



Designation: B924 – 02 (Reapproved 2006)

Standard Specification for Seamless and Welded Nickel Alloy Condenser and Heat Exchanger Tubes With Integral Fins¹

This standard is issued under the fixed designation B924; 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 specification² describes seamless and welded nickel alloy tubing on which the external or internal surface, or both, has been modified by a cold forming process to produce an integral enhanced surface, for improved heat transfer. The tubes are used in surface condensers, evaporators, heat exchangers and similar heat transfer apparatus in unfinned end diameters up to and including 1 in. (25.4 mm).

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 The following precautionary statement pertains to the test method portion only: Section 10 of this specification. *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 requirements prior to use.*

2. Referenced Documents

2.1 ASTM Standards:³

- A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys
- B163 Specification for Seamless Nickel and Nickel Alloy (UNS N06845) Condenser and Heat-Exchanger Tubes
- B167 Specification for Nickel-Chromium-Iron Alloys

(UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696), Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617), and Nickel-Iron-Chromium-Tungsten Alloy (UNS N06674) Seamless Pipe and Tube

B407 Specification for Nickel-Iron-Chromium Alloy Seamless Pipe and Tube

B423 Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloy (UNS N08825, N08221, and N06845) Seamless Pipe and Tube

B444 Specification for Nickel-Chromium-Molybdenum-Columbium Alloys (UNS N06625 and UNS N06852) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Pipe and Tube

B468 Specification for Welded UNS N08020 Alloy Tubes

B515 Specification for Welded UNS N08120, UNS N08800, UNS N08810, and UNS N08811 Alloy Tubes

B516 Specification for Welded Nickel-Chromium-Iron Alloy (UNS N06600, UNS N06603, UNS N06025, and UNS N06045) Tubes

B622 Specification for Seamless Nickel and Nickel-Cobalt Alloy Pipe and Tube

B626 Specification for Welded Nickel and Nickel-Cobalt Alloy Tube

B674 Specification for UNS N08925, UNS N08354, and UNS N08926 Welded Tube

B676 Specification for UNS N08367 Welded Tube

B677 Specification for UNS N08925, UNS N08354, and UNS N08926 Seamless Pipe and Tube

B690 Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08366 and UNS N08367) Seamless Pipe and Tube

B704 Specification for Welded UNS N06625, UNS N06219 and UNS N08825 Alloy Tubes

B729 Specification for Seamless UNS N08020, UNS N08026, and UNS N08024 Nickel-Alloy Pipe and Tube

B751 Specification for General Requirements for Nickel and Nickel Alloy Welded Tube

B829 Specification for General Requirements for Nickel and Nickel Alloys Seamless Pipe and Tube

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 ASME Boiler and Pressure Vessel Code applications, see related Specification SB-924 in Section II of that Code.

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.

B899 Terminology Relating to Non-ferrous Metals and Alloys

E426 Practice for Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Austenitic Stainless Steel and Similar Alloys

E571 Practice for Electromagnetic (Eddy-Current) Examination of Nickel and Nickel Alloy Tubular Products

3. Terminology

3.1 For definition of general terms used in this specification, refer to Terminologies **A941** and **B899**.

3.2 *Definitions of Terms Specific to this Document (Integral Fin Tube Nomenclature):*

- D = outside diameter of unenhanced section
- D_i = inside diameter of unenhanced section
- d_r = root diameter of enhanced section outside of tube
- d_o = outside diameter of enhanced section
- d_i = inside diameter of enhanced section
- W = wall thickness of unenhanced section
- W_f = wall thickness of enhanced section
- F_h = height of fin—enhanced section outside of tube
- F_m = mean fin thickness—enhanced section outside of tube
- P = mean rib pitch—enhanced section inside of tube
- R_h = height of rib—enhanced section inside of tube
- H_a = rib helix angle—enhanced section inside of tube
- T_t = transition taper

4. Ordering Information

4.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Such requirements may include, but are not limited to, the following:

- 4.1.1 ASTM designation and year of issue (this specification),
- 4.1.2 ASTM designation and year of issue (plain tube specification),
- 4.1.3 Welded or seamless,
- 4.1.4 Alloy grade and UNS designation,
- 4.1.5 Dimensions; plain tube outside diameter, plain tube wall thickness (ave. or min. specified), length and location of unenhanced surfaces and the total tube length. Configuration of enhanced surfaces (fins per unit length, fin height, wall thickness under fin, rib pitch, rib height, etc.) shall be as agreed upon between the manufacturer and purchaser. (Refer to **Figs. 1 and 2**).
- 4.1.6 Temper (as-finned or stress relief annealed),
- 4.1.7 Quantity,
- 4.1.8 Packaging,

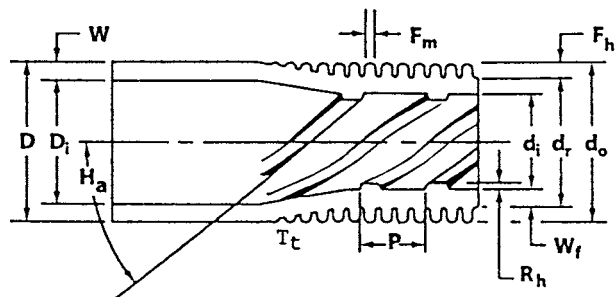


FIG. 2 Outside and Inside Enhancement

- 4.1.9 Nondestructive tests,
- 4.1.10 Customer inspection,
- 4.1.11 Mill test report, and
- 4.1.12 Certification.

5. General Requirements

5.1 Seamless material furnished under this specification shall conform to the requirements of Specification **B829**, unless otherwise provided herein.

5.2 Welded material furnished under this specification shall conform to the applicable requirements of Specification **B751**, unless otherwise provided herein.

5.3 Enhanced (integrally finned) sections of the tube shall be produced by cold forming the tubing in such a manner that exterior fins, wall under the fin and inside ribs (when specified) are homogeneous.

5.4 Tubes described by this specification shall be furnished with unenhanced (plain) ends.

5.5 Enhanced sections of the tube are normally supplied in the “as finned” temper (cold worked condition produced by the enhancing operation). The unenhanced sections of the tube shall be in the annealed condition and shall be suitable for rolling-in operations.

6. Materials and Manufacture

6.1 The integrally enhanced (finned) tubes shall be manufactured from seamless, welded, or welded/cold worked plain tubes that conform to one of the following ASTM specifications: **B163, B167, B407, B423, B444, B468, B515, B516, B622, B626, B674, B676, B677, B690, B704, and B729**.

7. Temper

7.1 The tube after enhancing shall normally be supplied in the as-finned temper. When specified by the purchaser, for bending, coiling or other fabricating operations, enhanced portions of the tube may be stress relief annealed or solution annealed.

7.2 Heat treatment of enhanced sections and bend areas, or both, shall be in accordance with the governing plain tube specification.

8. Chemical Composition

8.1 The tubing specified shall conform to the chemical requirements prescribed in the governing plain tube specification.

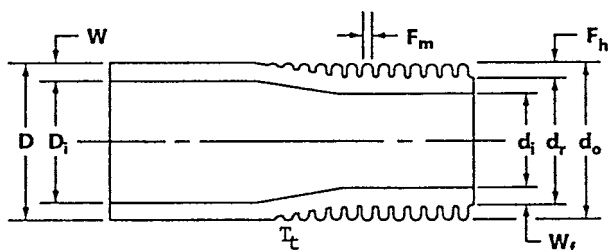


FIG. 1 Outside Enhancement Only