



Designation: B221M – 21

Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)¹

This standard is issued under the fixed designation B221M; 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.

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

1. Scope*

1.1 This specification covers aluminum and aluminum-alloy extruded bars, rods, wires, profiles, and tubes in the aluminum alloys (Note 1) and tempers shown in Table 2.

NOTE 1—Throughout this specification the use of the term *alloy* in the general sense includes aluminum as well as aluminum alloy.

NOTE 2—For rolled or cold-finished bars and rods refer to Specification B211/B211M, for drawn seamless tube used in pressure applications, Specification B210/B210M, for structural pipe and tube, Specification B429/B429M, and for seamless pipe and tube used in pressure applications, Specification B241/B241M.

NOTE 3—Pipe and tube products listed in this specification are intended for general purpose applications. This specification may not address the manufacturing processes, integrity testing, and verification required for fluid-carrying applications involving pressure. See Specification B210/B210M, B241/B241M, or both as appropriate for seamless pipe and tube used in fluid-carrying applications involving pressure. See Specification B234M, as appropriate, for use in surface condensers, evaporators, and heat exchangers.

1.2 Alloy and temper designations are in accordance with ANSI H35.1/H35.1M. The equivalent Unified Numbering System alloy designations are those of Table 1 preceded by A9, for example, A91100 for Aluminum 1100 in accordance with Practice E527.

1.3 For acceptance criteria for inclusion of new aluminum and aluminum alloys in this specification, see Annex A2.

1.4 This specification is the metric counterpart of Specification B221.

1.5 The values stated in SI are to be regarded as standard. No other units of measurement are included in this specification.

1.6 *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.*

mentations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 The following documents of the issue in effect on the date of material purchase form a part of this specification to the extent referenced herein:

2.2 ASTM Standards:²

B210/B210M Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes

B211/B211M Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire

B234M Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes for Surface Condensers, Evaporators, and Heat Exchangers (Metric)

B241/B241M Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

B429/B429M Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

B557M Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products (Metric)

B594 Practice for Ultrasonic Inspection of Aluminum-Alloy Wrought Products

B660 Practices for Packaging/Packing of Aluminum and Magnesium Products

B666/B666M Practice for Identification Marking of Aluminum and Magnesium Products

B807/B807M Practice for Extrusion Press Solution Heat Treatment for Aluminum Alloys

B881 Terminology Relating to Aluminum- and Magnesium-Alloy Products

B918/B918M Practice for Heat Treatment of Wrought Aluminum Alloys

B945 Practice for Aluminum Alloy Extrusions Press Cooled from an Elevated Temperature Shaping Process for Production of T1, T2, T5 and T10–Type Tempers

¹ This specification is under the jurisdiction of ASTM Committee B07 on Light Metals and Alloys and is the direct responsibility of Subcommittee B07.03 on Aluminum Alloy Wrought 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

TABLE 1 Chemical Composition Limits ^{A,B,C}

| Alloy | Silicon | Iron | Copper | Manga- nese | Magne- sium | Chromium | Zinc | Titanium | Vanadium | Other Elements ^D | | Aluminum |
|--------------------|--------------|---------------------------|-----------|----------------|----------------|-----------|---------|-----------|-----------|-----------------------------|--------------------|------------------------|
| | | | | | | | | | | Each | Total ^E | |
| 1060 | 0.25 | 0.35 | 0.05 | 0.03 | 0.03 | ... | 0.05 | 0.03 | 0.05 | 0.03 | ... | 99.60 min ^F |
| 1100 ^G | 0.95 Si + Fe | ... | 0.05–0.20 | 0.05 | ... | ... | 0.10 | ... | ... | 0.05 | 0.15 | 99.00 min ^F |
| 2014 ^H | 0.50–1.2 | 0.7 | 3.9–5.0 | 0.40–1.2 | 0.20–0.8 | 0.10 | 0.25 | 0.15 | ... | 0.05 | 0.15 | rem |
| 2024 ^H | 0.50 | 0.50 | 3.8–4.9 | 0.30–0.9 | 1.2–1.8 | 0.10 | 0.25 | 0.15 | ... | 0.05 | 0.15 | rem |
| 2219 ^I | 0.20 | 0.30 | 5.8–6.8 | 0.20–0.40 | 0.02 | ... | 0.10 | 0.02–0.10 | 0.05–0.15 | 0.05 | 0.15 | rem |
| 3003 | 0.6 | 0.7 | 0.05–0.20 | 1.0–1.5 | ... | ... | 0.10 | ... | ... | 0.05 | 0.15 | rem |
| Alclad 3003 | ... | 3003 Clad with 7072 Alloy | | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 3004 | 0.30 | 0.7 | 0.25 | 1.0–1.5 | 0.8–1.3 | ... | 0.25 | ... | ... | 0.05 | 0.15 | rem |
| 3102 | 0.40 | 0.7 | 0.10 | 0.05–0.40 | ... | ... | 0.30 | 0.10 | ... | 0.05 | 0.15 | rem |
| 5052 | 0.25 | 0.40 | 0.10 | 0.10 | 2.2–2.8 | 0.15–0.35 | 0.10 | ... | ... | 0.05 | 0.15 | rem |
| 5083 | 0.40 | 0.40 | 0.10 | 0.40–1.0 | 4.0–4.9 | 0.05–0.25 | 0.25 | 0.15 | ... | 0.05 | 0.15 | rem |
| 5086 | 0.40 | 0.50 | 0.10 | 0.20–0.7 | 3.5–4.5 | 0.05–0.25 | 0.25 | 0.15 | ... | 0.05 | 0.15 | rem |
| 5154 ^G | 0.25 | 0.40 | 0.10 | 0.10 | 3.1–3.9 | 0.15–0.35 | 0.20 | 0.20 | ... | 0.05 | 0.15 | rem |
| 5454 | 0.25 | 0.40 | 0.10 | 0.50–1.0 | 2.4–3.0 | 0.05–0.20 | 0.25 | 0.20 | ... | 0.05 | 0.15 | rem |
| 5456 | 0.25 | 0.40 | 0.10 | 0.50–1.0 | 4.7–5.5 | 0.05–0.20 | 0.25 | 0.20 | ... | 0.05 | 0.15 | rem |
| 6005 | 0.6–0.9 | 0.35 | 0.10 | 0.10 | 0.40–0.6 | 0.10 | 0.10 | 0.10 | ... | 0.05 | 0.15 | rem |
| 6005A ^J | 0.50–0.9 | 0.35 | 0.30 | 0.50 | 0.40–0.7 | 0.30 | 0.20 | 0.10 | ... | 0.05 | 0.15 | rem |
| 6013 | 0.6–1.0 | 0.50 | 0.6–1.1 | 0.20–0.8 | 0.8–1.2 | 0.10 | 0.25 | 0.10 | ... | 0.05 | 0.15 | rem |
| 6020 ^K | 0.40–0.9 | 0.50 | 0.30–0.9 | 0.35 | 0.6–1.2 | 0.15 | 0.20 | 0.15 | ... | 0.05 | 0.15 | rem |
| 6026 ^L | 0.6–1.4 | 0.7 | 0.20–0.50 | 0.20–1.0 | 0.6–1.2 | 0.30 | 0.30 | 0.20 | ... | 0.05 | 0.15 | rem |
| 6041 ^M | 0.50–0.9 | 0.15–0.7 | 0.15–0.6 | 0.05–0.20 | 0.8–1.2 | 0.05–0.15 | 0.25 | 0.15 | ... | 0.05 | 0.15 | rem |
| 6042 ^N | 0.50–1.2 | 0.7 | 0.20–0.6 | 0.40 | 0.7–1.2 | 0.04–0.35 | 0.25 | 0.15 | ... | 0.05 | 0.15 | rem |
| 6060 | 0.30–0.6 | 0.10–0.30 | 0.10 | 0.10 | 0.35–0.6 | 0.05 | 0.15 | 0.10 | ... | 0.05 | 0.15 | rem |
| 6061 ^O | 0.40–0.8 | 0.7 | 0.15–0.40 | 0.15 | 0.8–1.2 | 0.04–0.35 | 0.25 | 0.15 | ... | 0.05 | 0.15 | rem |
| 6063 | 0.20–0.6 | 0.35 | 0.10 | 0.10 | 0.45–0.9 | 0.10 | 0.10 | 0.10 | ... | 0.05 | 0.15 | rem |
| 6064 ^P | 0.40–0.8 | 0.7 | 0.15–0.40 | 0.15 | 0.8–1.2 | 0.05–0.14 | 0.25 | 0.15 | ... | 0.05 | 0.15 | rem |
| 6066 | 0.9–1.8 | 0.50 | 0.7–1.2 | 0.6–1.1 | 0.8–1.4 | 0.40 | 0.25 | 0.20 | ... | 0.05 | 0.15 | rem |
| 6070 | 1.0–1.7 | 0.50 | 0.15–0.40 | 0.40–1.0 | 0.50–1.2 | 0.10 | 0.25 | 0.15 | ... | 0.05 | 0.15 | rem |
| 6082 | 0.7–1.3 | 0.50 | 0.10 | 0.40–1.0 | 0.6–1.2 | 0.25 | 0.20 | 0.10 | ... | 0.05 | 0.15 | rem |
| 6105 | 0.6–1.0 | 0.35 | 0.10 | 0.15 | 0.45–0.8 | 0.10 | 0.10 | 0.10 | ... | 0.05 | 0.15 | rem |
| 6162 | 0.40–0.8 | 0.50 | 0.20 | 0.10 | 0.7–1.1 | 0.10 | 0.25 | 0.10 | ... | 0.05 | 0.15 | rem |
| 6262 ^Q | 0.40–0.8 | 0.7 | 0.15–0.40 | 0.15 | 0.8–1.2 | 0.04–0.14 | 0.25 | 0.15 | ... | 0.05 | 0.15 | rem |
| 6351 | 0.7–1.3 | 0.50 | 0.10 | 0.40–0.8 | 0.40–0.8 | ... | 0.20 | 0.20 | ... | 0.05 | 0.15 | rem |
| 6360 | 0.35–0.8 | 0.10–0.30 | 0.15 | 0.02–0.15 | 0.25–0.45 | 0.05 | 0.10 | 0.10 | ... | 0.05 | 0.15 | rem |
| 6463 | 0.20–0.6 | 0.15 | 0.20 | 0.05 | 0.45–0.9 | ... | 0.05 | ... | ... | 0.05 | 0.15 | rem |
| 6560 | 0.30–0.7 | 0.10–0.30 | 0.05–0.20 | 0.20 | 0.20–0.6 | 0.05 | 0.15 | 0.10 | ... | 0.05 | 0.15 | rem |
| 7005 ^R | 0.35 | 0.40 | 0.10 | 0.20–0.7 | 1.0–1.8 | 0.06–0.20 | 4.0–5.0 | 0.01–0.06 | ... | 0.05 | 0.15 | rem |
| 7072 ^S | 0.7 Si + Fe | ... | 0.10 | 0.10 | ... | ... | 0.8–1.3 | ... | ... | ... | ... | rem |
| 7075 ^T | 0.40 | 0.50 | 1.2–2.0 | 0.30 | 2.1–2.9 | 0.18–0.28 | 5.1–6.1 | 0.20 | ... | 0.05 | 0.15 | rem |
| 7116 ^U | 0.15 | 0.30 | 0.50–1.1 | 0.05 | 0.8–1.4 | ... | 4.2–5.2 | 0.05 | 0.05 | 0.05 | 0.15 | rem |
| 7129 ^U | 0.15 | 0.30 | 0.50–0.9 | 0.10 | 1.3–2.0 | 0.10 | 4.2–5.2 | 0.05 | 0.05 | 0.05 | 0.15 | rem |

^A Limits are in weight percent maximum unless shown as a range, or stated otherwise.

^B Analysis shall be made for the elements for which limits are shown in this table.

^C For the purpose of determining conformance to these limits, an observed value or a calculated value obtained from analysis shall be rounded to the nearest unit in the last right-hand place of the figures used in expressing the specified limit, in accordance with the rounding-off method of Practice E29.

^D *Others* includes listed elements for which no specific limit is shown as well as unlisted metallic elements. The producer may analyze samples for trace elements not specified in the specification. However, such analysis is not required and may not cover all metallic *Others* elements. Should any analysis by the producer or the purchaser establish that an *Others* element exceeds the limit of *Each* or that the aggregate of several *Others* elements exceeds the limit of *Total*, the material shall be considered nonconforming.

^E *Other Elements*—Total shall be the sum of unspecified metallic elements 0.010 % or more, rounded to the second decimal before determining the sum.

^F The aluminum content shall be calculated by subtracting from 100.00 % the sum of all metallic elements present in amounts of 0.010 % or more each, rounded to the second decimal before determining the sum.

^G Be 0.0003 max for welding electrode, welding rod, and filler wire.

^H Upon agreement between the purchaser and the producer or supplier, a Zr + Ti limit of 0.20 % max is permitted. Properties in Specification (Table 2) are not based on the Zirconium and Titanium algorithm.

^I Zirconium, 0.10–0.25 %. The total for other elements does not include zirconium.

^J Manganese plus chromium shall total 0.12–0.50.

^K Lead 0.05 % max, Tin 0.9–1.5 %.

^L Bismuth 0.50–1.5 %, Lead 0.4 % max, Tin 0.05 % max.

^M Bismuth 0.30–0.9 %, Tin 0.35–1.2 %.

^N Bismuth 0.20–0.8 % Lead 0.15–0.40 %.

^O In 1965 the requirements for 6062 were combined with those for 6061 by revising the minimum chromium from "0.15 %" to "0.04 %." This action cancelled Alloy 6062.

^P Bismuth 0.50–0.7 %, Lead 0.20–0.04 %, ...

^Q Bismuth and lead shall be 0.40–0.7 % each.

^R Zirconium 0.08–0.20 %. The total for other elements does not include zirconium.

^S Composition of cladding alloy applied during the course of manufacture. Samples from finished tube shall not be required to conform to these limits.

^T Upon agreement between the purchaser and the producer or supplier, a Zr + Ti limit of 0.25 % max is permitted. Properties in Specification (Table 2) are not based on the Zirconium and Titanium algorithm.

^U Gallium 0.03 % max.

TABLE 2 Tensile Property Limits^{A,B}

| Temper | Product Type ^C | Specified Section or Wall Thickness, mm | | Area, mm ² | | Tensile Strength, MPa | | Yield Strength (0.2 %) | | Elongation, ^D % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|-------|-----------------------|------|-----------------------|-----|------------------------|-----|----------------------------|---------------------------|---|-------|-----|--------|-----|-----|-----|-----|-----|-----|-------|---|--------|--------|-----|-----|-----|-----|-----|-----|-------|-----|--------|--------|--------|-----|-----|-----|-----|-----|
| | | over | incl | over | incl | min | max | min | max | in 50 mm | in 50 × Diameter (5.56√A) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aluminum 1060 ^E | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| O | Extruded Tube | all | | all | | 60 | 95 | 15 | ... | 25 | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H112 | Extruded Tube | all | | all | | 60 | ... | 15 | ... | 25 | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aluminum 1100 ^E | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| O | Extruded Tube | all | | all | | 75 | 105 | 20 | ... | 25 | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H112 | Extruded Tube | all | | all | | 75 | ... | 20 | ... | 25 | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alloy 2014 ^E | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | ... | 205 | ... | 125 | 12 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T4 T4510 ^F T4511 ^F | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | 345 | ... | 240 | ... | 12 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T42 ^G | | | | | | | | | | | | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | 345 | ... | 200 | ... | 12 | 10 | | | | | | | | | | | | | | | | | | | |
| T6 T6510 ^F T6511 ^F | | | | | | | | | | | | | | | | | | | | | | | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 12.50 | all | | 415 | ... | 365 | ... | 7 | 6 | | | | | | | | |
| T62 ^G | Extruded Wire, Rod, Bar, Profiles, and Tube | 12.50 | 18.00 | all | | 440 | ... | 400 | ... | ... | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | 18.00 | ... | ... | 16 000 | 470 | ... | 415 | ... | ... | 6 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | 18.00 | | | | | | | | | | | | ... | 16 000 | 20 000 | 470 | ... | 400 | ... | ... |
| T62 ^G | Extruded Wire, Rod, Bar, Profiles, and Tube | 18.00 | ... | all | | 415 | ... | 365 | ... | 7 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | 18.00 | ... | ... | 16 000 | 415 | ... | 365 | ... | ... | 6 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | 18.00 | ... | 16 000 | 20 000 | 415 | ... | 365 | ... | ... | 5 | | | | | | | | | | |
| Alloy 2024 ^E | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, and Profiles | all | | all | | ... | 240 | ... | 130 | 12 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alloy 2025 ^E | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T3 T3510 ^F T3511 ^F | Extruded Wire, Rod, Bar, and Profiles | ... | 6.30 | all | | 395 | ... | 290 | ... | 12 | ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | 6.30 | 18.00 | all | | 415 | ... | 305 | ... | 10 | ... | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | 18.00 | 35.00 | all | | 450 | ... | 315 | ... | ... | 9 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 35.00 | ... | ... | 16 000 | 485 | ... | 360 | ... | ... | 9 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T3 T3510 ^F T3511 ^F | Extruded Tube | ... | 6.30 | all | | 395 | ... | 290 | ... | 10 | ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | 6.30 | 18.00 | all | | 415 | ... | 305 | ... | 10 | ... | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | 18.00 | 35.00 | all | | 450 | ... | 315 | ... | ... | 9 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 35.00 | ... | ... | 16 000 | 485 | ... | 330 | ... | ... | 9 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T42 ^G | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 18.00 | all | | 395 | ... | 260 | ... | 12 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | 18.00 | 35.00 | all | | 395 | ... | 260 | ... | ... | 9 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | 35.00 | ... | ... | 16 000 | 395 | ... | 260 | ... | ... | 9 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 35.00 | ... | 16 000 | 20 000 | 395 | ... | 260 | ... | ... | 7 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T81 T8510 ^F T8511 ^F | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 1.20 | all | | 440 | ... | 385 | ... | 4 | ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | 6.30 | 35.00 | all | | 455 | ... | 400 | ... | 5 | 4 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | 35.00 | ... | ... | 20 000 | 455 | ... | 400 | ... | ... | 4 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 35.00 | ... | ... | 20 000 | 455 | ... | 400 | ... | ... | 4 |

TABLE 2 *Continued*

| Temper | Product Type ^C | Specified Section or Wall Thickness, mm | | Area, mm ² | | Tensile Strength, MPa | | Yield Strength (0.2 %) | | Elongation, ^D % | |
|---|---|---|-----------------|-----------------------|--------|-----------------------|-----|------------------------|-----|----------------------------|---------------------------|
| | | over | incl | over | incl | min | max | min | max | in 50 mm | in 50 × Diameter (5.56√A) |
| Alloy 2219^E | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | ... | 220 | ... | 125 | 12 | 10 |
| T31 T3510 ^F T3511 ^F | } Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 12.50 | ... | 16 000 | 290 | ... | 180 | ... | 14 | 12 |
| | | | 12.50 | 80.00 | ... | 16 000 | 310 | ... | 185 | ... | ... |
| T62 ^G | } Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 25.00 | ... | 16 000 | 370 | ... | 250 | ... | 6 | 5 |
| | | | 25.00 | | ... | 20 000 | 370 | ... | 250 | ... | ... |
| T81 T8510 ^F T8511 ^F | } Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 80.00 | ... | 16 000 | 400 | ... | 290 | ... | 6 | 5 |
| | | | | | | | | | | | |
| Alloy 3003^E | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | 95 | 130 | 35 | ... | 25 | 22 |
| H112 | Extruded Wire, Rod, Bar, and Profiles | all | | all | | 95 | ... | 35 | ... | ... | ... |
| H112 | Extruded Tube | all | | all | | 95 | ... | 35 | ... | 25 | 22 |
| Alclad Alloy 3003 | | | | | | | | | | | |
| O | Extruded Tube | all | | all | | 90 | 125 | 30 | ... | 25 | 22 |
| H112 | Extruded Tube | all | | all | | 90 | ... | 30 | ... | 25 | 22 |
| Alloy 3004^E | | | | | | | | | | | |
| O | Extruded Tube | all | | all | | 160 | 200 | 60 | ... | ... | ... |
| Alloy 3102 | | | | | | | | | | | |
| H112 | Extruded Tube | 0.63 | 1.20 | all | | 75 | 125 | 30 | ... | 25 | ... |
| Alloy 5052^E | | | | | | | | | | | |
| O | Extruded Tube | all | | all | | 170 | 240 | 70 | ... | ... | ... |
| Alloy 5083^E | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, and Profiles | ... | 130.00 | ... | 20 000 | 270 | 350 | 110 | ... | 14 | 12 |
| H111 | Extruded Wire, Rod, Bar, and Profiles | ... | 130.00 | ... | 20 000 | 275 | ... | 165 | ... | 12 | 10 |
| H112 | Extruded Wire, Rod, Bar, and Profiles | ... | 130.00 | ... | 20 000 | 270 | ... | 110 | ... | 12 | 10 |
| O | Extruded Tube | | 70 ^H | ... | 20 000 | 270 | 350 | 110 | ... | 14 | 12 |
| H111 | Extruded Tube | | 70 ^H | ... | 20 000 | 275 | ... | 165 | ... | 12 | 10 |
| H112 | Extruded Tube | | 70 ^H | ... | 20 000 | 270 | ... | 110 | ... | 12 | 10 |
| Alloy 5086^E | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, and Profiles | ... | 130.00 | ... | 20 000 | 240 | 315 | 95 | ... | 14 | 12 |
| H111 | Extruded Wire, Rod, Bar, and Profiles | ... | 130.00 | ... | 20 000 | 250 | ... | 145 | ... | 12 | 10 |
| H112 | Extruded Wire, Rod, Bar, and Profiles | ... | 130.00 | ... | 20 000 | 240 | ... | 95 | ... | 12 | 10 |
| O | Extruded Tube | | 70 ^H | ... | 20 000 | 240 | 315 | 95 | ... | 14 | 12 |
| H111 | Extruded Tube | | 70 ^H | ... | 20 000 | 250 | ... | 145 | ... | 12 | 10 |
| H112 | Extruded Tube | | 70 ^H | ... | 20 000 | 240 | ... | 95 | ... | 12 | 10 |

TABLE 2 *Continued*

| Temper | Product Type ^C | Specified Section or Wall Thickness, mm | | Area, mm ² | | Tensile Strength, MPa | | Yield Strength (0.2 %) | | Elongation, ^D %, min | |
|-------------------------|---|---|-----------------|-----------------------|--------|-----------------------|-----|------------------------|-----|---------------------------------|---------------------------|
| | | over | incl | over | incl | min | max | min | max | in 50 mm | in 50 × Diameter (5.56√A) |
| Alloy 5154 | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | 205 | 285 | 75 | ... | ... | ... |
| H112 | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | 205 | ... | 75 | ... | ... | ... |
| Alloy 5454 ^E | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, and Profiles | ... | 130.00 | ... | 20 000 | 215 | 285 | 85 | ... | 14 | 12 |
| H111 | Extruded Wire, Rod, Bar, and Profiles | ... | 130.00 | ... | 20 000 | 230 | ... | 130 | ... | 12 | 10 |
| H112 | Extruded Wire, Rod, Bar, and Profiles | ... | 130.00 | ... | 20 000 | 215 | ... | 85 | ... | 12 | 10 |
| O | Extruded Tube | | 70 ^H | | 20 000 | 215 | 285 | 85 | ... | 14 | 12 |
| H111 | Extruded Tube | | 70 ^H | | 20 000 | 230 | ... | 130 | ... | 12 | 10 |
| H112 | Extruded Tube | | 70 ^H | | 20 000 | 215 | ... | 85 | ... | 12 | 10 |
| Alloy 5456 ^E | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, and Profiles | ... | 120.00 | ... | 20 000 | 285 | 365 | 130 | ... | 14 | 12 |
| H111 | Extruded Wire, Rod, Bar, and Profiles | ... | 120.00 | ... | 20 000 | 290 | ... | 180 | ... | 12 | 10 |
| H112 | Extruded Wire, Rod, Bar, and Profiles | ... | 120.00 | ... | 20 000 | 285 | ... | 130 | ... | 12 | 10 |
| O | Extruded Tube | | 70 ^I | | 20 000 | 285 | 365 | 130 | ... | 14 | 12 |
| H111 | Extruded Tube | | 70 ^I | | 20 000 | 290 | ... | 180 | ... | 12 | 10 |
| H112 | Extruded Tube | | 70 ^I | | 20 000 | 285 | ... | 130 | ... | 12 | 10 |
| Alloy 6005 | | | | | | | | | | | |
| T1 | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 12.50 | all | | 170 | ... | 105 | ... | 16 | 14 |
| T5 | Extruded Wire, Rod, Bar, Profiles, and Tube | { | 3.20 | all | | 260 | ... | 240 | ... | 8 | ... |
| | | | 3.20 | all | | 260 | ... | 240 | ... | 10 | 9 |
| Alloy 6005A | | | | | | | | | | | |
| T1 | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 6.30 | all | | 170 | ... | 100 | ... | 15 | ... |
| T5 | Extruded Wire, Rod, Bar, Profiles, and Tube | { | 6.30 | all | | 260 | ... | 215 | ... | 7 | ... |
| | | | 6.30 | all | | 260 | ... | 215 | ... | 9 | 8 |
| T61 | Extruded Wire, Rod, Bar, Profiles, and Tube | { | 6.30 | all | | 260 | ... | 240 | ... | 8 | ... |
| | | | 6.30 | all | | 260 | ... | 240 | ... | 10 | 9 |
| Alloy 6013 | | | | | | | | | | | |
| T6, T6511 ^F | Extrusion, Rod, and Seamless Tube | 5.00 | 12.50 | all | | 340 | ... | 315 | ... | 8 | ... |
| | | 12.50 | 20.00 | all | | 340 | ... | 315 | ... | ... | 7 |
| | | 20.00 | 50.00 | all | | 340 | ... | 310 | ... | ... | 7 |
| Alloy 6020 | | | | | | | | | | | |
| T6511 ^F | Extruded Rod and Bar | 80.00 | 160.00 | all | | 260 | ... | 240 | ... | ... | 9 |

TABLE 2 *Continued*

| Temper | Product Type ^C | Specified Section or Wall Thickness, mm | | Area, mm ² | | Tensile Strength, MPa | | Yield Strength (0.2 %) | | Elongation, ^D % | |
|---|---|---|--------|-----------------------|------|-----------------------|-----|------------------------|-----|----------------------------|---------------------------|
| | | over | incl | over | incl | min | max | min | max | in 50 mm | in 50 × Diameter (5.56√A) |
| Alloy 6026 | | | | | | | | | | | |
| T6, T6510, ^F T6511 ^F | Extruded Profiles | 5.00 | 40.00 | all | | 340 | ... | 260 | ... | 6 | 8 |
| T6, T6510, ^F T6511 ^F | Extruded Tube | 10.00 | 30.00 | all | | 340 | ... | 260 | ... | 6 | 8 |
| T6, T6510, ^F T6511 ^F | Extruded Bar, Rod, and Wire | 30.00 | 140.00 | all | | 370 | ... | 300 | ... | 6 | 8 |
| | | 140.00 | 200.00 | all | | 340 | ... | 250 | ... | 6 | 8 |
| | | 200.00 | 250.00 | all | | 300 | ... | 200 | ... | 6 | 8 |
| Alloy 6041 | | | | | | | | | | | |
| T6, T6511 ^F | Extruded Rod, Bar, and Profiles | 10.00 | 50.00 | all | | 310 | ... | 275 | ... | 10 | 9 |
| Alloy 6042 | | | | | | | | | | | |
| T5, T5511 ^F | Extruded Rod, Bar, and Profiles | 10.00 | 12.50 | all | | 260 | ... | 240 | ... | 10 | ... |
| | | 12.50 | 50.00 | all | | 260 | ... | 240 | ... | ... | 9 |
| Alloy 6060 | | | | | | | | | | | |
| T51 | Extruded Profiles | ... | 3.20 | all | | 150 | ... | 110 | ... | 8 | ... |
| T61 | Extruded Profiles | ... | 3.20 | all | | 205 | ... | 170 | ... | 8 | ... |
| | | 3.20 | 25.00 | all | | 205 | ... | 170 | ... | 10 | 9 |
| Alloy 6061 ^E | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | ... | 150 | ... | 110 | 16 | 14 |
| T1 | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 16.00 | all | | 180 | ... | 95 | ... | 16 | 14 |
| T4, T4510, ^F T4511 ^F | Extruded Wire, Rod, Bar Profiles, and Tube | all | | all | | 180 | ... | 110 | ... | 16 | 14 |
| | | all | | all | | 180 | ... | 110 | ... | 16 | 14 |
| T42 ^G | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | 180 | ... | 85 | ... | 16 | 14 |
| T51 | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 16.00 | all | | 240 | ... | 205 | ... | 8 | 7 |
| T6, T62, ^G T6510, ^F T6511 ^F | Extruded Wire, Rod, Bar, Profiles and Tube | ... | 6.30 | all | | 260 | ... | 240 | ... | 8 | ... |
| | | 6.30 | ... | all | | 260 | ... | 240 | ... | 10 | 9 |
| Alloy 6063 | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | ... | 130 | ... | ... | 18 | 16 |
| T1 | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 12.50 | all | | 115 | ... | 60 | ... | 12 | 10 |
| | | 12.50 | 25.00 | all | | 110 | ... | 55 | ... | ... | 10 |
| T4, T42 ^G | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 12.50 | all | | 130 | ... | 70 | ... | 14 | 12 |
| | | 12.50 | 25.00 | all | | 125 | ... | 60 | ... | ... | 12 |
| T5 | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 12.50 | all | | 150 | ... | 110 | ... | 8 | 7 |
| | | 12.50 | 25.00 | all | | 145 | ... | 105 | ... | ... | 7 |
| T52 | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 25.00 | all | | 150 | 205 | 110 | 170 | 8 | 7 |
| T54 | Extruded Wire, Rod, Bar, and Profiles | ... | 3.20 | all | | 225 | ... | 205 | ... | 8 | ... |
| | | 3.20 | 12.50 | all | | 225 | ... | 205 | ... | 10 | ... |

TABLE 2 *Continued*

| Temper | Product Type ^C | Specified Section or Wall Thickness, mm | | Area, mm ² | | Tensile Strength, MPa | | Yield Strength (0.2 %) | | Elongation, ^D % | |
|---|---|---|--------|-----------------------|--------|-----------------------|-----|------------------------|-----|----------------------------|---------------------------|
| | | over | incl | over | incl | min | max | min | max | in 50 mm | in 50 × Diameter (5.56√A) |
| Alloy 6063 (Continued) | | | | | | | | | | | |
| T6, T62 ^G | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 3.20 | all | | 205 | ... | 170 | ... | 8 | ... |
| | | 3.20 | 25.0 | all | | 205 | ... | 170 | ... | 10 | 9 |
| T65 | Extruded Wire, Rod, Bar, and Profiles | ... | 5.00 | all | | 250 | ... | 230 | ... | 7 | ... |
| Alloy 6064 | | | | | | | | | | | |
| T6 | Extruded Wire, Rod, Bar, and Profiles | 5.00 | 80.00 | all | | 290 | ... | 260 | ... | 10 | 9 |
| T6511 ^F | Extruded Wire, Rod, Bar, and Profiles | 5.00 | 80.00 | all | | 290 | ... | 260 | ... | 10 | 9 |
| Alloy 6066 | | | | | | | | | | | |
| O | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | ... | 200 | ... | 125 | 16 | 14 |
| T4, T4510, ^F T4511 ^F | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | 275 | ... | 170 | ... | 14 | 12 |
| | | | | | | | | | | | |
| T42 ^G | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | 275 | ... | 165 | ... | 14 | 12 |
| T6, T6510, ^F T6511 ^F | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | 345 | ... | 310 | ... | 8 | 7 |
| | | | | | | | | | | | |
| T62 ^G | Extruded Wire, Rod, Bar, Profiles, and Tube | all | | all | | 345 | ... | 290 | ... | 8 | 7 |
| Alloy 6070 | | | | | | | | | | | |
| T6, T62 ^G | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 80.00 | ... | 20 000 | 330 | ... | 310 | ... | 6 | 5 |
| Alloy 6082 | | | | | | | | | | | |
| T6, T6511 ^F | Extruded Wire, Rod, Bar, and Profiles | 5.00 | 20.00 | all | | 310 | ... | 260 | ... | 6 | 8 |
| | | 20.00 | 150.00 | all | | 310 | ... | 260 | ... | 8 | 8 |
| | | 150.00 | 200.00 | all | | 280 | ... | 240 | ... | 8 | 8 |
| T6 | Extruded Tube | 5.00 | 25.00 | all | | 310 | ... | 260 | ... | 8 | 10 |
| Alloy 6105 | | | | | | | | | | | |
| T1 | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 12.50 | all | | 170 | ... | 105 | ... | 16 | 14 |
| T5 | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 12.50 | all | | 260 | ... | 240 | ... | 8 | 7 |
| T6 | Extruded Wire, Rod, Bar, and Profiles | ... | 12.50 | all | | 260 | ... | 240 | ... | 8 | 7 |
| Alloy 6162 | | | | | | | | | | | |
| T5, T5510, ^F T5511 ^F | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 25.00 | all | | 255 | ... | 235 | ... | 7 | 6 |
| T6, T6510, ^F T6511 ^F | Extruded Wire, Rod, Bar, Profiles, and Tube | ... | 6.30 | all | | 260 | ... | 240 | ... | 8 | ... |
| | | 6.30 | 12.50 | all | | 260 | ... | 240 | ... | 10 | 9 |
| Alloy 6262 | | | | | | | | | | | |
| T6, T62, ^G T6510, ^F T6511 ^F | Extruded Wire, Rod, Bar, Profiles and Tube | all | | all | | 260 | ... | 240 | ... | 10 | 9 |