



# Standard Specification for Seamless and Welded Titanium and Titanium Alloy Condenser and Heat Exchanger Tubes with Enhanced Surface for Improved Heat Transfer<sup>1</sup>

This standard is issued under the fixed designation B891; 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<sup>2</sup> covers seamless and welded titanium and titanium alloy tubing on which at least part of the external or internal surface has been enhanced by cold forming for improved heat transfer. The tubes are used in surface condensers, evaporators, heat exchangers, coils, and similar heat transfer apparatus in diameters up to and including 1 in. (25.4 mm). The base tube wall thickness is typically at least 0.049 in. average, but lighter gauge may be negotiated with the manufacturer.

1.2 Tubing purchased to this specification will typically be inserted through close-fitting holes in tubesheets, baffles, or support plates spaced along the tube length such as defined in the Tubular Exchanger Manufacturer's Association (TEMA) Standard.<sup>3</sup> The tube ends will also be expanded, and may then be welded. Tube may also be bent to form U-tubes or be coiled or otherwise formed, although tight radii may require unenhanced length for the bends.

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 The following precautionary statement pertains to the test method portion only: Section 8, 9, 10 and S1 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 establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee B10 on Reactive and Refractory Metals and Alloys and is the direct responsibility of Subcommittee B10.01 on Titanium.

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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications, see related Specification SB-\_\_\_\_\_ in Section II of that Code.

<sup>3</sup> Available from Tubular Exchanger Manufacturers Association, Inc. 25 North Broadway Tarrytown, NY 10591, [www.tema.org](http://www.tema.org).

## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>4</sup>

A1047/A1047M Test Method for Pneumatic Leak Testing of Tubing

B338 Specification for Seamless and Welded Titanium and Titanium Alloy Tubes for Condensers and Heat Exchangers

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

E1316 Terminology for Nondestructive Examinations

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *base tube, n*—the seamless or welded tube conforming to Specification B338 prior to enhancing.

3.1.2 *finished tube, n*—the tube following enhancement and any heat treatment, forming, or other processing specified.

3.1.3 *enhanced tube or section, n*—all or sections of tube length that have been mechanically worked inside, outside, or both, to produce increased surface area for improved heat transfer.

3.1.4 *finned section, n*—sections of tube exterior length that have been mechanically worked to produce increased surface area for improved heat transfer; see Table 1 for nomenclature of finning details.

3.1.5 *ribbed section, n*—sections of tube interior length that have been mechanically worked to produce increased surface area for improved heat transfer; see Table 1 for nomenclature of ribbing details.

3.1.6 *plain ends, n*—tube ends that have not been enhanced to allow for tube expansion for which properties are essentially identical to the base tube.

3.1.7 *land, n*—section of finished tube where the exterior and the interior surfaces have not been enhanced, to provide

<sup>4</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto: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