Designation: B 434 – 00

Standard Specification for Nickel-Molybdenum-Chromium-Iron Alloys (UNS N10003, UNS N10242)* Plate, Sheet, and Strip[1]

This standard is issued under the fixed designation B 434; 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[2] covers nickel-molybdenum-chromium-iron alloys (UNS N10003 and UNS N10242)* plate, sheet, and strip for use in general corrosive 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 annealing is performed in an atmosphere yielding a bright finish.

1.2.2 *Plate*—Hot rolled, 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[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 112 Test Methods for Determining the Average Grain Size[4]

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

4.1.2 *Certification*—State if certification or a report of test results is required (Section 15),

4.1.3 *Purchase Inspection*—State which tests or inspections are to be witnessed (Section 13), and

4.1.4 *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 requirements as to chemical composition prescribed in Table 1.

5.2 If a product (check) analysis is made by the purchaser, the material shall conform to the requirements specified in Table 1 subject to the permissible tolerances in 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 2.

6.2 *Grain Size for Sheet and Strip*—Sheet and strip shall conform to the grain size requirements given in Table 3.

7. Dimensions and Permissible Variations

7.1 *Weight*—For calculation of mass or weight, the following densities shall be used:

Alloy	lb/in^3	g/cm^3
N10003	0.317	8.78
N10242	0.327	9.05

7.2 *Thickness*:

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

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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 Their Alloys.

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[2] For ASME Boiler and Pressure Vessel Code applications see related Specification SB-434 in section II of that Code.

* 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 Chemical Requirements

Element	Composition, %	
	UNS N10242	UNS N10003
Chromium	7.0-9.0	6.0–8.0
Iron, max	2.0	5.0
Carbon	0.03 max	0.04–0.08
Silicon, max	0.80	1.00
Cobalt, max	1.00	0.20
Manganese, max	0.80	1.00
Tungsten, max	...	0.50
Vanadium, max	...	0.50
Molybdenum	24.0-26.0	15.0–18.0
Phosphorus, max	0.030	0.015
Sulfur, max	0.015	0.020
Aluminum plus titanium, max	...	0.50
Copper, max	0.50	0.35
Boron, max	0.006	0.010
Nickel	remainder	remainder
Aluminum, max	0.50	...

TABLE 2 Mechanical Properties for Plate and Sheet

UNS	Tensile Strength, min, ksi (MPa)	Yield Strength (0.2 % Offset), min, ksi (MPa)	Elongation in 2 in. (50.8 mm) or 4*D*[A] min, %
N10003	100 (690)	40 (280)	40
N10242	105 (725)	45 (310)	40

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

TABLE 3 Grain Size for Annealed Sheets

Thickness, in. (mm)	ASTM Micrograin Size Number, max	Average Grain Diameter, max, in (mm)
0.125 (3.175) and under	3.0	0.0050 (0.127)
Over 0.125 (3.175)	1.5	0.0084 (0.214)

TABLE 4 Permissible Variations in Thickness of Plate[A]

Specified Thickness, in. (mm)	Permissible Variations in Thickness, in. (mm)[BC]	
	Plus	Minus
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 2½(25.4 to 63.5), incl	5[D]	0.010 (0.25)

[A] Applicable to plate 48 in. (1.22 m) and under in width.
[B] Measured 3/8in. (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 percentage of thickness.

7.2.2 *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 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.

7.3 *Width*:

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

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

TABLE 5 Permissible Variations in Thickness of Sheet[A] and Strip

Specified Thickness, in. (mm)	Permissible Variations in Thickness, in[BC] (mm) (All Widths)	
	Plus	Minus
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 4.5), incl	0.018 (0.46)	0.010 (0.25)

[A] Applicable to sheet 48 in. (1.22 m) and under in width.
[B] Measured 3/8in. (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.

TABLE 6 Permissible Variations in Width and Length of Sheared 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)	
	Plus	Minus	Plus	Minus
Inches				
Sheared				
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
Abrasive cut				
3/16 to 1½, incl	1/16	1/16	1/16	1/16
Over 1½ to 2½, incl	1/8	1/8	1/8	1/8
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

7.4 *Length*:

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

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 deg (1/16 in. in 24 in. or 2.6 mm/m).

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)	
		Plus	Minus
	Sheet		
0.187 (4.76) 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)

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

7.8 *Edges*:

7.8.1 Plate shall have sheared or abrasive cut edges.

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 imperfections.

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 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

10.1 *Chemical Analysis*—One test per heat.

10.2 *Tension Tests*—One test per lot.

10.3 *Grain Size*—One test per lot.

10.4 *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 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 ½in. (12.7 mm) in thickness.

11.3.2 The largest possible round specimen shown 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 methods:

12.1.1 *Chemical Analysis*—Test Methods E 1473. The nickel composition shall be determined arithmetically by difference.

12.1.2 *Tension Test*—Test Methods E 8.

12.1.3 *Grain Size*—Test Methods E 112. Plate 1 shall be used for the comparison procedure.

12.1.4 *Determining Significant Places*—Practice E 29.

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

Properties	Rounded Unit for Observed or Calculated Value
Chemical composition and tolerance	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 tested 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 When specified in the purchase order or contract, a manufacturer's certification shall be furnished to the purchaser stating that 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.

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 the name of the material; 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 N10003; UNS N10242

APPENDIX

(Nonmandatory Information)

X1. HEAT TREATMENT

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