



# Standard Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip<sup>1</sup>

This standard is issued under the fixed designation B 582; 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 The specification<sup>2</sup> covers plate, sheet, and strip of nickel-chromium-iron-molybdenum-copper alloys (UNS N06007, N06975, N06985, and N06030)\* as shown in Table 1, 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, solution annealed, and descaled unless solution anneal is performed in an atmosphere yielding a bright finish.

1.2.2 *Plate*—Hot or cold 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.

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 Material Safety Data Sheet 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:

B 880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys<sup>3</sup>

E 8 Test Methods for Tension Testing of Metallic Materials<sup>4</sup>

E 18 Test Methods for Rockwell Hardness and Rockwell

Superficial Hardness of Metallic Materials<sup>4</sup>

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications<sup>5</sup>

E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition<sup>6</sup>

E 140 Hardness Conversion Tables for Metals (Relationship Between Brinell Hardness, Vickers Hardness, Rockwell Hardness, Rockwell Superficial Hardness, and Knoop Hardness)<sup>4</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 *cold-rolled plate*—material  $\frac{3}{16}$  to  $\frac{3}{8}$  in. (4.76 to 9.52 mm), inclusive, in thickness.

3.1.2 *hot-rolled plate*—material  $\frac{3}{16}$  in. (4.76 mm) and over in thickness.

3.1.3 *plate*—material  $\frac{3}{16}$  in. (4.76 mm) and over in thickness.

3.1.4 *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 material ordered under this specification. Examples of such requirements include, but are not limited to, the following:

4.1.1 *Alloy*—Table 1,

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

4.1.3 *Optional Requirement, Plate*—How the plate is to be cut (see 7.1 and Table 2),

4.1.4 *Certification*—State if certification or a report of test results is required (Section 16),

4.1.5 *Purchaser Inspection*—State which tests or inspections are to be witnessed (Section 14), and

4.1.6 *Samples for Product (Check) Analysis*—State whether samples should be furnished (Section 5).

<sup>1</sup> 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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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications, see related Specification SB-582 in Section II of that Code.

\* New designation established in accordance with ASTM E 527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 02.04.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 03.01.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 14.02.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 03.05.



TABLE 1 Chemical Requirements

Element	Composition Limits, %			
	Alloy N06007	Alloy N06975	Alloy N06985	Alloy N06030
Nickel	remainder <sup>A</sup>	47.0 to 52.0	remainder <sup>A</sup>	remainder <sup>A</sup>
Chromium	21.0 to 23.5	23.0 to 26.0	21.0 to 23.5	28.0 to 31.5
Iron	18.0 to 21.0	remainder <sup>A</sup>	18.0 to 21.0	13.0 to 17.0
Molybdenum	5.5 to 7.5	5.0 to 7.0	6.0 to 8.0	4.0 to 6.0
Copper	1.5 to 2.5	0.70 to 1.20	1.5 to 2.5	1.0 to 2.4
Manganese	1.0 to 2.0	1.0 max	1.0 max	1.5 max
Cobalt, max	2.5	...	5.0	5.0
Carbon, max	0.05	0.03	0.015	0.03
Tungsten	1.0 max	...	1.5 max	1.5 to 4.0
Silicon, max	1.0	1.0	1.0	0.8
Phosphorus, max	0.04	0.03	0.04	0.04
Sulfur, max	0.03	0.03	0.03	0.02
Columbium + tantalum	1.75 to 2.50	...	0.50 max	0.30 to 1.50
Titanium	...	0.70–1.50	...	...

<sup>A</sup>See 13.1.1.

TABLE 2 Permissible Variations in Width and Length of Sheared, 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), incl	
	+	–	+	–
Inches				
<i>Sheared:</i>				
3/16 to 5/16, incl	3/16	1/8	1/4	1/8
Over 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>Torch-cut:</i> <sup>A</sup>				
3/16 to 2, excl	1/2	0	1/2	0
2 to 3, incl	5/8	0	5/8	0
Millimetres				
<i>Sheared:</i>				
4.76 to 7.94, incl	4.76	3.18	6.35	3.18
Over 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>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 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.

## 5. Chemical Composition

5.1 *Heat Analysis*—The material shall conform to the composition limits specified in Table 1.

5.2 *Product (Check) Analysis*—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 Specification B 880.

## 6. Mechanical Properties and Other Requirements

6.1 *Tensile Properties*—The material shall conform to the mechanical property requirements prescribed in Table 3.

6.2 *Hardness*—The hardness values given in Table 3 are informative only.

## 7. Edges

7.1 Plates shall have sheared or cut machined, abrasive cut, powder cut, or inert arc cut edges, as specified.

7.2 Sheet and strip shall have sheared or slit edges.

## 8. Permissible Variations in Dimensions

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

Alloy	Density	
	lb/in. <sup>3</sup>	g/cm <sup>3</sup>
N06007	0.300	8.31
N06975	0.295	8.17
N06985	0.300	8.31
N06030	0.297	8.22

### 8.2 Thicknesses:

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

8.2.2 *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. (9.52 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. (25.4 mm) in width.

### 8.3 Width:

8.3.1 *Plate*—The permissible variations in width of rectangular plates shall be as prescribed in Table 2.

8.3.2 *Sheet and Strip*—The permissible variations in width for sheet and strip shall be as prescribed in Table 6.

### 8.4 Length:

8.4.1 *Plate*—Permissible variations in the length of rectangular plate shall be as prescribed in Table 2.

8.4.2 *Sheet and Strip*—Sheet and strip may be ordered to cut lengths, in which case a variation of 1/8 in. (3.18 mm) over the specified length shall be permitted, with a 0 minus tolerance.

8.5 *Straightness*—The edgewise curvature (depth of cord) of sheet, strip, and plate shall not exceed 0.05 in./ft (4.2 mm/m).

8.6 *Squareness (Sheet)*—For sheets of all thickness and widths of 6 in. (152.4 mm) or more, the angle between adjacent sides shall be 90 ± 0.15° (1/16 in. in 24 in. or 2.6 mm/m).

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

## 9. Workmanship, Finish, and Appearance

9.1 The material shall be uniform in quality and condition, smooth, and free of injurious imperfections.



TABLE 3 Mechanical Property Requirements

Alloy	Thickness, in. (mm)	Tensile Strength min, psi (MPa)	Yield Strength (0.2 % Offset), min, psi (MPa)	Elongation in 2 in. or 50.8 mm or 4D <sup>A</sup> min, %	Rockwell Hardness, <sup>B</sup> max
Annealed Plate					
N06007	3/16 to 3/4 (4.76 to 19.05), incl	90 000 (621)	35 000 (241)	35	100 HRB
	Over 3/4 to 2 1/2 (19.05 to 63.5), incl	85 000 (586)	30 000 (207)	30	100 HRB
N06975	3/16 to 2 1/2 (4.76 to 63.5), incl	85 000 (586)	32 000 (221)	40	100 HRB
N06985	3/16 to 3/4 (4.76 to 19.05), incl	90 000 (621)	35 000 (241)	45	100 HRB
	Over 3/4 to 2 1/2 (19.05 to 63.5), incl	85 000 (586)	30 000 (207)	35	100 HRB
N06030	...	85 000 (586)	35 000 (241)	30	...
Annealed Sheet					
N06985	Over 0.020 (0.51)	90 000 (621)	35 000 (241)	45	100 HRB
Annealed Sheet and Strip					
N06007	Over 0.020 (0.51)	90 000 (621)	35 000 (241)	40	100 HRB
N06975	Over 0.020 (0.51)	85 000 (586)	32 000 (221)	40	100 HRB
N06030	Over 0.020 (0.51)	85 000 (586)	35 000 (241)	30	...

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

<sup>B</sup>Hardness values are shown for information purposes only and are not to be used as a basis for rejection or acceptance. For approximate hardness conversions, see Hardness Conversion Tables E 140.

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 (4.76 to 5.56), incl	0.021 (0.53)	0.010 (0.25)
Over 7/32 to 1/4 (5.56 to 6.35), incl	0.024 (0.61)	0.010 (0.25)
Over 1/4 to 3/8 (6.35 to 9.52), incl	0.027 (0.69)	0.010 (0.25)
Over 3/8 to 1/2 (9.52 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. (1.22 m) and under in width.

<sup>B</sup>Measured 3/8 in. (9.52 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 percent of thickness.

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

Specified Thickness, in. (mm)	Permissible Variations in Thickness, in. <sup>B,C</sup> (mm) (All Widths)	
	+	–
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. (1.22 m) and under in width.

<sup>B</sup>Measured 3/8 in. (9.52 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.

## 10. Sampling

### 10.1 Lots for Chemical Analysis and Mechanical Testing:

10.1.1 A lot for chemical analysis shall consist of one heat.

10.1.2 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.

### 10.2 Sampling for Chemical Analysis:

10.2.1 A representative sample shall be obtained from each lot during pouring or subsequent processing.

10.2.2 Product (check) analysis shall be wholly the responsibility of the purchaser.

### 10.3 Sampling for Mechanical Testing:

10.3.1 Representative samples shall be taken from each lot of finished material.

## 11. Number of Tests and Retests

11.1 *Chemical Analysis*—One test per lot.

11.2 *Tension Tests*—One test per lot.

11.3 *Hardness Tests*—One test per lot.

11.4 *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.

## 12. Specimen Preparation

12.1 Tension test specimens shall be taken from material in the final condition and tested transverse to the direction of rolling when width will permit.

12.2 Tension test specimens shall be any of the standard or subsize specimens shown in Test Methods E 8.

12.3 In the event of disagreement, referee specimens shall be as follows:

12.3.1 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.

12.3.2 The largest possible round specimen shown in Test Methods E 8 for material 1/2 in. (12.7 mm) and over.

**TABLE 6 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 (4.76) 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)

### 13. Test Methods and Chemical Analysis

13.1 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 standards:

13.1.1 *Chemical Analysis*—Test Methods E 1473. For elements not covered by Test Methods E 1473, the referee test method shall be as agreed upon between the manufacturer and the purchaser. The composition of the remainder element shall be determined arithmetically by difference.

13.1.2 *Tension Test*—Test Methods E 8.

13.1.3 *Rockwell Hardness Test*—Test Methods E 18.

13.1.4 *Hardness Conversion*—Hardness Conversion Tables E 140.

13.1.5 *Determining Significant Places*—Practice E 29.

13.1.6 *Method of Sampling*—Practice E 55.

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

Requirements	Rounded unit for observed or calculated value
Chemical composition and tolerances	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 %

### 14. Inspection

14.1 Inspection of the material shall be made as agreed upon between the manufacturer and the purchaser as part of the purchase contract.

### 15. Rejection and Rehearing

15.1 Material 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.

### 16. Certification

16.1 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.

### 17. Product Marking and Package Marking

17.1 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.

17.2 Each bundle or shipping container shall be marked with the name of the material; this specification number; alloy; 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.

### 18. Keywords

18.1 plate; sheet; strip; N06007; N60975; N06985; N06030

## APPENDIX

### (Nonmandatory Information)

#### X1. HEAT TREATMENT

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



## **B 582 – 02**

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