Designation: ~~B649 – 06 (Reapproved 2016)~~ B649 – 17

Standard Specification for Ni-Fe-Cr-Mo-Cu-N Low-Carbon Alloys (UNS N08925, UNS N08031, UNS N08034, UNS N08354, and UNS N08926), and Cr-Ni-Fe-N Low-Carbon Alloy (UNS R20033) Bar and Wire, and Ni-Cr-Fe-Mo-N Alloy (UNS N08936) Wire[1]

This standard is issued under the fixed designation B649; 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 covers nickel-iron-chromium-molybdenum-copper-nitrogen alloys (UNS N08925, UNS N08031, UNS N08034, UNS N08354, and UNS N08926), and chromium-nickel-iron-nitrogen low-carbon alloy (UNS R20033) bar and wire, and nickel-chromium-iron-molybdenum-nitrogen alloy (UNS N08936) wire.

1.2 ASTM International has adopted definitions whereby some grades, such as UNS N08904,[2] previously in this specification were recognized as stainless steels, because those grades have iron as the largest element by mass percent. Such grades are under the oversight of ASTM Committee A01 and its subcommittees. The products of N08904 previously covered in this specification are now covered by Specifications A479/A479M and A484/A484M.

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:*[3]

A479/A479M Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
A484/A484M Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings
B880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys
E8 Test Methods for Tension Testing of Metallic Materials
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition
E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)
E1473 Test Methods for Chemical Analysis of Nickel, Cobalt and High-Temperature Alloys

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

---

[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.

Current edition approved ~~June 1, 2016~~July 1, 2017. Published ~~June 2016~~August 2017. Originally approved in 1981. Last previous edition approved in ~~2011~~2016 as B649 – 06 ~~(2011).~~(2016). DOI: ~~10.1520/B0649-06R16.~~10.1520/B0649-17.

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

[3] 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**

3.1.1 *bars, n*—hot-finished rounds, squares, octagons, and hexagons: ¼ in. (6.35 mm) and over in diameter or size. Hot-finished flats: ¼ in. to 10 in. (254 mm) inclusive in width, ⅛ in. (3.18 mm) and over in thickness. Cold-finished rounds, squares, octagons, hexagons, and shapes: over ½ in. (12.70 mm) in diameter or size. Cold-finished flats: ⅜ in. (9.52 mm) and over in width (see 3.1.1.1) and ⅛ in. and over in thickness (see 3.1.1.2).

3.1.1.1 *Discussion*—

Widths less than ⅜ in. (9.52 mm) and thicknesses less than 3⁄16 in. (4.76 mm) are described generally as flat wire.

3.1.1.2 *Discussion*—

Thickness ⅛ in. to under 3⁄16 in. (3.18 mm to under 4.76 mm) can be cold-rolled strip as well as bar.

3.1.2 *wire, n*—cold-finished only: round, square, octagon, hexagon, and shape wire, ½ in. (12.70 mm) and under in diameter or size. Cold-finished only: flat wire, 3⁄16 in. to under ⅜ in. (4.76 mm to under 9.52 mm) in width, 0.010 to under 3⁄16 in. (0.25 to under 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 to this specification. Examples of such requirements include, but are not limited to, the following:

4.1.1 Quantity (weight or number of pieces),
4.1.2 Alloy name or UNS number,
4.1.3 Form (bar or wire),
4.1.4 Dimensions,
4.1.5 Finish (Section 9),
4.1.6 ASTM designation and year of issue,
4.1.7 Exceptions to the specification or special requirements, and
4.1.8 Certification (Section 16). State if certification is required.

5. Materials and Manufacture

5.1 *Heat Treatment*—With the exception of UNS N08936, the material shall be supplied in the solution-treated condition except as noted in 5.2. UNS N08936 shall be supplied in the cold drawn condition.

TABLE 1 Chemical Requirements

~~Element~~	UNS N08936	UNS N08925	UNS N08031	UNS ~~N08354~~		UNS N08926	UNS R20033
Carbon, max	0.020	0.020	0.015		0.030	0.020	0.015
~~Manganese, max~~	~~4.00–6.00~~	~~1.00~~	~~2.0~~		~~1.00~~	~~2.00~~	~~2.0~~
Phosphorus, max	0.025	0.045	0.020		0.030	0.03	0.02
Sulfur, max	0.010	0.030	0.010	0.010		0.01	0.01
Silicon, max	0.50	0.50	0.3		1.00	0.5	0.50
Nickel	33.00–35.00	24.00–26.00	30.0–32.0		34.0–36.0	24.00–26.00	30.0–33.0
Chromium	26.00–28.00	19.00–21.00	26.0–28.0		22.0–24.0	19.00–21.00	31.0–35.0
Molybdenum	5.00–6.00	6.0–7.0	6.0–7.0		7.0–8.0	6.0–7.0	0.50–2.0
Copper	0.50	0.8–1.5	1.0–1.4		...	0.5–1.5	0.30–1.20
Nitrogen	0.30–0.50	0.1–0.2	0.15–0.25		0.17–0.24	0.15–0.25	0.35–0.60
Iron	balance	balance	balance	balance	balance	balance	

TABLE 1 Chemical Requirements

Element	UNS N08936	UNS N08925	UNS N08031	UNS N08034	UNS N08354	UNS N08926	UNS R20033
Carbon, max	0.020	0.020	0.015	0.01	0.030	0.020	0.015
Manganese[A]	4.00–6.00	1.00	2.0	1.0-4.0	1.00	2.00	2.0
Phosphorus, max	0.025	0.045	0.020	0.020	0.030	0.03	0.02
Sulfur, max	0.010	0.030	0.010	0.010	0.010	0.01	0.01
Silicon, max	0.50	0.50	0.3	0.1	1.00	0.5	0.50
Nickel	33.00–35.00	24.00–26.00	30.0–32.0	33.5-35.0	34.0–36.0	24.00–26.00	30.0–33.0
Chromium	26.00–28.00	19.00–21.00	26.0–28.0	26.0-27.0	22.0–24.0	19.00–21.00	31.0–35.0
Molybdenum	5.00–6.00	6.0–7.0	6.0–7.0	6.0-7.0	7.0–8.0	6.0–7.0	0.50–2.0
Copper	0.50	0.8–1.5	1.0–1.4	0.5-1.5	...	0.5–1.5	0.30–1.20
Nitrogen	0.30–0.50	0.1–0.2	0.15–0.25	0.10-0.25	0.17–0.24	0.15–0.25	0.35–0.60
Iron	balance	balance	balance	balance	balance	balance	balance
Aluminum	...	...	...	0.3	...	...	...

[A] Maximum %, unless range or minimum is indicated.