Designation: B424 – 11 (Reapproved 2016)

Standard Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825, UNS N08221, and UNS N06845) Plate, Sheet, and Strip[1]

This standard is issued under the fixed designation B424; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification[2] covers rolled nickel-iron-chromium-molybdenum-copper alloy (UNS N08825, UNS N08221, and UNS N06845)[3] plate, sheet, and strip.

1.2 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.

1.3 *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 and health practices, and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[4]

B425 Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825, UNS N08221, and UNS N06845) Rod and Bar

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

3. Terminology

3.1 *Descriptions of Terms Specific to This Standard*—The terms given in Table 1 shall apply.

4. General Requirements

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

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:

5.1.1 ASTM designation and year of issue.

5.1.2 Alloy name or UNS number.

5.1.3 *Condition*—Table 2 and Appendix X1.

5.1.4 *Finish*—Appendix X1.

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

5.1.6 *Quantity.*

5.1.7 *Optional Requirements:*

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

5.1.7.2 *Strip*—Whether to be furnished with commercial slit edge, square edge, or round edge.

5.1.7.3 *Plate*—Whether to be furnished specially flattened (see 8.7); also how plate is to be cut (Table 3).

5.1.8 *Certification*—State if certification is required (Specification B906, section on Material Test Report and Certification).

5.1.9 *Samples for Product (Check) Analysis*—Whether samples for product (check) analysis should be furnished (see Specification B906, section on Sampling).

5.1.10 *Purchaser Inspection*—If the purchaser wishes to witness tests or inspection of material at the place of manufacture, the purchase order must so state, indicating which tests or inspections are to be witnessed (Specification B906, section on Inspection).

6. Chemical Composition

6.1 The material shall conform to the composition limits specified in Table 4.

6.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis per Specification B906.

[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-424 in Section II of that Code.

[3] New designation established in accordance with ASTM E527 and SAE J1086, 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**

TABLE 1 Product Description

Product	Thickness, in. (mm)
Hot-rolled plate[A]	3/16 (4.76) and over
Cold-rolled plate[A]	3/16 to 3/8 (4.8 to 9.5), incl
Hot-rolled sheet[A]	0.018 to 0.250 (0.46 to 6.4), incl
Cold-rolled sheet[B]	0.018 to 0.250 (0.46 to 6.4), incl
Cold-rolled strip[B]	0.005 to 0.250 (0.13 to 6.4), incl

[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] 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.

7. Mechanical Properties

7.1 *Mechanical Properties*—The material shall conform to the mechanical properties specified in Table 2.

8. Dimensions and Permissible Variations

8.1 *Thickness and Weight:*

8.1.1 *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 Specification B906, Permissible Variations in Thickness and Overweight of Rectangular Plates Table.

8.1.1.1 For use with Specification B906, Permissible Variations in Thickness and Overweight of Rectangular Plates Table, plate shall be assumed to weigh 0.294 lb/in.^{3} (8.138 g/cm^3).

8.1.2 *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 Specification B906, Permissible Variations in Thickness for Rectangular Plates Over 2 in. (51 mm) in Thickness Table.

8.1.3 *Sheet and Strip*—The permissible variations in thickness of sheet and strip shall be as prescribed in Specification B906, Permissible Variations in Thickness of Sheet and Strip Table. 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. (25.4 mm) in width.

8.2 *Width or Diameter:*

8.2.1 *Plate*—The permissible variations in width of rectangular plates and diameter of circular plates shall be as prescribed in Specification B906, Permissible Variations in Width of Sheared, Plasma Torch-Cut, and Abrasive-Cut Rectangular Plate Table and Permissible Variations in Diameter for Circular Plates Table.

8.2.2 *Sheet and Strip*—The permissible variations in width for sheet and strip shall be as prescribed in Specification B906, Permissible Variations in Width of Sheet and Strip Table.

8.3 *Length:*

8.3.1 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.

8.3.2 Permissible variations in length of rectangular plate shall be as prescribed in Specification B906, Permissible Variations in Length of Sheared, Plasma, Torch-Cut, and Abrasive-Cut Rectangular Plate Table.

8.4 *Straightness:*

8.4.1 The edgewise curvature (depth of chord) of flat sheet, strip, and plate shall not exceed 0.05 in. (1.27 mm) multiplied by the length in feet (0.04 mm multiplied by the length in centimetres).

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

8.5 *Edges:*

8.5.1 When finished edges of strip are specified in the contract or order, the following descriptions shall apply:

8.5.1.1 Square-edge strip shall be supplied with finished edges, with sharp, square corners, without bevel or rounding.

8.5.1.2 Round-edge strip shall be supplied with finished edges, semicircular in form, the diameter of the circle forming the edge being equal to the strip thickness.

8.5.1.3 When no description of any required form of strip edge is given, it shall be understood that edges such as those resulting from slitting or shearing will be acceptable.

8.5.1.4 Sheet shall have sheared or slit edges.

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

8.6 *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).

8.7 *Flatness*—Standard flatness tolerances for plate shall conform to the requirements of Table 3. "Specifically-flattened" plate, when so specified, shall have permissible variations in flatness as agreed upon between the manufacturer and the purchaser.

9. Product Marking

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

10. Keywords

10.1 N08825; N08221; N06845; plate; sheet; strip

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

Alloy	Condition	Tensile Strength, min, ksi (MPa)	Yield Strength[A] (0.2 % Offset), min, ksi (MPa)	Elongation in 2 in. or 50 mm (or 4 *D*), min, %
Hot-Rolled Plate:				
UNS N08825	annealed	85 (586)	35 (241)	30
UNS N08221	annealed	79 (544)	34 (235)	30
UNS N06845	annealed	100 (690)	40 (276)	30
Cold-Rolled Plate:				
UNS N08825	annealed	85 (586)	35 (241)	30
UNS N08221	annealed	79 (544)	34 (235)	30
UNS N06845	annealed	100 (690)	40 (276)	30
Hot-Rolled Sheet:				
UNS N08825	annealed	85 (586)	35 (241)	30
UNS N08221	annealed	79 (544)	34 (235)	30
UNS N06845	annealed	100 (690)	40 (276)	30
Cold-Rolled Sheet:				
UNS N08825	annealed	85 (586)	35 (241)	30
UNS N08221	annealed	79 (544)	34 (235)	30
UNS N06845	annealed	100 (690)	40 (276)	30
Cold-Rolled Strip:				
UNS N08825	annealed	85 (586)[B]	35 (241)	30[B]
UNS N08221	annealed	79 (544)[B]	34 (235)	30[B]
UNS N06845	annealed	100 (690)[B]	40 (276)	30

[A] Yield strength requirements do not apply to material under 0.020 in. (0.51 mm) in thickness.
[B] Not applicable for thickness under 0.010 in. (0.25 mm).

TABLE 3 Permissible Variations From Flatness of Rectangular, Circular, and Sketch Plates

NOTE 1—Permissible variations apply to plates up to 12 ft (3.66 m) in length, or to any 12 ft (3.66 m) of longer plates. If the longer dimension is under 36 in. (914 mm), the permissible variation is not greater than ¼ in. (6.4 mm).

NOTE 2—The shorter dimension specified is considered the width, and the permissible variation in flatness across the width does not exceed the tabular amount of that dimension.

NOTE 3—The maximum deviation from a flat surface does not customarily exceed the tabular tolerance for the longer dimension specified.

Specified Thickness	Permissible Variations from a Flat Surface for Thickness and Widths Given, in. (mm)								
	To 48 (1220), excl	48 to 60 (1220 to 1520), excl	60 to 72 (1520 to 1830), excl	72 to 84 (1830 to 2130), excl	84 to 96 (2130 to 2440), excl	96 to 108 (2440 to 2740), excl	108 to 120 (2740 to 3050), excl	120 to 144 (3050 to 3660), excl	144 (3660), and over
				Inches					
3/16 to 1/4, excl	3/4	1 1/16	1 1/4	1 3/8	1 5/8	1 5/8	...	...	...
1/4 to 3/8, excl	11/16	3/4	15/16	1 1/8	1 3/8	1 7/16	1 9/16	1 7/8	...
3/8 to 1/2, excl	1/2	9/16	11/16	3/4	15/16	1 1/8	1 1/4	1 7/16	1 3/4
1/2 to 3/4, excl	1/2	9/16	5/8	5/8	13/16	1 1/8	1 1/8	1 1/8	1 3/8
3/4 to 1, excl	1/2	9/16	5/8	5/8	3/4	13/16	15/16	1	1 1/8
1 to 2, excl	1/2	9/16	9/16	9/16	11/16	11/16	11/16	3/4	1
2 to 4, incl	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8
				Millimetres					
4.8 to 6.4, excl	19.05	27.0	31.7	34.9	41.3	41.3	...	...	...
6.4 to 9.5, excl	17.5	19.0	23.8	28.6	35.0	36.5	39.7	47.6	...
9.5 to 12.7, excl	12.7	14.3	17.5	19.0	23.8	28.6	31.7	35.0	44.4
12.7 to 19.0, excl	12.7	14.3	15.9	15.9	20.6	28.6	28.6	28.6	34.9
19.0 to 25.4, excl	12.7	14.3	15.9	15.9	19.0	20.6	23.8	25.4	28.6
25.4 to 50.8, excl	12.7	14.3	14.3	14.2	17.5	17.5	17.5	19.0	25.4
50.8 to 101.6, incl	6.4	7.9	9.5	11.1	12.7	14.3	15.9	19.0	22.2

TABLE 4 Chemical Requirements[A]

Element	UNS N08825	UNS N08221	UNS N06845
Nickel	38.0 to 46.0	39.0 to 46.0	44.0 to 50.0
Chromium	19.5 to 23.5	20.0 to 22.0	20.0 to 25.0
Iron	22.0 min[B]	Balance[B]	Remainder[B]
Manganese	1.0	1.0	0.5
Carbon	0.05	0.025	0.05
Copper	1.5 to 3.0	1.5 to 3.0	2.0 to 4.0
Silicon	0.5	0.5	0.5
Sulfur	0.03	0.03	0.010
Aluminum	0.2	0.2	...
Titanium	0.6 to 1.2	0.6 to 1.0	...
Molybdenum	2.5 to 3.5	5.0 to 6.5	5.0 to 7.0
Tungsten	...	...	2.0 to 5.0

[A] Maximum unless range or minimum is given. Where ellipses (...) appear in this table, there is no requirement and analysis for the element need not be determined or reported.
[B] Element shall be determined arithmetically by difference.

APPENDIX

(Nonmandatory Information)

X1. CONDITIONS AND FINISHES NORMALLY SUPPLIED

X1.1 Scope

X1.1.1 This appendix lists the conditions and finishes in which plate, sheet, and strip are normally supplied. These are subject to change, and the manufacturer should be consulted for the latest information available.

X1.2 Plate

X1.2.1 Hot-rolled, annealed, and descaled.

X1.2.2 Cold-rolled, annealed, and descaled.

X1.3 Sheet

X1.3.1 Hot-rolled, annealed, and descaled.

X1.3.2 Cold-rolled, annealed, and descaled or bright annealed.

X1.4 Strip

X1.4.1 Cold-rolled, annealed, descaled, or bright annealed.