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**SPECIFICATION FOR WELDED NICKEL-
CHROMIUM-ALUMINUM ALLOY (UNS N06699) AND
NICKEL-CHROMIUM-IRON ALLOY (UNS N06600, UNS
N06601, UNS N06603, UNS N06025, UNS N06045, UNS
N06690, AND UNS N06693) TUBES**



SB-516

(23)

(Identical with ASTM Specification B516-18 except that certification and a test report have been made mandatory.)

Specification for Welded Nickel-Chromium-Aluminum Alloy (UNS N06699) and Nickel-Chromium-Iron Alloy (UNS N06600, UNS N06601, UNS N06603, UNS N06025, UNS N06045, UNS N06690, and UNS N06693) Tubes

1. Scope

1.1 This specification covers welded UNS N06600, N06601, N06603, N06025, N06045, UNS N06690, UNS N06693, and UNS N06699 alloy boiler, heat exchanger, and condenser tubes for general corrosion resisting and low or high-temperature service.

1.2 This specification covers tubes $\frac{1}{8}$ 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 B751 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 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, health, and 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:

B751 Specification for General Requirements for Nickel and Nickel Alloy Welded Tube
B899 Terminology Relating to Non-ferrous Metals and Alloys

3. Terminology

3.1 Terms defined in Terminology B899 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*—Certification and a report of test results are required,
- 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.

TABLE 1 Chemical Requirements

Element	Composition Limits, %							
	N06600	N06601	N06603	N06025	N06045	N06690	N06693	N06699
Nickel ^A	72.0 min	58.0-63.0	Bal	Bal	45.0 min	58.0 min	Bal	Bal
Chromium	14.0 min 17.0 max	21.0-25.0	24.0–26.0	24.0–26.0	26.0–29.0	27.0-31.0	27.0-31.0	26.0-30.0
Iron	6.0 min 10.0 max	Bal ^A	8.0–11.0	8.0–11.0	21.0–25.0	7.0-11.0	2.5-6.0	2.5 max
Manganese	1.0 max	1.0 max	0.15 max	0.15 max	1.0 max	0.5 max	1.0 max	0.50 max
Carbon	0.15 max	0.10 max	20.0-40.0	0.15–0.25	0.05–0.12	0.05 max	0.15 max	0.005-0.10
Copper	0.5 max	1.0 max	0.50 max	0.10 max	0.3 max	0.5 max	0.5 max	0.50 max
Silicon	0.5 max	0.5 max	0.50 max	0.5 max	2.5–3.0	0.5 max	0.5 max	0.50 max
Sulfur	0.015 max	0.015 max	0.010 max	0.010 max	0.010 max	0.015 max	0.01 max	0.01 max
Aluminum	...	1.0-1.7	2.4-3.0	1.8–2.4	...	...	2.5-4.0	1.9-3.0
Titanium	...	...	0.01–0.25	0.1–0.2	...	...	1.0 max	0.60 max
Niobium	...	...	...	...	...	...	0.5-2.5	0.50 max
Phosphorus	...	...	0.020 max	0.02 max	0.02 max	...	...	0.02 max
Zirconium	...	...	0.01–0.40	0.01–0.10	...	...	...	0.10 max
Yttrium	...	...	0.01–0.15	0.05–0.12	...	...	...	...
Cerium	...	...	...	...	0.03–0.09	...	...	...
Nitrogen	...	...	...	...	...	...	...	0.05 max

^A Element shall be determined arithmetically by difference.

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 B751.

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 B751.

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 B751.

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
N06601	80 000 (550)	30 000 (205)	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
N06690	85 000 (586)	35 000 (240)	30
N06693	100 000 (690)	50 000 (345)	30
N06699	89 000 (610)	35 000 (240)	40

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 B751 unless otherwise provided herein.

9. Keywords

9.1 welded tube; N06600; N06601; N06603; N06025; N06045; N06690; N06693; N06699