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Standard Specification for Nickel-Chromium-Molybdenum-Cobalt-Tungsten- Iron-Silicon Alloy (UNS N06333) Bar¹

This standard is issued under the fixed designation B719; 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 covers wrought alloy UNS N06333 in the form of hot-finished and cold-finished bars and flats intended for heat resisting applications and general corrosive service.

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 Material Safety Data Sheet (MSDS) 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:²

- 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
- E10 Test Method for Brinell Hardness of Metallic Materials
- E18 Test Methods for Rockwell Hardness of Metallic Materials
- E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness
- E1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *bars, n*—material of round, hexagonal, octagonal, or square solid section, furnished in straight lengths, ¼ in. (6.35 mm) and over in diameter or size.

3.1.2 *flats, n*—material ¼ to 10 in. (6.35 to 254 mm), inclusive, in width and 120 in. (3.05 mm) and over 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 Alloy name or UNS number.
- 4.1.2 Quantity.
- 4.1.3 ASTM Designation and year of issue.
- 4.1.4 Section (round, square, hexagonal, and so forth).
- 4.1.5 Dimensions, including length.

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 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.

4.1.6 Finish, hot or cold.

4.1.7 *Certification*—state if certification is required (Section 16).

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

4.1.9 *Purchaser Inspection*—If a purchaser wishes to witness tests or inspections of material at the place of manufacture, the purchase order must so state indicating which tests or inspections are to be witnessed.

5. Material and Manufacture

5.1 All material shall be furnished in the annealed condition, except that cold-drawn hexagons may be given a cold draw sizing pass subsequent to the final anneal.

NOTE 1—Hot-finished rectangular bar in widths 10 in. (254 mm) and under may be furnished as hot-finished plate with sheared or cut edges.

6. Chemical Requirements

6.1 The material shall conform to the requirements as to chemical composition specified in Table 1.

6.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis variations per Specification B880.

7. Mechanical and Other Requirements

7.1 The mechanical properties of the material at room temperature shall conform to those shown in Table 2.

8. Permissible Variations in Dimensions

8.1 All bars shall conform to the permissible variations in dimensions specified in Tables 3-8, inclusive.

9. Workmanship, Finish, and Appearance

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

10. Sampling

10.1 *Lot Definitions*:

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

10.1.2 A lot for mechanical properties shall consist of material from one heat of the same condition and cross section, and no more than 40 000 lb (18 100 kg) in mass.

10.2 *Test Material Selection*:

10.2.1 *Chemical Analysis*—Representative samples from each lot shall be taken during pouring or subsequent processing.

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

10.2.2 *Mechanical Properties*—Samples of the material to provide test specimens for mechanical properties shall be taken from such locations in each lot as to be representative of that lot.

11. Number of Tests

11.1 *Chemical Analysis*—One test per lot.

11.2 *Mechanical Properties*—One test per lot.

12. Specimen Preparation

12.1 Tension-test specimens shall be taken from material in the final condition and tested in the direction of fabrication.

TABLE 1 Chemical Requirements

Element	Composition Limits, %
Carbon	0.10 max
Manganese	2.0 max
Phosphorus	0.03
Sulfur	0.03
Silicon	1.5 max
Chromium	24.0–27.0
Nickel	44.0–48.0
Molybdenum	2.5–4.0
Cobalt	2.5–4.0
Tungsten	2.5–4.0
Iron ^A	remainder

^A Element may be determined arithmetically by difference.

TABLE 2 Mechanical Properties

Tensile Strength, min psi (MPa)	Yield Strength, 0.2 % offset, min. psi (MPa)	Elongation in 2 in. or 50 mm, or 4D, min%	Hardness ^A
80 000 (551)	35 000 (241)	30	75 to 95 HRB

^A Hardness values are informative only and not to be construed as the basis for acceptance.

12.1.1 All material shall be tested in full cross-section size when possible. When a full cross-section size test cannot be performed, the largest possible round specimen in Test Methods E8 shall be used.

13. Test Methods

13.1 Determine the chemical composition, mechanical, and other properties of the material as enumerated in this specification, in case of disagreement, in accordance with the following methods:

Test	ASTM Designation
Chemical analysis	E1473
Tension	E8
Brinell Hardness	E10
Rockwell Hardness	E18
Hardness Conversion	E140
Rounding procedure	E29
Requirement	Rounded-Off Unit for Observed or Calculated Value
Chemical composition and tolerances (when expressed in decimals)	Nearest unit in the last right- hand place of figures of the specified limit. If two choices are possible, as when the digits dropped are exactly a 5 or a 5 followed only by zeros, choose the one ending in an even digit with zero defined as an even digit.
Tensile and yield strengths	Nearest 1000 psi (6.9 MPa)
Elongation	Nearest 1 %

14. Inspection

14.1 Inspection of the material by the purchaser shall be as agreed upon by the purchaser and the supplier 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 producer's or supplier's certification shall be furnished to the purchaser that the material was manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

17. Packaging and Package Marking

17.1 Material shall be bundled or boxed in such a manner as to assure undamaged delivery to its destination when properly transported by a common carrier.

17.2 Each bundle or shipping container shall be marked with the grade of the material or UNS number and heat number.

18. Keywords

18.1 N06333; bar