 mm)
5	Over 5 in. (127.0 mm) to 9 in. (228.6 mm), incl	1/8 in. (3.17 mm) to 0.008 in. (0.20 mm), incl	0.010 in. (0.25 mm)	0.010 in. (0.25 mm)
5	Over 9 in. (228.6 mm) to 20 in. (508.0 mm), incl	0.105 in. (2.667 mm) to 0.015 in. (0.381 mm)	0.010 in. (0.25 mm)	0.010 in. (0.25 mm)
5	Over 20 in. (508.0 mm) to 23 15/16 in. (608.0 mm), incl	0.080 in. (2.032 mm) to 0.023 in. (0.584 mm)	0.015 in. (0.38 mm)	0.015 in. (0.38 mm)

Edge Number 3						
Specified Thickness, in.	Width Tolerance for Thickness and Width Given, Over and Under, in.					
	Under 1/2 to 3/16, incl	1/2 to 6, incl	Over 6 to 9, incl	Over 9 to 12, incl	Over 12 to 20, incl	Over 20 to 24, excl
Under 3/16 in. to 0.161, incl	...	0.016	0.020	0.020	0.031	0.031
0.16 to 0.100, incl	0.010	0.010	0.016	0.016	0.020	0.020
0.100 to 0.069, incl	0.008	0.008	0.010	0.010	0.016	0.020
0.068	0.005	0.005	0.005	0.010	0.016	0.020
Specified Thickness, mm	Width Tolerance for Thickness and Width Given, Over and Under, mm					
	Under 12.7 to 4.76, incl	12.7 to 152.4, incl	Over 152.4 to 228.6, incl	Over 228.6 to 304.8, incl	Over 304.8 to 508.0, incl	Over 508.0 to 609.6, excl
Under 4.76 to 4.09, incl	...	0.41	0.51	0.51	0.79	0.79
4.09 to 2.54, incl	0.25	0.25	0.41	0.41	0.51	0.51
2.54 to 1.75, incl	0.20	0.20	0.25	0.25	0.41	0.51
1.75 and under	0.13	0.13	0.13	0.25	0.41	0.51

TABLE 13 Length and Camber Tolerances for Cold-Rolled Strip

Length Tolerances	
Specified Length	Tolerance, Over Specified Length (No Tolerance Under)
To 5 ft (1.5 m), incl	3/8 in. (9.52 mm)
Over 5 ft (1.5 m) to 10 ft (3.0 m), incl	1/2 in. (12.70 mm)
Over 10 ft (3.0 m) to 20 ft (6.1 m), incl	5/8 in. (15.88 mm)
Camber Tolerances[A]	
Specified Width, in. (mm)	Tolerance per Unit Length of Any 8 ft (2438 mm), in. (mm)
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)

[A] Camber is the deviation of a side edge from a straight line, and measurement is taken by placing an 8-ft (2.4-m) straightedge on the concave side and measuring the greatest distance between the strip edge and the straightedge.

TABLE 14 Thickness Tolerances of Plates

NOTE 1—Thickness is measured along the longitudinal edges of the plate at least 3/8 in. (9.53 mm) from the edge.

Specified Thickness, in. (mm)	Width,[A] in. (m)			
	Tolerance Over Specified Thickness,[B] in. (mm)			
	To 84 (2.1), incl	Over 84 to 120 (2.1 to 3.0), incl	Over 120 to 144 (3.0 to 3.7), incl	Over 144 (3.7)
3/16 to 3/8 (4.76 to 9.52), excl	0.046 (1.17)	0.050 (1.27)	...	...
3/8 to 3/4 (9.52 to 19.05), excl	0.054 (1.37)	0.058 (1.47)	0.075 (1.90)	0.090 (2.29)
3/4 to 1 (19.05 to 25.40), excl	0.060 (1.52)	0.064 (1.63)	0.083 (2.11)	0.100 (2.54)
1 to 2 (25.40 to 50.80), incl[C]	0.070 (1.78)	0.074 (1.88)	0.095 (2.41)	0.115 (2.92)

[A] For circles the above over-thickness tolerances apply to the diameter of the circle corresponding to the width ranges shown. For plates of irregular shape the above over-thickness tolerances apply to the greatest width corresponding to the width ranges shown.
[B] For plates up to 2 in. (50.8 mm), incl, in thickness, the tolerance under specified thickness is 0.01 in. (0.25 mm).
[C] Plates over 2 in. (50.8 mm) thick are produced. Thickness tolerances for such plates are not included.

13. Inspection

13.1 Inspection of the material by the purchaser shall be made as agreed upon by the purchaser and the manufacturer as set forth in the purchase contract.

14. Rejection and Rehearing

14.1 *Rejection*:

14.1.1 Any rejection based on tests made by the purchaser in accordance with this specification shall be reported to the