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.

Designation: A213/A213M – 21a

Used in USDOE-NE standards

# Standard Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes[1]

This standard is issued under the fixed designation A213/A213M; 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 seamless ferritic and austenitic steel boiler, superheater, and heat-exchanger tubes, designated Grades T5, TP304, etc. These steels are listed in Tables 1 and 2.

1.2 Grades containing the letter, H, in their designation, have requirements different from those of similar grades not containing the letter, H. These different requirements provide higher creep-rupture strength than normally achievable in similar grades without these different requirements.

1.3 The tubing sizes and thicknesses usually furnished to this specification are ⅛ in. [3.2 mm] in inside diameter to 5 in. [127 mm] in outside diameter and 0.015 to 0.500 in. [0.4 to 12.7 mm], inclusive, in minimum wall thickness or, if specified in the order, average wall thickness. Tubing having other diameters may be furnished, provided such tubes comply with all other requirements of this specification.

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

1.5 *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

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

2.2 *AWS Specifications*[4]

A5.5/A5.5M Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding

A5.23/A5.23M Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding

A5.28/A5.28M Specification for Low-Alloy Steel Electrodes for Gas Shielded Arc Welding

A5.29/A5.29M Low-Alloy Steel Electrodes for Flux Cored Arc Welding

## 3. Terminology

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

## 4. Ordering Information

4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for products under this specification. Such requirements to be considered include, but are not limited to, the following:

4.1.1 Quantity (feet, metres, or number of lengths),

4.1.2 Name of material (seamless tubes),

4.1.3 Grade (Tables 1 and 2),

4.1.4 Condition (hot finished or cold finished),

4.1.5 Heat treatment type (Table 3).

4.1.6 Controlled structural characteristics (see 6.3),

[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-213 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 American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126, http://www.aws.org.

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

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**TABLE 1 Chemical Composition Limits, %[A] , for Low Alloy Steel**

| Grade | UNS Designation | Composition, % | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Carbon | Manganese | Phosphorus | Sulfur | Silicon | Nickel | Chromium | Molybdenum | Vanadium | Boron | Niobium[E] | Nitrogen | Aluminum | Tungsten | Other Elements |
| T2 | K11547 | 0.10–0.20 | 0.30–0.61 | 0.025 | 0.025[B] | 0.10–0.30 | ... | 0.50–0.81 | 0.44–0.65 | ... | ... | ... | ... | ... | ... | ... |
| T5 | K41545 | 0.15 | 0.30–0.60 | 0.025 | 0.025 | 0.50 | ... | 4.00–6.00 | 0.45–0.65 | ... | ... | ... | ... | ... | ... | ... |
| T5b | K51545 | 0.15 | 0.30–0.60 | 0.025 | 0.025 | 1.00–2.00 | ... | 4.00–6.00 | 0.45–0.65 | ... | ... | ... | ... | ... | ... | ... |
| T5c | K41245 | 0.12 | 0.30–0.60 | 0.025 | 0.025 | 0.50 | ... | 4.00–6.00 | 0.45–0.65 | ... | ... | ... | ... | ... | ... | Ti 4xC–0.70 |
| T9 | K90941 | 0.15 | 0.30–0.60 | 0.025 | 0.025 | 0.25–1.00 | ... | 8.00–10.00 | 0.90–1.10 | ... | ... | ... | ... | ... | ... | ... |
| T11 | K11597 | 0.05–0.15 | 0.30–0.60 | 0.025 | 0.025 | 0.50–1.00 | ... | 1.00–1.50 | 0.44–0.65 | ... | ... | ... | ... | ... | ... | ... |
| T12 | K11562 | 0.05–0.15 | 0.30–0.61 | 0.025 | 0.025[B] | 0.50 | ... | 0.80–1.25 | 0.44–0.65 | ... | ... | ... | ... | ... | ... | ... |
| T17 | K12047 | 0.15–0.25 | 0.30–0.61 | 0.025 | 0.025 | 0.15–0.35 | ... | 0.80–1.25 | ... | 0.15 | ... | ... | ... | ... | ... | ... |
| T21 | K31545 | 0.05–0.15 | 0.30–0.60 | 0.025 | 0.025 | 0.50–1.00 | ... | 2.65–3.35 | 0.80–1.06 | ... | ... | ... | ... | ... | ... | ... |
| T22 | K21590 | 0.05–0.15 | 0.30–0.60 | 0.025 | 0.025 | 0.50 | ... | 1.90–2.60 | 0.87–1.13 | ... | ... | ... | ... | ... | ... | ... |
| T23 | K40712 | 0.04–0.10 | 0.10–0.60 | 0.030 | 0.010 | 0.50 | 0.40 | 1.90–2.60 | 0.05–0.30 | 0.20–0.30 | 0.0010–0.006 | 0.02–0.08 | 0.015 | 0.030 | 1.45–1.75 | Ti 0.005–0.060 Ti/N ≥ 3.5[C] |
| T24 | K30736 | 0.05–0.10 | 0.30–0.70 | 0.020 | 0.010 | 0.15–0.45 | ... | 2.20–2.60 | 0.90–1.10 | 0.20–0.30 | 0.0015–0.007 | ... | 0.012 | 0.02 | ... | Ti 0.06–0.10 |
| T36 | K21001 | 0.10–0.17 | 0.80–1.20 | 0.030 | 0.025 | 0.25–0.50 | 1.00–1.30 | 0.30 | 0.25–0.50 | 0.02 | ... | 0.015–0.045 | 0.02 | 0.050 | ... | Cu 0.50–0.80 |
| T91 Type 1 | K90901 | 0.07–0.14 | 0.30–0.60 | 0.020 | 0.010 | 0.20–0.50 | 0.40 | 8.0–9.5 | 0.85–1.05 | 0.18–0.25 | ... | 0.06–0.10 | 0.030–0.070 | 0.02 | ... | Ti 0.01 Zr 0.01 |
| T91 Type 2 | K90901 | | | | | | | | | | | | | | | |
| Heat | | 0.08–0.12 | 0.30–0.50[D] | 0.020[D] | 0.005[D] | 0.20–0.40[D] | 0.20[D] | 8.0–9.5[D] | 0.85–1.05 | 0.18–0.25 | 0.001[D] | 0.06–0.10 | 0.035–0.070[D] | 0.020[D] | 0.05[D] | Ti 0.01[D] Zr 0.01[D] Cu 0.10[D] Sb 0.003[D] Sn 0.010[D] As 0.010[D] N/Al 4.0 min |
| Product | | 0.07–0.13 | | | | | | | 0.80–1.05 | 0.16–0.27 | | 0.05–0.11 | | | | |
| T92 | K92460 | 0.07–0.13 | 0.30–0.60 | 0.020 | 0.010 | 0.50 | 0.40 | 8.5–9.5 | 0.30–0.60 | 0.15–0.25 | 0.001–0.006 | 0.04–0.09 | 0.030–0.070 | 0.02 | 1.5–2.00 | Ti 0.01 Zr 0.01 |
| T93 | K91350 | 0.05–0.10 | 0.20–0.70 | 0.020 | 0.008 | 0.05–0.50 | 0.20 | 8.50–9.50 | ... | 0.15–0.30 | 0.007–0.015 | [F] | 0.005–0.015 | 0.030 | 2.5–3.5 | Co 2.5–3.5 Nd 0.010–0.060 O 0.0050 |
| T115 | K91060 | | | | | | | | | | | | | | | |
| Heat | | 0.08–0.13 | 0.20–0.50 | 0.020 | 0.005 | 0.15–0.45 | 0.25 | 10.0–11.0 | 0.40–0.60 | 0.18–0.25 | 0.001 | 0.02–0.06 | 0.030–0.070 | 0.02 | ... | Ti 0.01 Zr 0.01 Cu 0.10 As 0.010 Sn 0.010 Sb 0.003 W 0.05 N/Al 4.0 min CNB[G] 10.5 max |



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**TABLE 1** *Continued*

| Grade | UNS Designation | Composition, % | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Carbon | Manganese | Phosphorus | Sulfur | Silicon | Nickel | Chromium | Molybdenum | Vanadium | Boron | Niobium[E] | Nitrogen | Aluminum | Tungsten | Other Elements |
| Product | | 0.07–0.14 | 0.20–0.50 | 0.020 | 0.005 | 0.15–0.45 | 0.25 | 10.0–11.0 | 0.37–0.63 | 0.16–0.27 | 0.001 | 0.02–0.07 | 0.030–0.070 | 0.02 | ... | Ti 0.01<br>Zr 0.01<br>Cu 0.10<br>As 0.010<br>Sn 0.010<br>Sb 0.003<br>W 0.05 |
| T122 | K91271 | 0.07–0.14 | 0.70 | 0.020 | 0.010 | 0.50 | 0.50 | 10.0–11.5 | 0.25–0.60 | 0.15–0.30 | 0.0005–0.005 | 0.04–0.10 | 0.040–0.100 | 0.02 | 1.50–2.50 | Cu 0.30–1.70<br>Ti 0.01<br>Zr 0.01 |
| T911 | K91061 | 0.09–0.13 | 0.30–0.60 | 0.020 | 0.010 | 0.10–0.50 | 0.40 | 8.5–9.5 | 0.90–1.10 | 0.18–0.25 | 0.0003–0.006 | 0.06–0.10 | 0.040–0.090 | 0.02 | 0.90–1.10 | Ti 0.01<br>Zr 0.01 |
| T921 | K91201 | 0.08–0.12 | 0.5–0.7 | 0.03 | 0.02 | 1.6–2.2 | 0.8–1.4 | 8.0–9.5 | 0.8–1.1 | ... | ... | ... | 0.02–0.05 | 0.04 | ... | Cu 0.8-1.4 |

[A] Maximum, unless range or minimum is indicated. Where ellipses (...) appear in this table, there is no requirement, and analysis for the element need not be determined or reported.
[B] It is permissible to order T2 and T12 with a sulfur content of 0.045 max. See 16.3.
[C] Alternatively, in lieu of this ratio minimum, the material shall have a minimum hardness of 275 HV in the hardened condition, defined as after austenitizing and cooling to room temperature but prior to tempering. Hardness testing shall be performed at mid-thickness of the product. Hardness test frequency shall be two samples of product per heat treatment lot and the hardness testing results shall be reported on the material test report.
[D] Applies to both heat and product analyses.
[E] The terms Niobium (Nb) and Columbium (Cb) are alternate names for the same element.
[F] Grade T93 shall have a Nb + Ta content of 0.05–0.12 %.
[G] Chromium-Nickel Balance is defined as CNB = (Cr + 6Si + 4Mo +1.5W + 11V + 5Nb + 9Ti + 12Al) – (40C + 30N + 4Ni + 2Mn + 1Cu).



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**TABLE 2 Chemical Composition Limits, %[A], for Austenitic and Ferritic Stainless Steel**

| Grade | UNS Designation | Composition | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Carbon | Manga-nese | Phospho-rus | Sulfur | Silicon | Chromium | Nickel | Molybdenum | Nitrogen[B] | Niobium[N] | Titanium | Other Elements |
| TP201 | S20100 | 0.15 | 5.5–7.5 | 0.060 | 0.030 | 1.00 | 16.0–18.0 | 3.5–5.5 | ... | 0.25 | ... | ... | ... |
| TP202 | S20200 | 0.15 | 7.5–10.0 | 0.060 | 0.030 | 1.00 | 17.0–19.0 | 4.0–6.0 | ... | 0.25 | ... | ... | ... |
| XM-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 | 0.10–0.30 | ... | V 0.10–0.30 |
| [C] | S21500 | 0.06–0.15 | 5.5–7.0 | 0.045 | 0.030 | 0.20–1.00 | 14.0–16.0 | 9.0–11.0 | 0.80–1.20 | ... | 0.75–1.25 | ... | B 0.003–0.009, V 0.15–0.40 |
| [C] | S25700 | 0.02 | 2.00 | 0.025 | 0.010 | 6.5–8.0 | 8.0–11.5 | 22.0–25.0 | 0.50 | ... | ... | ... | ... |
| TP304 | S30400 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 8.0–11.0 | ... | ... | ... | ... | ... |
| TP304L | S30403 | 0.035[D] | 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 | ... | ... | ... | ... | ... |
| [C] | S30432 | 0.07–0.13 | 1.00 | 0.040 | 0.010 | 0.30 | 17.0–19.0 | 7.5–10.5 | ... | 0.05–0.12 | 0.30–0.60 | ... | Al 0.003–0.030, B 0.001–0.010, Cu 2.5–3.5 |
| [C] | S30434 | 0.07–0.14 | 2.00 | 0.040 | 0.010 | 1.00 | 17.5–19.5 | 9.0–12.0 | ... | ... | 0.10–0.40[E] | 0.10–0.25[E] | B 0.001–0.004 Cu 2.50–3.50 |
| 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 | S30453 | 0.035[D] | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 8.0–11.0 | ... | 0.10–0.16 | ... | ... | ... |
| [C] | S30615 | 0.016–0.24 | 2.00 | 0.030 | 0.030 | 3.2–4.0 | 17.0–19.5 | 13.5–16.0 | ... | ... | ... | ... | Al 0.8–1.5 |
| [C] | 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 | ... | ... | ... | ... | ... |
| TP309LMoN | S30925 | 0.025 | 2.00 | 0.040 | 0.030 | 0.70 | 23.0–26.0 | 13.0–16.0 | 0.5–1.2 | 0.25–0.40 | ... | ... | ... |
| TP309Cb | S30940 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 22.0–24.0 | 12.0–16.0 | ... | ... | 10xC–1.10 | ... | ... |
| TP309HCb | S30941 | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 22.0–24.0 | 12.0–16.0 | ... | ... | 10xC-1.10 | ... | ... |
| ... | S30942 | 0.03–0.10 | 2.00 | 0.040 | 0.030 | 1.00 | 21.0–23.0 | 14.5–16.5 | | 0.10–0.20 | 0.50–0.80 | | B=0.001–0.005 |
| [C] | S31002 | 0.02 | 2.00 | 0.020 | 0.015 | 0.15 | 24.0–26.0 | 19.0–22.0 | 0.10 | 0.10 | ... | ... | ... |
| 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 | ... | ... | ... | ... | ... |
| TP310MoCbN | S31025 | 0.10 | 1.50 | 0.030 | 0.030 | 1.00 | 19.5–23.0 | 23.0–26.0 | 1.0–2.0 | 0.10–0.25 | 0.10–0.40 | 0.20 | B 0.002–0.010 |
| | S31035 | 0.04–0.10 | 0.60 | 0.025 | 0.015 | 0.40 | 21.5–23.5 | 23.5–26.5 | ... | 0.20–0.30 | 0.40–0.60 | ... | W 3.0–4.0 Co 1.0–2.0 Cu 2.5–3.5 B 0.002–0.008 |
| TP310Cb | S31040 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 24.0–26.0 | 19.0–22.0 | ... | ... | 10xC-1.10 | ... | ... |
| TP310HCb | S31041 | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 24.0–26.0 | 19.0–22.0 | ... | ... | 10xC-1.10 | ... | ... |
| TP310HCbN | S31042 | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 24.0–26.0 | 19.0–22.0 | ... | 0.15–0.35 | 0.20–0.60 | ... | ... |
| [C] | S31043 | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 24.0–26.0 | 19.0–22.0 | ... | 0.15–0.35 | 0.20–0.50[O] | ... | Ta 0.20 min[O] |
| TP310MoLN | S31050 | 0.025 | 2.00 | 0.020 | 0.030 | 0.40 | 24.0–26.0 | 21.0–23.0 | 2.00–3.00 | 0.10–0.16 | ... | ... | ... |
| [C] | S31060 | 0.05–0.10 | 1.00 | 0.040 | 0.030 | 0.50 | 22.0–24.0 | 10.0–12.5 | ... | 0.18–0.25 | ... | ... | Ce + La 0.025–0.070 B 0.001–0.010 |
| [C] | S31254 | 0.020 | 1.00 | 0.030 | 0.010 | 0.80 | 19.5–20.5 | 17.5–18.5 | 6.0–6.5 | 0.18–0.22 | ... | ... | Cu 0.50–1.00 |



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**TABLE 2** *Continued*

| Grade | UNS Designation | Composition | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Carbon | Manganese | Phosphorus | Sulfur | Silicon | Chromium | Nickel | Molybdenum | Nitrogen[B] | Niobium[N] | Titanium | Other Elements |
| ... | S31266 | 0.030 | 2.00–4.00 | 0.035 | 0.020 | 1.00 | 23.0–25.0 | 21.0–24.0 | 5.2–6.2 | 0.35–0.60 | ... | ... | Cu 1.00–2.00<br>W 1.50–2.50 |
| [C] | S31272 | 0.08–0.12 | 1.50–2.00 | 0.030 | 0.015 | 0.30–0.70 | 14.0–16.0 | 14.0–16.0 | 1.00–1.40 | ... | ... | 0.30–0.60 | B 0.004–0.008 |
| [C] | 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 | ... | ... | Cu 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 | S31603 | 0.035[D] | 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 | 11.0–14.0 | 2.00–3.00 | ... | ... | ... | ... |
| TP316Ti | S31635 | 0.08 | 2.00 | 0.045 | 0.030 | 0.75 | 16.0–18.0 | 10.0–14.0 | 2.00–3.00 | 0.10 | ... | 5X (C + N)–0.70 | ... |
| 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 | S31653 | 0.035[D] | 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 | 0.035 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 11.0–15.0 | 3.0–4.0 | ... | ... | ... | ... |
| TP317LM | S31725 | 0.03 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 13.5–17.5 | 4.0–5.0 | 0.20 | ... | ... | Cu 0.75 |
| TP317LMN | S31726 | 0.03 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–20.0 | 13.5–17.5 | 4.0–5.0 | 0.10–0.20 | ... | ... | Cu 0.75 |
| [C] | S31730 | 0.030 | 2.00 | 0.040 | 0.010 | 1.00 | 17.0–19.0 | 15.0–16.5 | 3.0–4.0 | 0.045 | ... | ... | Cu 4.0–5.0 |
| [C] | S31740 | 0.005–0.020[P] | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 11.0–15.0 | 3.0–4.5 | 0.06–0.15 | 0.20–0.50[P] | ... | ... |
| [C] | 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 | ... | ... | Cu 0.40 |
| TP321 | S32100 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–12.0 | ... | ... | ... | 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 | ... | ... | ... | 4(C + N)–0.70 | ... |
| [C] | S32615 | 0.07 | 2.00 | 0.045 | 0.030 | 4.8–6.0 | 16.5–19.5 | 19.0–22.0 | 0.30–1.50 | ... | ... | ... | Cu 1.50–2.50 |
| [C] | S33228 | 0.04–0.08 | 1.00 | 0.020 | 0.015 | 0.30 | 26.0–28.0 | 31.0–33.0 | ... | ... | 0.60–1.00 | ... | Ce 0.05–0.10,<br>Al 0.025 |
| [C] | 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 | 0.10 | ... | ... |
| TP347 | S34700 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–20.0 | 9.0–13.0 | ... | ... | 10xC–1.10 | ... | ... |
| TP347W | S34705 | 0.05 | 2.00 | 0.040 | 0.030 | 1.00 | 17.0–20.0 | 8.00–11.0 | ... | 0.10–0.25 | 0.25–0.50 | ... | V 0.20–0.50<br>W 1.50–2.60 |
| TP347H | S34709 | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–13.0 | ... | ... | 8xC–1.10 | ... | ... |
| TP347HFG | S34710 | 0.06–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–13.0 | ... | ... | 8xC–1.10 | ... | ... |
| TP347LN | S34751 | 0.005–0.020 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–13.0 | ... | 0.06–0.10 | 0.20–0.50[F] | ... | ... |
| [C] | S34752 | 0.005–0.020 | 2.00 | 0.035 | 0.010 | 0.60 | 17.0–19.0 | 10.0–13.0 | 0.20–1.20 | 0.06–0.12 | 0.20–0.50[F] | ... | Cu 2.50–3.50<br>B 0.001–0.005 |
| TP348 | S34800 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–13.0 | ... | ... | [G] | ... | Co 0.20, Ta 0.10 |
| TP348H | S34809 | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–13.0 | ... | ... | [H] | ... | Co 0.20, Ta 0.10 |
| ... | S35045 | 0.06–0.10 | 1.50 | 0.045 | 0.015 | 1.00 | 25.0–29.0 | 32.0–37.0 | ... | ... | ... | 0.15–0.60 | Al 0.15–0.60<br>Cu 0.75 |
| XM-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 | ... | ... | ... | Cu 0.75–1.50<br>Al 0.30 |
| Alloy 20 | N08020 | 0.070 | 2.00 | 0.045 | 0.035 | 1.00 | 19.0-21.0 | 32.0-38.0 | 2.00-3.00 | ... | [M] | ... | Cu 3.00-4.00 |
| | N08028 | 0.030 | 2.50 | 0.030 | 0.030 | 1.0 | 26.0-28.0 | 30.0-34.0 | 3.0-4.0 | | | | Cu 0.6-1.4 |
| | N08029 | 0.020 | 2.0 | 0.025 | 0.015 | 0.6 | 26.0-28.0 | 30.0-34.0 | 4.0-5.0 | | | | Cu 0.6-1.4 |



Full document details: ASTM A213/A213M-21a
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