Designation: B 814 – 02

Standard Specification for Nickel-Chromium-Iron-Molybdenum-Tungsten Alloy (UNS N06920) Plate, Sheet, and Strip[1]

This standard is issued under the fixed designation B 814; 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-chromium-iron-molybdenum-tungsten alloy UNS N06920 in the form of rolled plate, sheet, and strip for general corrosion service.

1.2 The following products are covered under this specification:

1.2.1 *Sheet and Strip*—Hot or cold rolled, annealed and descaled unless solution-annealing is performed in an atmosphere yielding a bright finish; and

1.2.2 *Plate*—Hot rolled, solution-annealed, and descaled.

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

1.4 *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 heal 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 Alloys[2]

E 8 Test Methods for Tension Testing of Metallic Materials[3]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[4]

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

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

3.1.2 *sheet and strip*—material under 3⁄16 in. (4.76 mm) in thickness.

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 *Alloy*.

4.1.2 *Dimensions*—Thickness (in decimals of an inch), width, and length (inch or fraction of an inch).

4.1.3 *Certification*—State whether a report of test results is required (Section 15).

4.1.4 *Optional Requirement*—Plate; state how the plate is to be cut (see 7.8.1 and Table 1).

4.1.5 *Purchase Inspection*—State which tests or inspections are to be witnessed (Section 13).

4.1.6 *Samples for Product (Check) Analysis*—State whether samples shall be furnished (9.2.2).

5. Chemical Composition

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

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

6. Mechanical Properties and Other Requirements

6.1 *Tensile Properties*—The material shall conform to the room temperature tensile properties prescribed in Table 3.

7. Dimensions, Mass, and Permissible Variations

7.1 For the purposes of calculating the weight of the material covered by this specification, a density of 0.303 lb/in.^{3}(8.39 g/cm^3) shall be used.

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

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[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 Permissible Variations in Width and Length of Sheared, Plasma-Torch-Cut, or Abrasive Cut Rectangular Plate

Specified Thickness	Permissible Variations in Widths and Lengths for Dimensions Given, in. (mm)			
	Up to 30 (760), incl		Over 30 (760)	
	+	−	+	−
Inches				
Sheared:				
3/16 to 5/16	3/16	1/8	1/4	1/8
5/16 to 1/2 , incl	1/4	1/8	3/8	1/8
Abrasive Cut:				
3/16 to 1 1/2 , incl	1/16	1/16	1/16	1/16
Over 1 1/2 to 2 1/2 , incl	1/8	1/8	1/8	1/8
Plasma-Torch-Cut:[A]				
3/16 to 2, excl	1/2	0	1/2	0
2 to 3, incl	5/8	0	5/8	0
Millimetres				
Sheared:				
4.76 to 7.94, excl	4.76	3.18	6.35	3.18
7.94 to 12.70, incl	6.35	3.18	9.52	3.18
Abrasive Cut:				
4.76 to 38.1, incl	1.59	1.59	1.59	1.59
Over 38.1 to 63.5, incl	3.18	3.18	3.18	3.18
Plasma-Torch-Cut:[A]				
4.8 to 50.8, excl	12.7	0	12.7	0
50.8 to 76.2, incl	15.9	0	15.9	0

[A]The tolerance spread shown for plasma-torch-cutting may be obtained all on the minus side, or divided between the plus and the minus side if so specified by the purchaser.

TABLE 2 Chemical Requirements

Element	Composition Limits, %
Chromium	20.5–23.0
Iron	17.0–20.0
Molybdenum	8.0–10.0
Tungsten	1.0–3.0
Carbon, max	0.03
Cobalt, max	5.0
Manganese, max	1.0
Phosphorus, max	0.040
Sulfur, max	0.030
Silicon, max	1.0
Nickel	Remainder[A]

[A]See 12.1.1.

TABLE 3 Mechanical Property Requirements

Tensile Strength, min, ksi (MPa)	95 (655)
Yield Strength, min, ksi (MPa)	35 (240)
Elongation in 2 in. (50.8 mm) or 4*D*[A], min,%	35

[A]*D* refers to the diameter of the tension specimen.

7.2 *Thickness*:

7.2.1 *Plate*—The permissible variations in thickness of plate shall be as prescribed in Table 4 and Table 5.

7.2.2 *Sheet and Strip*—The permissible variations in thickness of sheet and strip shall be as prescribed in Table 6. The thickness shall be measured with the micrometer spindle 3/8 in. (9.525 mm) or more from any edge for material 1 in. (25.4 mm) or over in width and at any place on material under 1 in. (25.4 mm) in width.

TABLE 4 Permissible Variations in Thickness of Plate[A]

Specific Thickness, in. (mm)	Permissible Variations in Thickness, in. (mm)[B,C]	
	+	−
3/16 to 7/32 (4.762 to 5.556), incl	0.021 (0.53)	0.010 (0.25)
Over 7/32 to 1/4 (5.556 to 6.350), incl	0.024 (0.61)	0.010 (0.25)
Over 1/4 to 3/8 (6.350 to 9.525), incl	0.027 (0.69)	0.010 (0.25)
Over 3/8 to 1/2 (9.525 to 12.70), incl	0.030 (0.76)	0.010 (0.25)
Over 1/2 to 5/8 (12.70 to 15.88), incl	0.035 (0.89)	0.010 (0.25)
Over 5/8 to 3/4 (15.88 to 19.05), incl	0.040 (1.02)	0.010 (0.25)
Over 3/4 to 7/8 (19.05 to 22.25), incl	0.045 (1.14)	0.010 (0.25)
Over 7/8 to 1 (22.22 to 25.4), incl	0.050 (1.27)	0.010 (0.25)
Over 1 to 2 1/2 (25.4 to 63.5), incl	5[D]	0.010 (0.25)

[A]Applicable to plate 48 in. (1219 mm) and under in width.
[B]Measured 3/8 in. (9.525 mm) or more from any edge.
[C]Buffing or grinding for removal of light surface imperfections shall be permitted. The depth of such buffed or ground areas shall not exceed the minimum tolerance thickness.
[D]Expressed as percent of thickness.

7.3 *Width*:

7.3.1 *Plate*—The permissible variations in width of rectangular plates shall be as prescribed in Table 1.

7.3.2 *Sheet and Strip*—The permissible variations in width for sheet and strip shall be as prescribed in Table 7.

7.4 *Length*:

7.4.1 *Plate*—Permissible variations in the length of rectangular plate shall be as prescribed in Table 1.

7.4.2 *Sheet and Strip*—Sheet and strip may be ordered to cut lengths, in which case a variation of 1/8 in. (3.175 mm) over the specified length shall be permitted, with a 0 minus tolerance.

7.5 *Straightness*:

7.5.1 The edgewise curvature (depth of chord) of flat sheet, strip, and plate shall not exceed the product of 0.05 in. multiplied by the length in feet (0.04 mm multiplied by the length in centimetres).

7.5.2 Straightness for coiled strip is subject to agreement between the manufacturer and the purchaser.

7.6 *Squareness (Sheet)*—For sheets of all thicknesses and widths of 6 in. (152.4 mm) or more, the angle between adjacent sides shall be 90 ±0.15° (1/16 in. in 24 in. or 2.6 mm/m).

7.7 *Flatness*—Plate, sheet, and strip shall be commercially flat.

7.8 *Edges*:

7.8.1 Plates shall have sheared, abrasive cut, or plasma-torch-cut edges as specified.

7.8.2 Sheet and strip shall have sheared or slit edges.

8. Workmanship, Finish, and Appearance

8.1 The material shall be uniform in quality and condition, smooth, and free of injurious defects.

9. Sampling

9.1 *Lots for Chemical Analysis and Mechanical Testing*:

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

TABLE 5 Permissible Variations in Thickness for Wide Plates[A]

Specified Thickness[B], in. (mm)	Width, in. (mm)			
	Over 48 (1219 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[C], in. (mm)			
⅜ (9.52) to ¾ (19.05), excl	0.055 (1.40)	0.060 (1.52)	0.075 (1.90)	0.090 (2.29)
¾ (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)

[A]Thickness is measured along the longitudinal edges of the plate at least ⅜ in. (9.52 mm), but not more than 3 in. (76.20 mm), from the edge.
[B]Plates over 2 in. (50.80 mm) thick are produced. Thickness tolerances for such plates are not included.
[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. For plates up to 2 in. (50.80 mm), inclusive, in thickness, the tolerance under the specified thickness is 0.010 in. (0.25 mm).

TABLE 6 Permissible Variations in Thickness of Sheet[A] and Strip

Specified Thickness, in. (mm)	Permissible Variations in Thickness, in.[B,C] (mm) (All Widths)	
	+	−
0.020 to 0.034 (0.51 to 0.86), incl	0.004 (0.10)	0.004 (0.10)
Over 0.034 to 0.056 (0.86 to 1.42), incl	0.005 (0.13)	0.005 (0.13)
Over 0.056 to 0.070 (1.42 to 1.78), incl	0.006 (0.15)	0.006 (0.15)
Over 0.070 to 0.078 (1.78 to 1.98), incl	0.007 (0.18)	0.007 (0.18)
Over 0.078 to 0.093 (1.98 to 2.36), incl	0.008 (0.20)	0.008 (0.20)
Over 0.093 to 0.109 (2.36 to 2.77), incl	0.009 (0.23)	0.009 (0.23)
Over 0.109 to 0.125 (2.77 to 3.18), incl	0.010 (0.25)	0.010 (0.25)
Over 0.125 to 0.140 (3.18 to 3.56), incl	0.013 (0.33)	0.010 (0.25)
Over 0.140 to 0.171 (3.56 to 4.34), incl	0.016 (0.41)	0.010 (0.25)
Over 0.171 to 0.187 (4.34 to 4.75), incl	0.018 (0.46)	0.010 (0.25)

[A]Applicable to sheet 48 in. (1219 mm) and under in width.
[B]Measured ⅜ in. (9.525 mm) or more from any edge.
[C]Buffing for removal of light surface imperfections shall be permitted. The depth of such buffed areas shall not exceed the permissible minus variation.

9.1.2 A lot of plate, sheet, or strip for mechanical testing shall be defined as the material from one heat in the same condition and specified thickness.

9.2 *Sampling for Chemical Analysis*:

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

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

9.3 *Sampling for Mechanical Testing*—Representative samples shall be taken from each lot of finished material.

10. Number of Tests and Retests

10.1 *Chemical Analysis*—One test per heat.

10.2 *Tension Tests*—One test per lot.

10.3 *Retests*—If one of the specimens used in the above tests of any lot fails to meet the specified requirements, two additional specimens shall be taken from different sample pieces and tested. The results of the tests on both of these specimens shall meet the specified requirements.

11. Specimen Preparation

11.1 Tension test specimens shall be taken from material in the final condition and tested transverse to the direction of rolling when width will permit.

11.2 Tension test specimens shall be any of the standard or subsize specimens described 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, machined to the form and dimensions given for the sheet-type specimen in Test Methods E 8 for material under ½ in. (12.7 mm) in thickness.

11.3.2 The largest possible round specimen described in Test Methods E 8 for material ½ in. (12.7 mm) and over.

12. Test Methods

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

12.1.1 *Chemical Analysis*—Test Methods E 1473.

12.1.2 *Tension Test*—Test Methods E 8.

12.1.3 *Determining Significant Places*—Practice E 29.

12.1.4 *Method of Sampling*—Practice E 55.

12.2 For purposes of determining compliance with the limits in this specification, an observed or calculated value shall be rounded 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 %

13. Inspection

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

14. Rejection and Rehearing

14.1 Material evaluated by the purchaser 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 rehearing.

15. Certification

15.1 A manufacturer's certification shall be furnished to the purchaser stating that the material has been manufactured, tested, and inspected in accordance with this specification, and that the test results on representative samples meet specification requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

TABLE 7 Permissible Variations in Width of Sheet and Strip

Specified Thickness, in. (mm)	Specified Width, in. (mm)	Permissible Variations, in Specified Width, in. (mm)	
		+	–
	Sheet		
0.187 (4.75) and Under	2 (50.8) and Over	0.125 (3.18)	0
	Strip (Slit Edges)		
Over 0.020 to 0.075 (0.51 to 1.90), incl	24 (610) and under	0.007 (0.18)	0.007 (0.18)
Over 0.075 to 0.100 (1.90 to 2.54), incl	24 (610) and under	0.009 (0.23)	0.009 (0.23)
Over 0.100 to 0.125 (2.54 to 3.18), incl	24 (610) and under	0.012 (0.30)	0.012 (0.30)

16. Product Marking

16.1 Each plate, sheet, or strip shall be marked on one face with the specification number, heat number, manufacturer's identification, and size. The markings shall have no deleterious effect on the material or its performance and shall be sufficiently stable to withstand normal handling.

16.2 Each bundle or shipping container shall be marked with this specification number; the size; gross, tare, and net weight; consignor and consignee address; contract or order number; and such other information as may be defined in the contract or order.

17. Keywords

17.1 plate; sheet; strip; UNS N06920

APPENDIX

(Nonmandatory Information)

X1. HEAT TREATMENT

X1.1 Proper heat treatment during or subsequent to fabrication is necessary for optimum performance, and the manufacturer shall be consulted for details.