Designation: B 516 – 03

Standard Specification for Welded Nickel-Chromium-Iron Alloy (UNS N06600, UNS N06603, UNS N06025, and UNS N06045) Tubes[1]

This standard is issued under the fixed designation B 516; 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 welded UNS N06600*, N06603, N06025, and N06045 alloy boiler, heat exchanger, and condenser tubes for general corrosion resisting and low or high-temperature service.

1.2 This specification covers tubes ⅛ to 5 in. (3.18 to 127 mm), inclusive, in outside diameter and 0.015 to 0.500 in. (0.38 to 12.70 mm), inclusive, in wall thickness. Table 2 of Specification B 751 lists the dimensional requirements of these sizes. Tubes having other dimensions may be furnished provided such tubing complies with all other requirements of this specification.

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 751 Specification for General Requirements for Nickel and Nickel Alloy Welded Tube[2]

B 899 Terminology Relating to Non-ferrous Metals and Alloys[2]

3. Terminology

3.1 Terms defined in Terminology B 899 shall apply unless defined otherwise in this standard.

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 Quantity (feet or number of lengths),

4.1.2 UNS number,

4.1.3 Size (outside diameter minimum or average wall thickness),

4.1.4 Length (random or specific),

4.1.5 Class,

4.1.6 ASTM designation,

4.1.7 *Product Analysis*— State if required,

4.1.8 *Certification*— State if a certification or a report of test results is required, and

4.1.9 *Purchaser Inspection*—State which tests or inspections are to be witnessed, if any.

5. Material and Manufacture

5.1 Tube shall be made from flat-rolled alloy by an automatic welding process with no addition or filler metal. Subsequent to welding and prior to final annealing, the material shall be cold-worked in either the weld metal only or both weld and base metal.

5.2 Tube shall be furnished with oxide removed. When bright annealing is used, descaling is not necessary.

6. Chemical Composition

6.1 The material shall conform to the composition limits specified in Table 1. One test is required for each lot as defined in Specification B 751.

6.2 If a product analysis is performed, it shall meet the chemistry limits prescribed in Table 1, subject to the analysis tolerances specified in Specification B 751.

7. Mechanical Properties and Other Requirements

7.1 *Mechanical Properties*—The material shall conform to the mechanical property requirements specified in Table 2. One test is required for each lot as defined in Specification B 751.

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

[2] *Annual Book of ASTM Standards*, Vol 02.04.

TABLE 1 Chemical Requirements

Element	Composition Limits,%			
	N06600	N06603	N06025	N06045
Nickel[A]	72.0 min	Bal	Bal	45.0 min
Chromium	14.0 min 17.0 max	24.0–26.0	24.0–26.0	26.0–29.0
Iron	6.0 min 10.0 max	8.0–11.0	8.0–11.0	21.0–25.0
Manganese	1.0 max	0.15 max	0.15 max	1.0 max
Carbon	0.15 max	20.0-40.0	0.15–0.25	0.05–0.12
Copper	0.5 max	0.50 max	0.10 max	0.3 max
Silicon	0.5 max	0.50 max	0.5 max	2.5–3.0
Sulfur	0.015 max	0.010 max	0.010 max	0.010 max
Aluminum	...	2.4-3.0	1.8–2.4	...
Titanium	...	0.01–0.25	0.1–0.2	...
Phosphorus	...	0.020 max	0.02 max	0.02 max
Zirconium	...	0.01–0.40	0.01–0.10	...
Yttrium	...	0.01–0.15	0.05–0.12	...
Cerium	...	...	...	0.03–0.09

[A] Nickel shall be determined arithmetically by difference.

TABLE 2 Mechanical Property Requirements

Alloy	Tensile Strength min, psi (MPa)	Yield Strength 0.2 % Offset, min, psi (MPa)	Elongation in 2 in. or 50 mm, min, %
N06600	80 000 (550)	35 000 (240)	30
N06603	94 000 (650)	43 000 (300)	25
N06025	98 000 (680)	39 000 (270)	30
N06045	90 000 (620)	35 000 (240)	30

7.2 *Flattening Test*— A flattening test shall be made on each end of one tube per lot. Superficial ruptures resulting from surface imperfections shall not be cause for rejection.

7.3 *Flange Test*— A flange test shall be made on each end of one tube per lot.

7.4 *Nondestructive Test Requirements*:

7.4.1 *Class 1*—Each piece in each lot shall be subject to one of the following four tests: hydrostatic, pneumatic (air underwater), eddy current, or ultrasonic.

7.4.2 *Class 2*—Each piece in each lot shall be subjected to a leak test and an electric test as follows:

7.4.2.1 *Leak Test*—Hydrostatic or pneumatic (air underwater).

7.4.2.2 *Electric Test*— Eddy current or ultrasonic.

7.5 The manufacturer shall have the option to test to Class 1 or Class 2 and select the nondestructive test methods, if not specified by the purchaser.

8. General Requirements

8.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification B 751 unless otherwise provided herein.

9. Keywords

9.1 welded tube; N06600; N06603; N06025; N06045