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Used in USDOE-NE Standards

Standard Specification for Welded Austenitic Steel Boiler, Superheater, Heat-Exchanger, and Condenser Tubes[1]

This standard is issued under the fixed designation A249/A249M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification[2] covers nominal-wall-thickness welded tubes and heavily cold worked welded tubes made from the austenitic steels listed in Table 1, with various grades intended for such use as boiler, superheater, heat exchanger, or condenser tubes.

1.2 Grades TP304H, TP309H, TP309HCb, TP310H, TP310HCb, TP316H, TP321H, TP347H, and TP348H are modifications of Grades TP304, TP309S, TP309Cb, TP310S, TP310Cb, TP316, TP321, TP347, and TP348, and are intended for high-temperature service such as for superheaters and reheaters.

1.3 The tubing sizes and thicknesses usually furnished to this specification are ⅛ in. [3.2 mm] in inside diameter to 12 in. [304.8 mm] in outside diameter and 0.015 to 0.320 in. [0.4 to 8.1 mm], inclusive, in wall thickness. Tubing having other dimensions may be furnished, provided such tubes comply with all other requirements of this specification.

1.4 Mechanical property requirements do not apply to tubing smaller than ⅛ in. [3.2 mm] in inside diameter or 0.015 in. [0.4 mm] in thickness.

1.5 Optional supplementary requirements are provided and, when one or more of these are desired, each shall be so stated in the order.

1.6 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. The inch-pound units shall apply unless the "M" designation of this specification is specified in the order.

1.7 The following safety hazards caveat pertains only to the test method described in the Supplementary Requirements 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.* A specific warning statement is given in Supplementary Requirement S7, Note S7.1.

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

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

E213 Practice for Ultrasonic Testing of Metal Pipe and Tubing

E273 Practice for Ultrasonic Testing of the Weld Zone of Welded Pipe and Tubing

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

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[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-249 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.

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

TABLE 1 Chemical Requirements, %[A]

Grade	UNS Designation[B]	Composition, %										
		Carbon	Manganese	Phosphorous	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen[C]	Copper	Other
TP 201	S20100	0.15	5.50–7.5	0.060	0.030	1.00	16.0–18.0	3.5–5.5	...	0.25	...	...
TP 201LN	S20153	0.03	6.4–7.5	0.045	0.015	0.75	16.0–17.5	4.0–5.0	...	0.10–0.25	1.00	...
TP 202	S20200	0.15	7.5–10.0	0.060	0.030	1.00	17.0–19.0	4.0–6.0	...	0.25	...	...
TPXM-19	S20910	0.06	4.0–6.0	0.045	0.030	1.00	20.5–23.5	11.5–13.5	1.50–3.00	0.20–0.40	...	Cb 0.10–0.30 V 0.10–0.30
TPXM-29	S24000	0.08	11.5–14.5	0.060	0.030	1.00	17.0–19.0	2.3–3.7	...	0.20–0.40	...	...
TP304	S30400	0.08	2.00	0.045	0.030	1.00	18.0–20.0	8.0–11.0	...	...	...	...
TP304L[D]	S30403	0.030	2.00	0.045	0.030	1.00	18.0–20.0	8.0–12.0	...	...	...	...
TP304H	S30409	0.04–0.10	2.00	0.045	0.030	1.00	18.0–20.0	8.0–11.0	...	...	...	...
...	S30415	0.04–0.06	0.80	0.045	0.030	1.00–2.00	18.0–19.0	9.0–10.	...	0.12–0.18	...	Ce 0.03–0.08
TP304N	S30451	0.08	2.00	0.045	0.030	1.00	18.0–20.0	8.0–11.0	...	0.10–0.16	...	...
TP304LN[D]	S30453	0.030	2.00	0.045	0.030	1.00	18.0–20.0	8.0–11.0	...	0.10–0.16	...	...
TP305	S30500	0.12	2.00	0.045	0.030	1.00	17.0–19.0	11.0–13.0	...	...	...	...
...	S30615	0.16–0.24	2.00	0.030	0.030	3.2–4.0	17.0–19.5	13.5–16.0	...	...	...	...
...	S30815	0.05–0.10	0.80	0.040	0.030	1.40–2.00	20.0–22.0	10.0–12.0	...	0.14–0.20	...	Ce 0.03–0.08
TP309S	S30908	0.08	2.00	0.045	0.030	1.00	22.0–24.0	12.0–15.0	...	...	...	...
TP309H	S30909	0.04–0.10	2.00	0.045	0.030	1.00	22.0–24.0	12.0–15.0	...	...	...	...
TP309Cb	S30940	0.08	2.00	0.045	0.030	1.00	22.0–24.0	12.0–16.0	...	...	...	Cb 10x C-1.10
TP309HCb	S30941	0.04–0.10	2.00	0.045	0.030	1.00	22.0–24.0	12.0–16.0	...	...	...	Cb 10x C-1.10
TP310S	S31008	0.08	2.00	0.045	0.030	1.00	24.0–26.0	19.0–22.0	...	...	...	...
TP310H	S31009	0.04–0.10	2.00	0.045	0.030	1.00	24.0–26.0	19.0–22.0	...	...	...	...
TP310Cb	S31040	0.08	2.00	0.045	0.030	1.00	24.0–26.0	18.0–22.0	...	...	...	Cb 10x C-1.10
TP310HCb	S31041	0.04–0.10	2.00	0.045	0.030	1.00	24.0–26.0	19.0–22.0	...	...	...	Cb 10x C-1.10
...	S31050	0.030	2.00	0.030	0.015	0.40	24.0–26.0	21.0–23.0	2.00–3.00	0.10–0.16	...	...
...	S31254	0.020	1.00	0.030	0.010	0.80	19.5–20.5	17.5–18.5	6.0–6.5	0.18–0.25	0.50–1.00	...
...	S31277	0.020	3.00	0.030	0.010	0.50	20.5–23.0	26.0–28.0	6.5–8.0	0.30–0.40	0.50–1.50	...
TP316	S31600	0.08	2.00	0.045	0.030	1.00	16.0–18.0	10.0–14.0	2.00–3.00	...	...	...
TP316L[D]	S31603	0.030	2.00	0.045	0.030	1.00	16.0–18.0	10.0–14.0	2.00–3.00	...	...	...
TP316H	S31609	0.04–0.10	2.00	0.045	0.030	1.00	16.0–18.0	10.0–14.0	2.00–3.00	...	...	...
TP316N	S31651	0.08	2.00	0.045	0.030	1.00	16.0–18.0	10.0–13.0	2.00–3.00	0.10–0.16	...	...
TP316LN[D]	S31653	0.030	2.00	0.045	0.030	1.00	16.0–18.0	10.0–13.0	2.00–3.00	0.10–0.16	...	...
TP317	S31700	0.08	2.00	0.045	0.030	1.00	18.0–20.0	11.0–15.0	3.0–4.0	...	...	...
TP317L	S31703	0.030	2.00	0.045	0.030	1.00	18.0–20.0	11.0–15.0	3.0–4.0	...	...	...
...	S31725	0.030	2.00	0.045	0.030	1.00	18.0–20.0	13.5–17.5	4.0–5.0	0.20	...	...
...	S31726	0.030	2.00	0.045	0.030	1.00	17.0–20.0	14.5–17.5	4.0–5.0	0.10–0.20	...	...
...	S31727	0.030	1.00	0.030	0.030	1.00	17.5–19.0	14.5–16.5	3.8–4.5	0.15–0.21	2.8–4.0	...
...	S32050	0.030	1.50	0.035	0.020	1.00	22.0–24.0	20.0–23.0	6.0–6.8	0.21–0.32	0.40	...
...	S32053	0.030	1.00	0.030	0.010	1.00	22.0–24.0	24.0–26.0	5.0–6.0	0.17–0.22	...	...
TP321	S32100	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0	...	0.10	...	Ti 5(C+N)-0.70
TP321H	S32109	0.04–0.10	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0	...	0.10	...	Ti 5(C+N)-0.70
...	S32615	0.07	2.00	0.045	0.030	4.80–6.00	16.5–19.5	19.0–22.0	0.30–1.50	...	1.50–2.50	...

TABLE 1 *Continued*

...	S32654	0.020	2.0–4.0	0.030	0.005	0.50	24.0–25.0	21.0–23.0	7.0–8.0	0.45–0.55	0.30–0.60	...
...	S33228	0.04–0.08	1.00	0.020	0.015	0.30	26.0–28.0	31.0–333.0	...	...	...	Cb 0.60–1.00 Ce 0.05–0.10 Al0.025
...	S34565	0.030	5.0–7.0	0.030	0.010	1.00	23.0–25.0	16.0–18.0	4.0–5.0	0.40–0.60	...	Cb 0.10
TP347	S34700	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0	...	...	...	Cb 10xC-1.10
TP347H	S34709	0.04–0.10	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0	...	...	...	Cb 8xC-1.10
TP348	S34800	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0	...	...	...	(Cb+Ta) 10xC-1.10 Ta 0.10 Co 0.20
TP348H	S34809	0.04–0.10	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0	...	...	...	(Cb+Ta) 8xC-1.10 Ta 0.10 Co 0.20
...	S35045	0.06–0.10	1.50	0.045	0.015	1.00	25.0–29.0	32.0–37.0	...	...	0.75	Al 0.15–0.60 Ti 0.15–0.60
TPXM-15	S38100	0.08	2.00	0.030	0.030	1.50–2.50	17.0–19.0	17.5–18.5	...	...	...	...
...	S38815	0.030	2.00	0.040	0.020	5.5–6.5	13.0–15.0	15.0–17.0	0.75–1.50	...	0.75–1.50	Al 0.30 max
...	N08367	0.030	2.00	0.040	0.030	1.00	20.0–22.0	23.5–25.5	6.0–7.0	0.18–0.25	0.75	...
800	N08800	0.10	1.50	0.045	0.015	1.00	19.0–23.0	30.0–35.0	...	...	0.75	Al 0.15–0.60 Ti 0.15–0.60 Fe[E] 39.5 min
800H	N08810	0.05–0.10	1.50	0.045	0.015	1.00	19.0–23.0	30.0–35.0	...	...	0.75	Al 0.15–0.60 Ti 0.15–0.60 Fe[E] 39.5 min
...	N08811	0.05–0.10	1.50	0.045	0.015	1.00	19.0–23.0	30.0–35.0	...	...	0.75	Al 0.25–0.60[F] Ti 0.25–0.60[F] Fe[E] 39.5 min
...	N08926	0.020	2.00	0.030	0.010	0.50	19.0–21.0	24.0–26.0	6.0–7.0	0.15–0.25	0.50–1.50	...
...	N08904	0.020	2.00	0.040	0.030	1.00	19.0–23.0	23.0–28.0	4.0–5.0	0.10	1.00–2.00	...

[A] Maximum, unless otherwise indicated.
[B] New designation established in accordance with Practice E527 and SAE J1086.
[C] The method of analysis for nitrogen shall be a matter of agreement between the purchaser and manufacturer.
[D] For small diameter or thin walls, or both, where many drawing passes are required, a carbon maximum of 0.040 % is necessary in Grades TP 304L and TP 316L. Small outside diameter tubes are defined as those less than 0.500 in. [12.7 mm] in outside diameter and light wall are those less than 0.049 in. [1.2 mm] in minimum wall thickness.
[E] Iron shall be determined arithmetically by difference of 100 minus the sum of the other specified elements.
[F] (Al + Ti) = 0.85 to 1.20.

2.2 *ASME Boiler and Pressure Vessel Code:*
Section VIII [4]
2.3 *Other Standard:*
SAE J1086 Practice for Numbering Metals and Alloys (UNS)[5]

3. Ordering Information

3.1 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:
3.1.1 Quantity (feet, metres, or number of lengths),
3.1.2 Name of material welded tubes (WLD) or heavily cold worked tubes (HCW),
3.1.3 Grade (Table 1),
3.1.4 Size (outside diameter and nominal wall thickness),
3.1.5 Length (specific or random),
3.1.6 Optional requirements (13.6),
3.1.7 Test report required (see Certification Section of Specification A1016/A1016M),
3.1.8 Specification designation, and
3.1.9 Special requirements and any supplementary requirements selected.

4. General Requirements

4.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A1016/A1016M, unless otherwise provided herein.

5. Manufacture

5.1 The welded (WLD) tubes shall be made from flat-rolled steel by an automatic welding process with no addition of filler metal.
5.1.1 Subsequent to welding and prior to final heat treatment, the tubes shall be cold worked either in both weld and base metal or in weld metal only. The method of cold working may be specified by the purchaser. When cold drawn, the purchaser may specify the minimum amount of reduction in cross-sectional area or wall thickness, or both.
5.1.2 Heavily cold worked (HCW) tubes shall be made by applying cold working of not less than 35 % reduction in both wall and weld to a welded tube prior to the final anneal. No filler metal shall be used in the making of the weld. Prior to cold working, the weld shall be 100 % radiographically inspected in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, latest revision, Paragraph UW 51.

6. Heat Treatment

6.1 All material shall be furnished in the heat-treated condition in accordance with the requirements of Table 2.

6.2 A solution annealing temperature above 1950 °F [1065 °C] may impair the resistance to intergranular corrosion after subsequent exposure to sensitizing conditions in TP309HCb, TP310HCb, TP321, TP321H, TP347, TP347H, TP348, and TP348H. When specified by the purchaser, a lower temperature stabilization or re-solution anneal shall be used subsequent to the initial high temperature solution anneal (see Supplementary Requirement S4).

7. Chemical Composition

7.1 The heat analysis shall conform to the requirements as to chemical composition given in Table 1.

8. Product Analysis

8.1 An analysis of either one length of flat-rolled stock or one tube shall be made for each heat. The chemical composition thus determined shall conform to the requirements given in Section 7.

8.2 A product analysis tolerance of Table A1.1 in Specification A480/A480M shall apply. The product analysis tolerance is not applicable to the carbon content for material with a specified maximum carbon of 0.04 % or less.

8.3 If the original test for product analysis fails, retests of two additional lengths of flat-rolled stock or tubes shall be made. Both retests for the elements in question shall meet the requirements of the specification; otherwise all remaining material in the heat or lot (See Note 1) shall be rejected or, at the option of the producer, each length of flat-rolled stock or tube may be individually tested for acceptance. Lengths of flat-rolled stock or tubes that do not meet the requirements of the specification shall be rejected.

NOTE 1—For flattening and flange requirements, the term lot applies to all tubes prior to cutting of the same nominal size and wall thickness which

[4] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, ~~Three~~Two Park Ave., New York, NY 10016-5990, http://www.asme.org.
[5] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.

TABLE 2 Heat Treatment Requirements

Grade	UNS Number	Solutioning Temperature, min or range	Quenching Method
All grades not individually listed below		1900 °F [1040 °C]	A
...	S30815	1920 °F [1050 °C]	B
TP309HCb	S30941	1900 °F [1040 °C]C	B
TP310H	S31009	1900 °F [1040 °C]	B
TP310HCb	S31041	1900 °F [1040 °C]C	B
...	S31254	2100 °F [1150 °C]	B
...	S31277	2050 °F [1120 °C]	B
TP316H	S31609	1900 °F [1040 °C]	B
...	S31727	1975 °F [1080 °C]–	B
		2155 °F [1180 °C]	B
...	S32053	1975 °F [1080 °C]–	B
		2155 °F [1180 °C]	B
TP321	S32100	1900 °F [1040 °C]C	B
TP321H	S32109	2000 °F [1100 °C]C	B
...	S32654	2100 °F [1150 °C]	B
...	S33228	2050 °F [1120 °C]	B
...	S34565	2050 °F [1120 °C]–	B
		2140 °F [1170 °C]	B
TP347	S34700	1900 °F [1040 °C]C	B
TP347H	S34709	2000 °F [1100 °C]C	B
TP348	S34800	1900 °F [1040 °C]C	B
TP348H	S34809	2000 °F [1100 °C]C	B
...	S35045	2000 °F [1100 °C]	D
...	S38815	1950 °F [1065 °C]	B
...	N08367	2025 °F [1110 °C]	B
800	N08800	1900 °F [1040 °C]	B
800H	N08810	2050 °F [1120 °C]	B
...	N08811	2100 °F [1150 °C]	B
...	N08904	2000 °F [1100 °C]	B
...	N08926	2010 °F [1105 °C]	B

A Quenched in water or rapidly cooled by other methods, at a rate sufficient to prevent reprecipitation of carbides, as demonstrated by the capability of passing Practices A262, Practice E. The manufacturer is not required to run the test unless it is specified on the purchase order (See Supplementary Requirement S6). Note that Practices A262 requires the test to be performed on sensitized specimens in the low carbon and stabilized types and on specimens representative of the as-shipped condition of the other types. In the case of low-carbon types containing 3 % or more molybdenum, the applicability of the sensitizing treatment prior to testing shall be a matter for negotiation between the seller and purchaser.

B Quenched in water or rapidly cooled by other methods.

C A solution treating temperature above 1950 °F [1065 °C] may impair resistance to intergranular corrosion after subsequent exposure to sensitizing conditions in the indicated grades. When specified by the purchaser, a lower temperature stabilization or re-solution anneal shall be used subsequent to the higher-temperature solution anneal prescribed in this table (See Supplementary Requirement S4).

D Cooled in still air, or faster.

are produced from the same heat of steel. When final heat treatment is in a batch-type furnace, a lot shall include only those tubes of the same size and from the same heat which are heat treated in the same furnace charge. When the final heat treatment is in a continuous furnace, the number of tubes of the same size and from the same heat in a lot shall be determined from the size of the tubes as prescribed in Table 3.

NOTE 2—For tension and hardness test requirements, the term lot applies to all tubes prior to cutting, of the same nominal diameter and wall thickness which are produced from the same heat of steel. When final heat treatment is in a batch-type furnace, a lot shall include only those tubes of the same size and the same heat which are heat treated in the same furnace charge. When the final heat treatment is in a continuous furnace, a lot shall include all tubes of the same size and heat, annealed in the same furnace at the same temperature, time at heat, and furnace speed.

9. Tensile Requirements

9.1 The material shall conform to the tensile properties prescribed in Table 4.

TABLE 3 Number of Tubes in a Lot Heat Treated by the Continuous Process

Size of Tube	Size of Lot
2 in. [50.8 mm] and over in outside diameter and 0.200 in. [5.1 mm] and over in wall thickness	not more than 50 tubes
Less than 2 in. [50.8 mm] but over 1 in. [25.4 mm] in outside diameter or over 1 in. [25.4 mm] in outside diameter and under 0.200 in. [5.1 mm] in wall thickness	not more than 75 tubes
1 in. [25.4 mm] or less in outside diameter	not more than 125 tubes

TABLE 4 Tensile and Hardness Requirements[A]

Grade	UNS Designation	Tensile Strength, min, ksi [MPa]	Yield Strength, min, ksi [MPa]	Elongation in 2 in. or 50 mm, min, %	Rockwell Hardness Number, max
TP201	S20100	95 [655]	38 [260]	35	B95
TP 201LN	S20153	95 [655]	45 [310]	45	B100
TP202	S20200	90 [620]	38 [260]	35	B95
TPXM-19	S20910	100 [690]	55 [380]	35	C25
TPXM-29	S24000	100 [690]	55 [380]	35	B100
TP304	S30400	75 [515]	30 [205]	35	B90
TP304L	S30403	70 [485]	25 [170]	35	B90
TP304H	S30409	75 [515]	30 [205]	35	B90
. . .	S30415	87 [600]	42 [290]	35	B96
TP304N	S30451	80 [550]	35 [240]	35	B90
TP304LN	S30453	75 [515]	30 [205]	35	B90
TP305	S30500	75 [515]	30 [205]	35	B90
...	S32615	80 [550]	32 [220]	25	B100
...	S30615	90 [620]	40 [275]	35	B95
...	S30815	87 [600]	45 [310]	35	B95
TP309S	S30908	75 [515]	30 [205]	35	B90
TP309H	S30909	75 [515]	30 [205]	35	B90
TP309Cb	S30940	75 [515]	30 [205]	35	B90
TP309HCb	S30941	75 [515]	30 [205]	35	B90
TP310S	S31008	75 [515]	30 [205]	35	B90
TP310H	S31009	75 [515]	30 [205]	35	B90
TP310Cb	S31040	75 [515]	30 [205]	35	B90
TP310HCb	S31041	75 [515]	30 [205]	35	B90
...	S31050:				
	t ≤ 0.25 in.	84 [580]	39 [270]	25	B95
	t > 0.25 in.	78 [540]	37 [255]	25	B95
...	S31254:				
	t ≤ 0.187 in. [5.00 mm]	98 [675]	45 [310]	35	B100
	t > 0.187 in. [5.00 mm]	95 [655]	45 [300]	35	B100
...	S31277	112 [770]	52 [360]	40	B100
TP316	S31600	75 [515]	30 [205]	35	B90
TP316L	S31603	70 [485]	25 [170]	35	B90
TP316H	S31609	75 [515]	30 [205]	35	B90
TP316N	S31651	80 [550]	35 [240]	35	B90
TP316LN	S31653	75 [515]	30 [205]	35	B90
TP317	S31700	75 [515]	30 [205]	35	B90
TP317L	S31703	75 [515]	30 [205]	35	B90
...	S31725	75 [515]	30 [205]	35	B90
...	S31726	80 [550]	35 [240]	35	B90
...	S31727	80 [550]	36 [245]	35	B96
...	S32050	98 [675]	48 [330]	40	
...	S32053	93 [640]	43 [295]	40	B96
TP321	S32100	75 [515]	30 [205]	35	B90
TP321H	S32109	75 [515]	30 [205]	35	B90
. . .	S32654	109 [750]	62 [430]	35	B100
...	S33228	73 [500]	27 [185]	30	B90
. . .	S34565	115 [795]	60 [415]	35	B100
TP347	S34700	75 [515]	30 [205]	35	B90
TP347H	S34709	75 [515]	30 [205]	35	B90
TP348	S34800	75 [515]	30 [205]	35	B90
TP348H	S34809	75 [515]	30 [205]	35	B90
...	S35045	70 [485]	25 [170]	35	B90
TPXM-15	S38100	75 [515]	30 [205]	35	B90
...	S38815	78 [540]	37 [255]	30	B100
...	N08367				
	t ≤ 0.187	100 [690]	45 [310]	30	100
	t > 0.187	95 [655]	45 [310]	30	100
800	N08800	75 [515]	30 [205]	30	90
800H	N08810	65 [450]	25 [170]	30	90
...	N08811	65 [450]	25 [170]	30	90
. . .	N08904	71 [490]	31 [215]	35	B90
. . .	N08926	94 [650]	43 [295]	35	B100

[A] Not applicable to tubes less than ⅛ in. [3.2 mm] in outside diameter or having wall thickness below 0.015 in. [0.4 mm], or both. The tensile properties of such small diameter or thin wall tubes shall be a matter of agreement between the manufacturer and the purchaser.