Designation: ~~B434 – 06 (Reapproved 2016)~~ B434 – 22

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 B434; 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~~ Scope*

1.1 This specification[2] covers nickel-molybdenum-chromium-iron alloys ~~(UNS N10003 and UNS N10242)~~in the form of plate, sheet, and ~~strip for use in general corrosive service.~~strip. The alloys are typically for general corrosive service, but are not limited to this usage.

1.2 ~~The following products are covered under this specification:~~Alloys that can currently be certified to this specification are UNS N10003 and UNS N10242.[3]

~~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 standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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 Safety Data Sheet (SDS) for this product/material as provided by the manufacturer, to establish appropriate ~~safety~~ safety, health, and ~~health~~environmental practices, and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[4]

B880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys

B899 Terminology Relating to Non-ferrous Metals and Alloys

B906 Specification for General Requirements for Flat-Rolled Nickel and Nickel Alloys Plate, Sheet, and Strip

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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.

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

[4] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**

B1015 Practice for Form and Style of Standards Relating to Refined Nickel and Cobalt and Their Alloys
E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

3. Terminology

~~3.1 *Definitions of Terms Specific to This Standard:*~~

~~3.1.1 *plate, n*—material 3⁄16 in. (4.76 mm) and over in thickness.~~

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

3.1 Common B02.07 terminology is found in Specification B899.

3.2 The definitions for plate, sheet, and strip used in Specification B906 apply to the products of this specification with the following adjustments:

3.2.1 Strip can be either a cold-rolled or hot-rolled material.

3.2.2 The finishes allowed for products certified to this specification are stipulated in Section 6.

4. General Requirements

4.1 Material furnished under this specification shall conform to the applicable requirements of Specification B906 unless otherwise provided herein.

4.2 Product furnished to this specification shall conform to the requirements of Specification B906. Failure to comply with the general requirements of Specification B906 constitutes nonconformance with this specification. In case of conflict between the requirements and this specification, and the requirements of Specification B906, this specification shall prevail.

5. Ordering Information

5.1 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:~~to this specification.

~~5.1.1 *Dimensions*—Thickness (in decimals of an inch), width, and length (inch or fraction of an inch),~~

~~5.1.2 *Certification*—State if certification or a report of test results is required,~~

~~5.1.3 *Purchase Inspection*—State which tests or inspections are to be witnessed, and~~

~~5.1.4 *Samples for Product (Check) Analysis*—State whether samples shall be furnished.~~

5.2 Refer to the ordering information section of Specification B906 for examples of requirements.

6. Materials and Manufacture

6.1 The products certified to this specification shall have been manufactured in accordance with Specification B906.

6.2 The finish of the final products certified to this specification are:

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

6.2.2 *Plate*—Hot-rolled, annealed, and descaled.

7. Chemical Composition

7.1 The material shall conform to the ~~requirements as to chemical composition~~chemical requirements prescribed in Table 1.

7.2 If a product (check) analysis is made by the purchaser, ~~the material shall conform to the requirements specified~~ it shall be done in ~~Table 1 subject to the permissible tolerances in~~ conformance with Specification ~~B906~~B880.

8. Mechanical Properties and Other Requirements

8.1 *Tensile Properties*—The material shall conform to the room temperature tensile properties prescribed in Table 2.

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

9. Dimensions and Permissible Variations

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

Alloy	~~lb/in~~lb/in.^{3}	g/cm^3
N10003	0.317	8.78
N10242	0.327	9.05

9.2 *Thickness:*

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 1 Chemical Requirements[A]

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

[A] Values in the table are maximums unless a range or minimum is indicated.
[B] Includes titanium.

TABLE 2 Mechanical Properties for Plate and Sheet

UNS	Tensile Strength, min, ksi (MPa)	Yield Strength ~~(0.2 %%~~(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~~Number	Average Grain Diameter, ~~max, in~~ in. (mm)
0.125 (3.175) and under	3.0 or finer	0.0050 (0.127)
Over 0.125 (3.175)	1.5 or finer	0.0084 (0.214)

9.2.1 *Plate*—The permissible variations in thickness of plate shall be as prescribed in Table A2.1 in Specification B906.

9.2.2 *Sheet and Strip*—The permissible variations in thickness of sheet and strip shall be as prescribed in Table A2.2 in Specification B906. ~~The thickness shall be measured with the micrometer spindle ⅜ 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.~~

9.2.3 Products that are at least 1.00 in. (25.4 mm) in width shall have thickness measured with the micrometer spindle positioned 0.375 in. (9.53 mm) or more from any edge. Products that are less than 1.00 in. (25.4 mm) width may have the thickness measured with the micrometer spindle positioned anywhere.

9.3 *Width:*

9.3.1 *Plate*—The permissible variations in width of rectangular plates shall be as prescribed in Table A2.3 in Specification B906.

9.3.2 *Sheet and Strip*—The permissible variations in width for sheet and strip shall be as prescribed in Table A2.4 in Specification B906.

9.4 *Length:*

9.4.1 *Plate*—Permissible variations in the length of rectangular plate shall be as prescribed in Table A2.3 in Specification B906.

9.4.2 *Sheet and Strip*—Sheet and strip may be ordered to cut lengths, in which case a variation of ~~⅛~~0.125 in. ~~(3.175~~(3.18 mm) over the specified length shall be permitted, with a 0 minus tolerance.

9.5 *Straightness:*

9.5.1 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.~~number calculated by the equation below. The calculated number is the maximum allowed curvature in inches (inch-pound units) or millimeters (SI units).

$$\text{Curvature (customary unit)} = 0.05 \times \text{length (in feet)}$$
$$\text{Curvature (SI unit)} = 0.04 \times \text{length (in cm)}$$

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

9.6 *Squareness (Sheet)*—For sheets of all thicknesses and widths of ~~6~~6.00 in. (152.4 mm) or more, the angle between adjacent sides shall be 90 ± ~~0.15 deg~~0.15 deg (0.031 in. ~~/~~/ft or~~1/16~~ ~~in.~~2.60 mm ~~in 24 in. or 2.6 mm/m).~~/m). If diagonals are measured, then the two diagonals shall be within ±0.25 in. (6.35 mm).