Designation: B 755 – 00

Standard Specification for Nickel-Chromium-Molybdenum-Tungsten Alloys (UNS N06110) Plate, Sheet, and Strip[1]

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1. Scope

1.1 This specification covers rolled nickel-chromium-molybdenum-tungsten alloys (UNS N06110)[2] plate, sheet, and strip.

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

2. Referenced Documents

2.1 *ASTM Standards:*

B 756 Specification for Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06110) Rod and Bar[3]

B 880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys[3]

E 8 Test Methods for Tension Testing of Metallic Materials[4]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[5]

E 1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys[6]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 The terms given in Table 1 shall apply.

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 *ASTM designation*.

4.1.2 *Alloy name or UNS number*.

4.1.3 *Condition*—Table 2 and Appendix X1.

4.1.4 *Finish*—Appendix X1.

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

4.1.6 *Quantity*.

4.1.7 *Optional Requirements*:

4.1.7.1 *Sheet and Strip*—Whether to be furnished in coil, in cut straight lengths, or in random straight lengths, and

4.1.7.2 *Plate*—How plate is to be cut (Table 3 and Table 4).

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

4.1.9 *Samples for Product (Check) Analysis*—Whether samples for product (check) analysis should be furnished (see 5.2).

4.1.10 *Purchaser Inspection*—If the purchaser wishes to witness tests or inspection of material at place of manufacture, the purchase order must so state indicating which tests or inspections are to be witnessed (see Section 13).

5. Chemical Composition

5.1 The material shall conform to the composition limits specified in Table 5.

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

6. Mechanical Properties

6.1 The material shall conform to the mechanical properties specified in Table 2.

7. Dimensions and Permissible Variations

7.1 *Thickness and Weight*:

7.1.1 *Plate*—For plate up to 2 in. (50.8 mm), inclusive, in thickness, the permissible variation under the specified thickness and permissible excess in overweight shall not exceed the amounts prescribed in Table 6.

7.1.1.1 For use with Table 6, plate shall be assumed to weigh 0.303 lb/in.^{3}(8.386 g/cm^3).

[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 Their Alloys.

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[2] New designation established in accordance with ASTM E527 and SAE J1086, Recommended Practice for Numbering Metals and Alloys (UNS).

[3] *Annual Book of ASTM Standards*, Vol 02.04.

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

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

[6] *Annual Book of ASTM Standards*, Vol 03.06.

TABLE 1 Product Description

Product	Thickness, in. (mm)	Width, in. (mm)
Hot-rolled plate[A]	3/16 (4.8) and over (Table 4 and Table 5)	(Table 7)[B]
Hot-rolled sheet[A]	0.018 to 0.250 (0.46 to 6.4), incl (Table 6)	(Table 9)
Cold-rolled sheet[C]	0.018 to 0.250 (0.46 to 6.4), incl (Table 6)	(Table 9)
Cold rolled strip[C]	0.005 to 0.250 (0.13 to 6.4), incl (Table 6)	(Table 9)

[A] Material 3/16 to 1/4 in. (4.8 to 6.4 mm), incl, in thickness may be furnished as sheet or plate provided the material meets the specification requirements for the condition ordered.

[B] Hot-rolled plate, in widths 10 in. (254 mm) and under, may be furnished as hot-finished rectangles with shared or cut edges in accordance with Specification B 446 provided the mechanical property requirements of this specification are met.

[C] Material under 48 in. (1219 mm) in width may be furnished as sheet or strip provided the material meets the specification requirements for the condition ordered.

TABLE 2 Mechanical Properties for Plate, Sheet, and Strip (All Thicknesses and Sizes Unless Otherwise Indicated)

Condition (Temper)	Tensile strength, min, ksi (MPa)	Yield strength[A] (0.2% offset), min, ksi (MPa)	Elongation in 2 in. or 50 mm (or 4D) min,%[B]
	Hot-Rolled Plate[C]		
Annealed	95 (655)	45 (310)	50
	Hot-Rolled Sheet		
Annealed	95 (655)	45 (310)	50
	Cold-Rolled Sheet		
Annealed	95 (655)	45 (310)	50
	Cold-Rolled Strip		
Annealed	95 (655)	45 (310)	50

[A] Yield strength requirementc do not apply to material under 0.020 in. (0.51 mm) in thickness.

[B] Not applicable for thicknesses under 0.010 in. (0.25 mm).

[C] Applicable to 2.75 in. (70 mm) thickness and below.

7.1.2 *Plate*—For plate over 2 in. (50.8 mm) in thickness, the permissible variations over the specified thickness shall not exceed the amounts prescribed in Table 7.

7.1.3 *Sheet and Strip*—The permissible variations in thickness of sheet and strip shall be as prescribed in Table 8. The thickness of strip and sheet shall be measured with the micrometer spindle 3/8 in. (9.5 mm) or more from either edge for material 1 in. (25.4 mm) or over in width and at any place on the strip under 1 in. in width.

7.2 *Width or Diameter*:

7.2.1 *Plate*—The permissible variations in width or rectangular plates and diameter of circular plates shall be as prescribed in Table 3 and Table 9.

7.2.2 *Sheet and Strip*—The permissible variations in width for sheet and strip shall be as prescribed in Table 10.

7.3 *Length*:

7.3.1 Sheet and strip of all sizes may be ordered to cut lengths, in which case a variation of 1/8 in. (3.2 mm) over the specified length shall be permitted.

7.3.2 Permissible variations in length of rectangular plate shall be as prescribed in Table 4.

7.4 *Straightness*:

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

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

7.5 *Edges*:

7.5.1 Sheet and strip shall have sheared or slit edges.

7.5.2 Plate shall have sheared or cut (machines, abrasive cut, powder cut, or inert arc cut) edges, as specified.

7.6 *Squareness* (*Sheet*)—For sheets of all thicknesses, the angle between adjacent sides shall be 90 ± 0.15° (1/16 in. in 24 in.) 1.6 mm in 610 mm).

7.7 *Flatness*—Standard flatness tolerances for plate shall conform to the requirements of Table 11.

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.

9.1.2 A lot for mechanical 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 for plates weighing over 500 lb in which case 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*—Product analysis shall be wholly the responsibility of the purchaser.

9.2.2 *Mechanical Properties*—Samples of the material to provide test specimens for mechanical properties 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 *Mechanical Properties*—One test per lot.

11. Specimen Preparation

11.1 Tension test specimens shall be taken from material in the final condition (temper) 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 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, machined 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.

TABLE 3 Permissible Variations in Width[A] of Sheared, Plasma Torch-Cut, and Abrasive-Cut Rectangular Plate[BC]

Specified Thickness	Permissible Variations in Widths for Widths Given, in. (mm)									
	Up to 30 (760), incl		Over 30 to 72 (760 to 1830), incl		Over 72 to 108 (1830 to 2740), incl		Over 108 to 144 (2740 to 3660), incl		Over 144 to 160 (3660 to 4070), incl	
	+	−	+	−	+	−	+	−	+	−
Inches										
Sheared:[D]										
3/16 to 5/16, excl	3/16	1/8	1/4	1/8	3/8	1/8	1/2	1/8	...	...
5/16 to 1/2, excl	1/4	1/8	3/8	1/8	3/8	1/8	1/2	1/8	5/8	1/8
1/2 to 3/4, excl	3/8	1/8	3/8	1/8	1/2	1/8	5/8	1/8	3/4	1/8
3/4 to 1, excl	1/2	1/8	1/2	1/8	5/8	1/8	3/4	1/8	7/8	1/8
1 to 1 1/4, incl	5/8	1/8	5/8	1/8	3/4	1/8	7/8	1/8	1	1/8
Abrasive-cut:[E,F]										
3/16 to 1 1/4, incl	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Over 1 1/4 to 2 3/4, incl	3/16	1/8	3/16	1/8	3/16	1/8	3/16	1/8	3/16	1/8
Plasma torch-cut:[G]										
3/16 to 2, excl	1/2	0	1/2	0	1/2	0	1/2	0	1/2	0
2 to 2 3/4, incl	5/8	0	5/8	0	5/8	0	5/8	0	5/8	0
Millimetres										
Sheared:[D]										
4.8 to 7.9, excl	4.8	3.2	6.4	3.2	9.5	3.2	12.7	3.2	...	...
7.9 to 12.7, excl	6.4	3.2	9.5	3.2	9.5	3.2	12.7	3.2	15.9	3.2
12.7 to 19.1, excl	9.5	3.2	9.5	3.2	12.7	3.2	15.9	3.2	19.1	3.2
19.1 to 25.4, excl	12.7	3.2	12.7	3.2	15.8	3.2	19.1	3.2	22.2	3.2
25.4 to 31.8, incl	15.9	3.2	15.9	3.2	19.1	3.2	22.2	3.2	25.4	3.2
Abrasive-cut:[E,F]										
4.8 to 31.8, incl	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Over 31.8 to 69.8, incl	4.8	3.2	4.8	3.2	4.8	3.2	4.8	3.2	4.8	3.2
Plasma torch-cut:[G]										
4.8 to 50.8, excl	12.7	0	12.7	0	12.7	0	12.7	0	12.7	0
50.8 to 69.8, incl	15.9	0	15.9	0	12.7	0	12.7	0	12.7	0

[A] Permissible variations in width for powder- or inert arc-cut plate shall be as agreed upon between the manufacturer and the purchaser.
[B] Permissible variations in machined, powder-, or inert arc-cut circular plate shall be as agreed upon between the manufacturer and the purchaser.
[C] Permissible variations in plasma torch-cut sketch plates shall be as agreed upon between the manufacturer and the purchaser.
[D] The minimum sheared width is 24 in. (610 mm).
[E] The minimum abrasive-cut width is 2 in. (50.8 mm) and increases to 4 in. (101.6 mm) for thicker plates.
[F] These tolerances are applicable to lengths of 240 in. (6100 mm), max. For lengths over 240 in., an additional 1/16 in. (1.6 mm) is permitted, both plus and minus.
[G] The tolerance spread shown for plasma torch cutting may be obtained all on the minus side, or divided between the plus and minus side if so specified by the purchaser.

12. Test Methods

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

Test	ASTM Designation
Chemical analysis	E 1473
Tension	E 8
Rounding procedure	E 29

12.2 For purposes of determining compliance with the specified limits for requirements of the properties listed in the following table, an observed value or a calculated value shall be rounded in accordance with the rounding method of Practice E 29.

Test	Rounded 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 %

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 Rehearing

14.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer 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 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.