



Designation: A688/A688M – 24

Standard Specification for Seamless and Welded Austenitic Stainless Steel Feedwater Heater Tubes¹

This standard is issued under the fixed designation A688/A688M; 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 reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

1. Scope*

1.1 This specification² covers seamless and welded austenitic stainless steel feedwater heater tubes including those bent, if specified, into the form of U-tubes for application in tubular feed-water heaters.

1.2 The tubing sizes covered shall be 5/8 to 1 in. [15.9 to 25.4 mm] inclusive outside diameter, and average or minimum wall thicknesses of 0.028 in. [0.7 mm] and heavier.

1.3 The values stated in either SI units or inch-pound 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.

1.4 *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.*

2. Referenced Documents

2.1 ASTM Standards:³

A262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

A480/A480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

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

E112 Test Methods for Determining Average Grain Size

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

2.2 Other Standard:

SAE J1086 Practice for Numbering Metals and Alloys (UNS)⁴

3. Terminology

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

4. Ordering Information

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

4.1.1 Quantity (length or number of pieces),

4.1.2 Material description (seamless or welded),

4.1.3 Dimensions—Outside diameter, wall thickness (minimum or average wall), and length,

4.1.4 Grade (chemical composition) (Table 1),

4.1.5 U-bend requirements, if order specifies bending, U-bend schedules or drawings shall accompany the order,

4.1.6 Optional requirements—Purchaser shall specify if annealing of the U-bends is required or whether tubes are to be hydrotested or air tested (see 11.8)

4.1.7 Supplementary requirements—Purchaser shall specify on the purchase order if material is to be eddy current tested in accordance with Supplementary Requirements S1 or S2, and if special test reports are required under Supplementary Requirement S3, and,

4.1.8 Any additional special requirements.

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 A01.10 on Stainless and Alloy Steel Tubular Products.

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² For ASME Boiler and Pressure Vessel Code applications see related Specification SA-688 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.

⁴ Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

*A Summary of Changes section appears at the end of this standard



TABLE 1 Chemical Requirements

Element	Grade.....	TP 304	TP 304L	...	TP 304LN	TP 316	TP 316L	TP 316LN	TP XM-29	TP 304N	TP 316N	...	800	800H	...	...	...	...
	UNS Designation ^A	S30400	S30403	S30416	S30453	S31600	S31603	S31653	S24000	S30451	S31651	N08367	N08800	N08810	N08811	N08926	S31254	S32654
Composition, %																		
Carbon, max		0.08	0.035	0.030	0.035	0.08	0.035	0.035	0.060	0.08	0.08	0.030	0.10	0.05–0.10	0.06–0.10	0.020	0.020	0.020
Manganese, max ^B		2.00	2.00	2.00	2.00	2.00	2.00	2.00	11.50–14.50	2.00	2.00	2.00	1.50	1.50	1.50	2.00	1.00	2.0–4.0
Phosphorus, max		0.040	0.040	0.045	0.040	0.040	0.040	0.040	0.060	0.040	0.040	0.040	0.045	0.045	0.045	0.03	0.030	0.030
Sulfur, max		0.030	0.030	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.015	0.015	0.015	0.01	0.010	0.005
Silicon, max		0.75	0.75	0.80–2.00 ^C	0.75	0.75	0.75	0.75	1.00	0.75	0.75	1.00	1.00	1.00	1.00	0.5	0.80	0.50
Nickel		8.00–11.00	8.00–13.00	9.00–11.00	8.00–13.00	10.00–14.00	10.00–15.00	10.00–15.00	2.25–3.75	8.00–11.0	10.00–14.00	23.50–25.50	30.0–35.0	30.0–35.0	30.0–35.0	24.00–26.00	17.5–18.5	21.0–23.0
Chromium		18.00–20.00	18.00–20.00	17.50–19.50	18.00–20.00	16.00–18.00	16.00–18.00	16.00–18.00	17.00–19.00	18.0–20.0	16.0–18.0	20.00–22.00	19.00–23.0	19.00–23.0	19.00–23.0	19.00–21.00	19.5–20.5	24.0–25.0
Molybdenum		...	...	0.40–0.80	...	2.00–3.00	2.00–3.00	2.00–3.00	...	...	2.00–3.00	6.00–7.00	...	...	...	6.0–7.0	6.0–6.5	7.0–8.0
Nitrogen ^D		...	...	0.10 max	0.10–0.16	...	...	0.10–0.16	0.20–0.40	0.10–0.16	0.10–0.16	0.18–0.25	...	...	...	0.15–0.25	0.18–0.22	0.45–0.55
Copper		...	...	...	...	...	...	...	...	...	...	0.75 max	0.75	0.75	0.75	0.5–1.5	0.50–1.00	0.30–0.60
Titanium		...	...	...	...	...	...	...	...	...	...	...	0.15–0.60	0.15–0.60	0.25–0.60 ^E	...	...	...
Aluminum		...	...	...	...	...	...	...	...	...	...	...	0.60	0.60	0.60	...	...	...
Others		...	...	...	...	...	...	...	...	...	...	...	Fe 39.5 Min. ^F	Fe 39.5 Min. ^F	Fe 39.5 Min. ^F	...	...	...

^A New designation established in accordance with Practice E527 and SAE J1086.^B Maximum, unless otherwise noted.^C S30416 has a range for Silicon content instead of a max.^D The method of analysis for nitrogen shall be a matter of agreement between the purchaser and manufacturer.^E (Al + Ti) = 0.85 – 1.20.^F Fe shall be determined arithmetically by difference of 100 minus the sum of the other specified elements.