



Designation: **B515–20 B515 – 22**

Standard Specification for Welded Nickel-Iron-Chromium Alloy Tubes¹

This standard is issued under the fixed designation B515; 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 N08120, UNS N08800, UNS N08810 and UNS N08811² 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~~, 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 Material Safety Data Sheet (MSDS) 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.*

<https://standards.iteh.ai/catalog/standards/sist/f99e18be-7188-438a-befe-e2790940eb26/astm-b515-22>

2. Referenced Documents

2.1 ASTM Standards:³

[B751 Specification for General Requirements for Nickel and Nickel Alloy Welded Tube](#)

[E527 Practice for Numbering Metals and Alloys in the Unified Numbering System \(UNS\)](#)

3. Ordering Information

3.1 Orders for material to this specification should include the following information:

3.1.1 *Quantity* (feet or number of lengths),

3.1.2 *UNS Number*,

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 New designation established in accordance with ASTM 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

- 3.1.3 *Size* (outside diameter minimum or average wall thickness),
- 3.1.4 *Length* (random or specific),
- 3.1.5 *Class*,
- 3.1.6 *ASTM Designation*,
- 3.1.7 *Product Analysis*—State if required,
- 3.1.8 *Purchaser Inspection*—State which tests or inspections are to be witnessed, if any.

4. Materials and Manufacture

- 4.1 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.
- 4.2 Tube shall be furnished with oxide removed. When bright annealing is used, descaling is not necessary.

5. Chemical Composition

- 5.1 The material shall conform to the composition limits specified in **Table 1**. One test is required for each lot as defined in Specification **B751**.
- 5.2 If a product analysis is performed, it shall meet the chemistry limits prescribed in **Table 1**, subject to the analysis tolerances specified in Table 6 of Specification **B751**.

6. Mechanical and Other Properties

- 6.1 *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**.
- 6.2 *Grain Size*—A transverse sample representing the full-wall thickness of annealed alloys UNS N08120, N08810, and N08811 shall conform to an average grain size of ASTM No. 5 or coarser.
- 6.3 *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.
- 6.4 *Flange Test*—A flange test shall be made on each end of one tube per lot.
- 6.5 *Nondestructive Test Requirements*:
 - 6.5.1 *Class 1*—Each piece of each lot shall be subject to one of the following four tests: hydrostatic, pneumatic (air underwater), eddy current, or ultrasonic.
 - 6.5.2 *Class 2*—Each piece in each lot shall be subjected to a leak test and an electric test as follows:
 - 6.5.2.1 *Leak Test*—Hydrostatic or pneumatic (air underwater).
 - 6.5.2.2 *Electric Test*—Eddy current or ultrasonic.
- 6.6 The manufacturer shall have the option to test Class 1 or Class 2 and select the nondestructive test methods, if not specified by the purchaser.

TABLE 1 Chemical Requirements

Element	Composition Limits, %			
	Alloy N08120	Alloy N08800	Alloy N08810	Alloy N08811
Nickel, min	35.0	30.0	30.0	30.0
, max	39.0	35.0	35.0	35.0
Chromium, min	23.0	19.0	19.0	19.0
, max	27.0	23.0	23.0	23.0
Iron, min	remainder	39.5 ^A	39.5 ^A	39.5 ^A
Manganese, max	1.5	1.5	1.5	1.5
Carbon, min	0.02	...	...	...
, max	0.10	0.10	0.05 to 0.10	0.06 to 0.10
Copper, max	0.50	0.75	0.75	0.75
Silicon, max	1.0	1.0	1.0	1.0
Sulfur, max	0.03	0.015	0.015	0.015
Aluminum, min ^B	...	0.15	0.15	0.15
, max	0.40	0.60	0.60	0.60
Titanium, min ^B	...	0.15	0.15	0.15
, max	0.20	0.60	0.60	0.60
Columbium, min	0.4	...	...	...
, max	0.9	...	...	...
Molybdenum, max	2.50	...	...	...
Phosphorus, max	0.040	...	...	...
Tungsten, max	2.50	...	...	...
Cobalt, max	3.0	...	...	...
Nitrogen, min	0.15	...	...	...
, max	0.30	...	...	...
Boron, max	0.010	...	...	...

TABLE 1 Chemical Requirements^A

Element	Composition Limits, %			
	Alloy N08120	Alloy N08800	Alloy N08810	Alloy N08811
Nickel	35.0 – 39.0	30.0 – 35.0	30.0 – 35.0	30.0 – 35.0
Chromium	23.0 – 27.0	19.0 – 23.0	19.0 – 23.0	19.0 – 23.0
Iron	remainder	39.5 min ^B	39.5 min ^B	39.5 min ^B
Manganese	1.5	1.5	1.5	1.5
Carbon	0.02 – 0.10	0.10	0.05 – 0.10	0.06 – 0.10
Copper	0.50	0.75	0.75	0.75
Silicon	1.0	1.0	1.0	1.0
Sulfur	0.03	0.015	0.015	0.015
Aluminum	0.40	0.15 – 0.60	0.15 – 0.60	0.25 – 0.60 ^C
Titanium	0.20	0.15 – 0.60	0.15 – 0.60	0.25 – 0.60 ^C
Niobium ^D	0.4 – 0.90	...	...	...
Molybdenum	2.50	...	...	...
Phosphorus	0.040	0.045	0.045	0.045
Tungsten	2.50	...	...	...
Cobalt	3.0	...	...	...
Nitrogen	0.15 – 0.30	...	...	...
Boron	0.010	...	...	...

^A All values are maximums unless specified as a minimum or a range is provided.

^B Iron shall be determined arithmetically by difference.

^C Alloy UNS N08811: Al + Ti, 0.85 – 1.20. Al + Ti = 0.85 – 1.20.

^D Columbium and niobium are interchangeable names for the same element and both names are acceptable for use in B02.07 specifications.

TABLE 2 Mechanical Property Requirements

Alloy	Condition (Temper)	Tensile Strength, min, psi (MPa)	Yield Strength, 0.2 % Offset, min, psi (MPa)	Elongation in 2 in. or 50 mm, min, %
UNS N08120	annealed	90 000 (621)	40 000 (276)	30
UNS N08800	annealed	75 000 (520)	30 000 (205)	30
UNS N08810 and UNS N08811	annealed	65 000 (450)	25 000 (170)	30

7. General Requirements

7.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification **B751** unless otherwise provided herein.