



Designation: B 818 – 98a

## Standard Specification for Cobalt-Chromium-Nickel-Molybdenum-Tungsten Alloy (UNS R31233) Plate, Sheet and Strip<sup>1</sup>

This standard is issued under the fixed designation B 818; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification covers cobalt-chromium-nickel-molybdenum-tungsten alloy UNS R31233 in the form of rolled plate, sheet, and strip for wear applications and 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.

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.

### 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<sup>2</sup>

E 8 Test Methods for Tension Testing of Metallic Materials<sup>3</sup>

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications<sup>4</sup>

E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition<sup>5</sup>

E 1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys<sup>6</sup>

### 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.

3.1.2 *sheet and strip*—material under  $\frac{3}{16}$  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 the safe and satisfactory performance of material ordered under 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 if a report of test results is required (see Section 15).

4.1.4 *Optional Requirement*—Plate; state how plate is to be cut (see 7.7.1 and Table 1).

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

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

### 5. Chemical Composition

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

5.2 If a product (check) analysis is made by the purchaser, the material shall conform to the requirements specified in Table 2 subject to the permissible tolerances per 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 *Thickness:*

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

7.1.2 *Sheet and Strip*—The permissible variations in thickness of sheet and strip shall be as prescribed in Table 5. The thickness shall be measured with the micrometer spindle  $\frac{3}{8}$  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. in width.

7.2 *Width:*

7.2.1 *Plate*—The permissible variations in width of rectangular plates shall be as prescribed in Table 6.

7.2.2 *Sheet and Strip*—The permissible variations in width

<sup>1</sup> 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.

Current edition approved Oct. 10, 1998. Published November 1998. Originally published as B 818 – 91. Last previous edition B 818 – 98.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 02.04.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 03.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 14.02.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 03.05.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 03.06.



**TABLE 1 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)

**TABLE 2 Chemical Requirements**

Element	Composition Limits, %
Boron	0.015 max
Carbon	0.02–0.10
Chromium	23.5–27.5
Iron	1.0–5.0
Manganese	0.1–1.5
Molybdenum	4.0–6.0
Nitrogen	0.03–0.12
Nickel	7.0–11.0
Phosphorous	0.030 max
Sulfur	0.020 max
Silicon	0.05–1.00
Tungsten	1.0–3.0
Cobalt	Remainder <sup>A</sup>

<sup>A</sup>See 12.1.1.

**TABLE 3 Mechanical Property Requirements**

Tensile Strength, min, ksi (MPa)	130 (896)
Yield Strength, min, ksi (MPa)	55 (379)
Elongation in 2 in. (50.8 mm) or 4D <sup>A</sup> min %	15

<sup>A</sup>D refers to the diameter of the tension specimen.

**TABLE 4 Permissible Variations in Thickness of Plate<sup>A</sup>**

Specified Thickness, in. (mm)	Permissible Variations in Thickness, in. (mm) <sup>B,C</sup>	
	+	-
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 (22.25 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 <sup>D</sup>	0.010 (0.25)

<sup>A</sup>Applicable to plate 48 in. (1219 mm) and under in width.

<sup>B</sup>Measured 3/8 in. (9.525 mm) or more from any edge.

<sup>C</sup>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.

<sup>D</sup>Expressed as percentage of thickness.

for sheet and strip shall be as prescribed in Table 1.

**7.3 Length:**

**7.3.1 Plate**—Permissible variations in the length of rectangular plate shall be as prescribed in Table 6.

**7.3.2 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.

**7.4 Straightness:**

**7.4.1** The edgewise curvature (depth of chord) of flat sheet, strip, and plate shall not exceed the product of 0.05 in.

**TABLE 5 Permissible Variations in Thickness of Sheet<sup>A</sup> and Strip**

Specified Thickness, in. (mm)	Permissible Variations in Thickness, in. (mm) (All Widths) <sup>B,C</sup>	
	+	-
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)

<sup>A</sup>Applicable to sheet 48 in. (1219 mm) and under in width.

<sup>B</sup>Measured 3/8 in. (9.525 mm) or more from any edge.

<sup>C</sup>Buffing for removal of light surface imperfections shall be permitted. The depth of such buffed areas shall not exceed the permissible minus variation.

**TABLE 6 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				
<i>Sheared:</i>				
3/16 to 5/16, excl	3/16	1/8	1/4	1/8
5/16 to 1/2, incl	1/4	1/8	3/8	1/8
<i>Abrasive cut:</i>				
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
<i>Plasma-torch-cut:</i> <sup>A</sup>				
3/16 to 2, excl	1/2	0	1/2	0
2 to 3, incl	1/8	0	3/8	0
millimetres				
<i>Sheared:</i>				
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
<i>Abrasive cut:</i>				
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
<i>Plasma-torch-cut:</i> <sup>A</sup>				
4.8 to 50.8, excl	12.7	0	12.7	0
50.8 to 76.2, incl	15.9	0	15.9	0

<sup>A</sup>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.

multiplied by the length in feet (0.04 mm multiplied by the length in centimetres).

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

**7.5 Squareness (Sheet)**—For sheets of all thicknesses and widths of 6 in. (152.4 mm) or more, the angle between adjacent