Designation: A498/A498M – 17 (Reapproved 2023)

Standard Specification for Seamless and Welded Carbon Steel Heat-Exchanger Tubes with Integral Fins[1]

This standard is issued under the fixed designation A498/A498M; 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 describes seamless or welded low-carbon steel tubes on which the external or internal surface, or both, have been modified by a cold forming process to produce an integral increased surface area for improved heat transfer. The tubes are used in tubular heat exchangers, surface condensers, evaporators, superheaters, and similar heat-transfer apparatus in outside diameters up to 2 in. [50 mm], inclusive.

1.2 *Units*—This specification is expressed in both inch-pound units and in SI units; however, unless the purchase order or contract specifies the applicable M specification designation (SI units), the inch-pound units shall apply. The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 *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:*[2]

A179/A179M Specification for Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes

A214/A214M Specification for Electric-Resistance-Welded Carbon Steel Heat-Exchanger and Condenser Tubes

A334/A334M Specification for Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service

A450/A450M Specification for General Requirements for Carbon and Low Alloy Steel Tubes

A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

A1016/A1016M Specification for General Requirements for Ferritic Alloy Steel, Austenitic Alloy Steel, and Stainless Steel Tubes

A1047/A1047M Test Method for Pneumatic Leak Testing of Tubing

3. Terminology

3.1 *Definitions*—For definitions of general terms used in this specification, refer to Terminology A941.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *land*—a length of unmodified tube between adjacent sections of modified tube; used as support zones for baffles, or for bending where surface modification might compromise material integrity, or for other reasons.

3.2.2 *modified surface*—the surface of a tube having a series of integral fins, grooves, or ribs on the outside diameter, inside diameter, or both, for the purpose of increasing the surface area and improving heat transfer.

3.2.3 *unmodified surface*—the cylindrical surface of a tube made to the reference standards.

3.3 *Symbols (Integral Fin Tube Nomenclature):*

3.3.1 Bare tube symbols, see Fig. 1, Fig. 2, or Fig. 3.

3.3.1.1 *OD* = outside diameter of unmodified sections, and

3.3.1.2 *W* = wall thickness of unmodified sections.

3.3.2 OD surface modification symbols, see Fig. 1.

3.3.2.1 *od* = outside diameter of modified sections,

3.3.2.2 *rd* = root diameter of outside fins,

3.3.2.3 W_f = wall thickness at fin groove, either minimum or average,

3.3.2.4 *FH* = fin height,

3.3.2.5 N_{fpu} = number of fins per unit length, the reciprocal of *p*,

3.3.2.6 *p* = pitch, the distance from a point on one fin to the corresponding point on the adjacent fin along the tube longitudinal axis, and

[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.09 on Carbon Steel Tubular Products.

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[2] 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

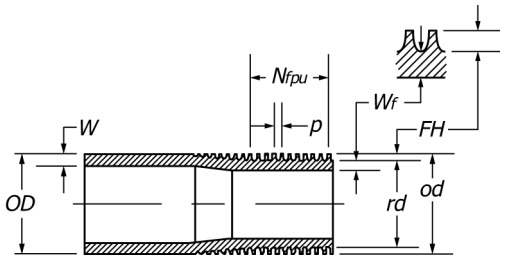

FIG. 1 OD Surface Modification Symbols – Fins

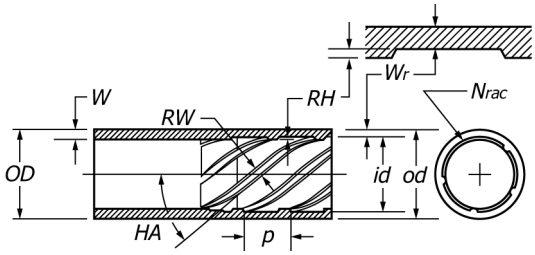

FIG. 2 ID Surface Modification Symbols – Ribs

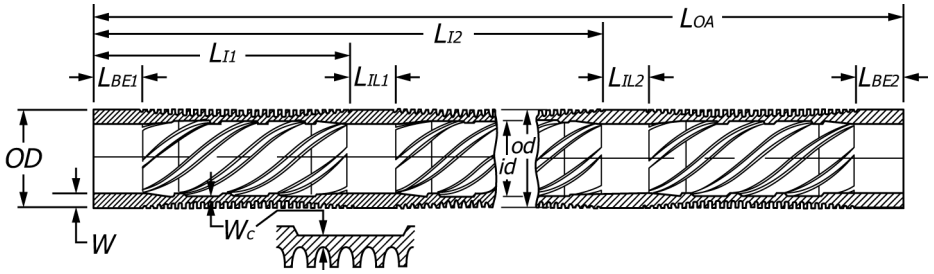

FIG. 3 Combined OD and ID Surface Modifications Plus Length Symbols

3.3.2.7 p = the reciprocal of N_{fpu}.

3.3.3 ID surface modification symbols, see Fig. 2.

3.3.3.1 od = outside diameter of modified sections,

3.3.3.2 id = inside diameter of id modified sections, to root of rib,

3.3.3.3 W_r = wall thickness at rib groove, either minimum or average,

3.3.3.4 RH = rib height,

3.3.3.5 RW = rib width,

3.3.3.6 HA = helix angle,

3.3.3.7 p = pitch, the distance from a point on one rib to the corresponding point on the adjacent rib along the tube longitudinal axis, and

3.3.3.8 N_{rac} = number of ribs around circumference.

3.3.4 Combined (OD + ID) surface modification symbols, see Figs. 1-3.

3.3.4.1 od = outside diameter of modified sections,

3.3.4.2 id = inside diameter of modified sections, to root of rib, and

3.3.4.3 W_c = wall thickness of combined modified surface, either minimum or average.

3.3.5 Length symbols, see Fig. 3.

3.3.5.1 L_{OA} = overall length,

3.3.5.2 L_{BE1} = length of first bare end,

3.3.5.3 L_{BE2} = length of second bare end,

3.3.5.4 L_{I1} = length to first intermediate land,

3.3.5.5 L_{IL1} = length of first intermediate land,

3.3.5.6 L_{I2} = length to second intermediate land,

3.3.5.7 L_{IL2} = length of second intermediate land,

3.3.5.8 L_{In} = length to n^{th} intermediate land, and

3.3.5.9 L_{ILn} = length of n^{th} intermediate land.

3.4 *Illustrations*—See Figs. 1-3.

4. Ordering Information

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

4.1.1 ASTM designation and year of issue for the modified tube (this specification).

4.1.2 ASTM designation and year of issue of the plain tube from which the modified tube is to be manufactured.

4.1.3 Grade (if applicable).

4.1.4 Type of material (if applicable: seamless or welded).

4.1.5 Quantity.

4.1.6 Dimensions:

4.1.6.1 Outside diameter.

4.1.6.2 Wall thickness.

4.1.6.3 Length.