



Designation: B924 – 02 (Reapproved 2022)

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 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 requirements prior to use.*

1.4 *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.*

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.

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 Condenser and Heat-Exchanger Tubes
- B167 Specification for Standard Specification for Nickel-Chromium-Aluminum Alloys (UNS N06699) Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696) Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617) Nickel-Iron-Chromium-Tungsten Alloy (UNS N06674) and Nickel-Chromium-Molybdenum-Copper Alloy (UNS N06235) Seamless Pipe and Tube
- B407 Specification for Nickel-Iron-Chromium Alloy Seamless Pipe and Tube
- B423 Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloy 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 Nickel-Iron-Chromium Alloy Tubes
- B516 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
- 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 Nickel-Iron-Chromium-Molybdenum and Iron-Nickel-Chromium-Molybdenum-Copper Welded Tube

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.

- B676 Specification for UNS N08367 Welded Tube
 B677 Specification for Nickel-Iron-Chromium-Molybdenum and Iron-Nickel-Chromium-Molybdenum-Copper Seamless Pipe and Tube
 B690 Specification for Iron-Nickel-Chromium-Molybdenum Alloy Seamless Pipe and Tube
 B704 Specification for Welded Nickel Alloy Tubes
 B729 Specification for Seamless Nickel-Iron-Chromium-Molybdenum-Copper 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
 B899 Terminology Relating to Non-ferrous Metals and Alloys
 E426 Practice for Electromagnetic (Eddy Current) Examination of Seamless and Welded Tubular Products, Titanium, 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.)

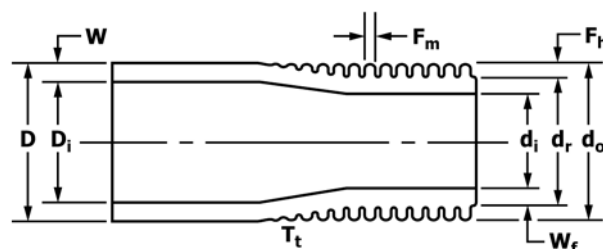


FIG. 1 Outside Enhancement Only

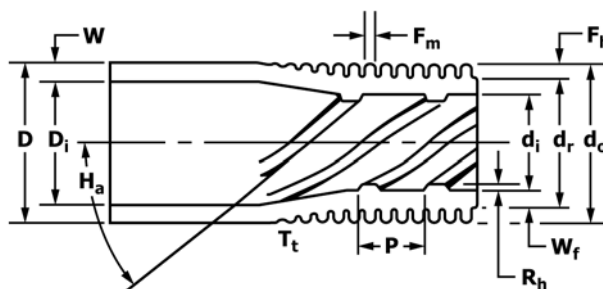


FIG. 2 Outside and Inside Enhancement

- 4.1.6 Temper (as-finned or stress relief annealed),
 4.1.7 Quantity,
 4.1.8 Packaging,
 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.