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Standard Practice for Heat Treatment of Wrought Aluminum Alloys¹

This standard is issued under the fixed designation B918/B918M; 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-Scope*

- 1.1 This practice is intended for use in the heat treatment of wrought aluminum alloys for general purpose applications.
- 1.1.1 The heat treatment of wrought aluminum alloys used in specific aerospace applications is covered in AMS 2772.²
- 1.1.2 Heat treatment of aluminum alloy castings for general purpose applications is covered in Practice B917/B917M.
- 1.2 Times and temperatures appearing in the heat-treatment tables are typical for various forms, sizes, and manufacturing methods and may not provide the optimum heat treatment for a specific item.
- 1.3 Some alloys in the 6xxx series may achieve the T4 temper by quenching from within the solution temperature range during or immediately following a hot working process, such as upon emerging from an extrusion die. Such alternatives to furnace heating and immersion quenching are indicated in Table 2, by Footnote L, for heat treatment of wrought aluminum alloys. However, this practice does not cover the requirements for a controlled extrusion press or hot rolling mill solution heat treatment. (Refer to Practice B807 for extrusion press solution heat treatment of aluminum alloys and to Practice B947 for hot rolling mill solution heat treatment of aluminum alloys.)
- 1.4 *Units*—The values stated in either SI units or inch-pound Metric or US Customary units are to be regarded separately as standard. 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.
- 1.5 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.
- 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.

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:³

B557 Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products

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

B881 Terminology Relating to Aluminum- and Magnesium-Alloy Products

B917/B917M Practice for Heat Treatment of Aluminum-Alloy Castings from All Processes

G69 Test Method for Measurement of Corrosion Potentials of Aluminum Alloys

2.3 American National Standard:

H35.1/H35.1(M) Alloy and Temper Designation Systems for Aluminum⁴

¹ This practice 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 Available from SAE International, 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.

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 National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.



3. Terminology

- 3.1 Definitions—Refer to Terminology B881 for definitions of product terms used in this practice.
- 3.2 Definition of Pyrometry Terms Specific to This Standard:
- 3.2.1 control sensor, n—sensor connected to the furnace temperature controller, which may or may not be recording.

TABLE 1 Tests Required

Product Form	Tensile Properties ^A	Heat-treat-induced Porosity ^B [Periodic Test]	Intergranular Corrosion ^C [Periodic Test]	Diffusion (Alclad Only) ^D [Periodic Test]	Eutectic Melting [Periodic Test]
Plate and sheet	X	X	Χ ^E	X	X
Wire, rod, bar, and profiles	X	X	X		X
Forgings	X	X	X		X
Tubing	X	X		X	Χ
Rivets, fastener components	X	X	X		X

^A Those specified in the applicable procurement material specification for lot release.

- 3.2.2 *load sensor*, *n*—sensor that is attached to the production material or a representation of production material, that supplies temperature data of the production material to process instrumentation.
 - 3.2.3 *monitoring sensor*, *n*—sensor connected to the monitoring instrument.
- 3.2.4 *test sensor*, *n*—sensor used in conjunction with a test instrument to perform a system accuracy test or temperature uniformity survey.

4. Equipment

- 4.1 *Heating Media*—Aluminum alloys are typically heat-treated in air chamber furnaces or molten salt baths; however, lead baths, oil baths, or fluidized beds, may be used. The use of uncontrolled heating is not permitted. Whichever heating means are employed, careful evaluation is required to ensure that the alloy being heat-treated responds properly to heat-treatment and is not damaged by overheating or by the heat-treatment environment.
- 4.1.1 Air chamber furnaces may be oil- or gas-fired or may be electrically heated. Furnace components that are significantly hotter than the metal should be suitably shielded for metal less than 0.250 in. [6.35 mm] thick to prevent adverse radiation effects. The atmosphere in air chamber furnaces must be controlled to prevent potential porosity resulting from solution heat treatment (see Note 1). The suitability of the atmosphere in an air-chamber furnace can be demonstrated by testing, in accordance with 7.4.2.1, that products processed in that furnace are free from heat-treat induced porosity.
- Note 1—Heat-treat induced porosity may lower mechanical properties and commonly causes blistering of the surface of the material. The condition is most likely to occur in furnaces in which the products of combustion contact the work, particularly if the gases are high in water vapor or contain compounds of sulfur. In general, the high-strength wrought alloys of the 2xxx and 7xxx series are most susceptible. Low-strength and Alclad (two sides) products are practically immune to this type of damage. Anodic films and proprietary heat-treat coatings are also useful in protecting against porosity resulting from solution heat treatment. Surface discoloration is a normal result of solution heat treatment of aluminum alloys and should not be interpreted as evidence of damage from overheating or as heat-treat induced porosity (see 7.4.2.1).
- 4.1.2 Salt baths heat the work rapidly and uniformly. The temperature of the bath can be closely controlled, an important consideration in solution heat treatment of wrought aluminum alloys. High-temperature oxidation of aluminum is not a problem in salt baths.
 - 4.2 Furnace Temperature Uniformity and Calibration Requirements:
- 4.2.1 After establishment of thermal equilibrium or a recurrent temperature pattern, the temperature in the working (soaking) zone, for all furnace control and test sensors, shall maintain temperature in the working (soaking) zone within the following allowable ranges:
- 4.2.1.1 50°F [28°C] range for furnaces used only for full annealing at 825°F [441°C] and higher, except 20°F [12°C] range if the annealing temperature is within 15°F [8°C] of the middle of the solution heat treating temperature range specified in Table 2. *Annealing:*
- (1) 50°F [28°C] range for furnaces used only for full annealing at 825°F [441°C] and higher. Annealing temperatures shall be controlled so as to preclude any material exceeding the lowest solution heat treating temperature for the alloy being annealed in accordance with Table 2. In the case of a practice in accordance with Table 2 with only a specified single solution heat treat temperature, the temperature shall not exceed the single provided temperature minus 10°F/6°C.
- (2) For furnaces used only for full annealing below 825°F [441°C] and for stress relieving, there are no temperature uniformity requirements.

^B Applicable only to material solution heat-treated in air furnaces.

^C Applicable to the most quench-sensitive alloys-tempers in the following order of preference: (1) 2xxx in -T3 or -T4 and (2) 7xxx in -T6 temper. No test is required if 2xxx-T3 or -T4 or 7xxx-T6, was not solution heat-treated during the period since the prior verification test.

 $^{^{\}it D}$ Not applicable for thicknesses less than 0.020 in.

^E Applicable to periodic testing of sheet product only.



TABLE 2 Recommended Heat Treatment for Wrought Aluminum Alloys^A

		Solution Heat Treatment			tion Heat Treatment	
Product	Metal Temperature, ±10°F [±6°C] ^{C,D}	Quench Temperature, °F [°C] ^E	Temper	Metal Temperature, ±10°F [±6°C]	Time at Temperature, h	Temper
		2011 Alloy ^A				
Cold-finished wire, rod,	945–995 [507–535]	110 [43] max	T3 ^F	320 [160]	14	T8 ^{<i>F</i>}
and bar			T4 T451 ^{<i>G</i>}			
			1451			· · · ·
Drawn tube	975 [524]	110 [43] max	T3 ^F	320 [160]	14	T8 ^F
			T4511 ^{<i>G</i>}			
		2014 Alloy ^A				
Flat sheet, bare or Alclad	925–945 [496–507] 935 [502]	110 [43] max	T3 ^F T42	320 [160]	18–20	T62
Coiled sheet, bare or Alclad	925–945 [496–507] 935 [502]	110 [43] max	T4 T42	320 [160] 320 [160]	18 18–20	T6 T62
Plate, bare or Alclad	925-945 [496-507]	110 [43] max	T451 ^G	320 [160]	18	T651 ^G
	935 [502]		T42	350 [177]	8–9	T62
Cold finished wire red	005 045 [406 507]	110 [42] may	T4	250 [177]	9	T6
Cold-finished wire, rod, and bar	925–945 [496–507]	110 [43] max	T451 ^H	350 [177] 350 [177]	9	T651 ^H
and bar	935 [502]		T42	350 [177]	8–9	T62
Extruded wire, rod, bar,	925–945 [496–507]	110 [43] max	T4	350 [177]	9	T6
profiles, and tube			T4510 ^H	350 [177]	9	T6510 ^H
			T4511 ^H	350 [177]	9	T6511 ^H
	935 [502]		T42	350 [177]	8–9	T62
Drawn tube	925–945 [496–507]	110 [43] max	T4	350 [177]	9	T6
Drawn tube	935 [502]	110 [45] IIIax	T42	350 [177]	8–9	T62
Die forgings	925–945 [496–507]	140–180 [60–82]	T4)	350 [177]	9	T6
Hand forgings and rolled	925–945 [496–507]	140–180 [60–82]	•T4	350 [177]	9	T6
rings	935 [502]	S://Standar	T452'	350 [177]	10	T652 ¹
	(=====	2017 Alloy ^A				
Cold-finished wire, rod,	925–950 [496–510]	110 [43] max	T4			
and bar			T451 ^H			
		2018 Alloy ^A	T42			
Die forgings	940–970 [504–521]	212 [100]	T4	340 [171]	10	T61
		A CITIA 2024 Alloy ^A S	M_17a	0.00[]		
Flat sheet, bare	910–930 [488–499]	110 [43] max	T3 ^F	375 [191]	12	T81 ^F
or Alclad / standards.it	eh ai/ca920 [493] and arc		2aa-b4 T3 61 ⁷ 9a	375 [191] ast	m-b91 8 -b918	T861 ^J
			T42	375 [191]	9–10	T62
			T42	375 [191]	16–18	T72
	010 020 [400 400]	110 [42] may	T4	075 [101]	0.10	
Coiled sheet, bare or Alclad	910–930 [488–499]	110 [43] max	T4 T42	375 [191]	9–10 9	T6 T62
or Alciau	920 [493]		T42	375 [191] 375 [191]	9 16–18	T72
Plate, bare or Alclad	910-930 [488-499]	110 [43] max	T351 ^G	375 [191]	12	T851 ^{<i>G</i>}
	920 [493]		T361 ^J	375 [191]	8	T861 ^J
			T42	375 [191]	9–10	T62
						T851 ^H
, ,	910–930 [488–499]	110 [43] max	T351 ^H	375 [191]	12	
, ,			T36 ^J	375 [191] 		
, ,	910–930 [488–499]		T36 ⁷ T4	375 [191] 375 [191]	 12	 T6
, ,			T36 ^J	375 [191] 		
and bar	910–930 [488–499] 920 [493]	110 [43] max	T36 ⁷ T4	375 [191] 375 [191] 375 [191]	 12	 T6
and bar Extruded wire, rod, bar,	910–930 [488–499] 920 [493]		T36 ^{<i>J</i>} T4 T42	375 [191] 375 [191]	 12 12–13 – – – – – – –	T6 T62 T81 ^F
and bar Extruded wire, rod, bar,	910–930 [488–499] 920 [493]	110 [43] max	T36 ^J T4 T42 T3 ^F	375 [191] 375 [191] 375 [191] 	 12 12–13 –––––– 12	T6 T62 T81 ^F T8510 ^H
and bar Extruded wire, rod, bar, orofiles, and tube	910–930 [488–499] 920 [493] 910–930 [488–499] 920 [493]	110 [43] max	T36 ^J T4 T42 T3 ^F T3510 ^H T3511 ^H T42	375 [191] 375 [191] 375 [191] 375 [191] 375 [191]	 12 12–13 	T6 T62 T81 ^F T8510 ^H T8511 ^H T62
and bar Extruded wire, rod, bar, profiles, and tube	910–930 [488–499] 920 [493] 910–930 [488–499] 920 [493]	110 [43] max	T36 ^J T4 T42 T3 ^F T3510 ^H T3511 ^H T42	375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191]	12 12–13 	T6 T62 T81 ^F T8510 ^H T8511 ^H T62
and bar Extruded wire, rod, bar, profiles, and tube	910–930 [488–499] 920 [493] 910–930 [488–499] 920 [493] 910–930 [488–499]	110 [43] max	T36 ^J T4 T42 T3 ^F T3510 ^H T3511 ^H T42 T3 ^F	375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191]	12 12–13 12 12 12 12 12 12–13	T6 T62 T81 ^F T8510 ^H T8511 ^H T62
Extruded wire, rod, bar, profiles, and tube	910–930 [488–499] 920 [493] 910–930 [488–499] 920 [493] 910–930 [488–499] 910–930 [488–499]	110 [43] max 110 [43] max 110 [43] max	T36 ^J T4 T42 T3 ^F T3511 ^H T42 T3 ^F T42	375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191]	12 12–13 	T6 T62 T81 ^F T8510 ^H T8511 ^H T62 T8 ^F T62
Extruded wire, rod, bar, profiles, and tube Drawn tube	910–930 [488–499] 920 [493] 910–930 [488–499] 920 [493] 910–930 [488–499] 920 [493]	110 [43] max 110 [43] max 110 [43] max 110 [43] max	T36 ^J T4 T42 T3 ^F T3511 ^H T42 T3 ^F T42	375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191]	12 12–13 12 12 12 12 12 12–13	T6 T62 T81 ^F T8510 ^H T8511 ^H T62
Extruded wire, rod, bar, profiles, and tube	910–930 [488–499] 920 [493] 910–930 [488–499] 920 [493] 910–930 [488–499] 910–930 [488–499]	110 [43] max 110 [43] max 110 [43] max 110 [43] max 2025 Alloy ⁴	T36 ^J T4 T42 T3 ^F T3510 ^H T3511 ^H T42 T3 ^F T42	375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191]	12 12-13 	T6 T62 T81 ^F T8510 ^H T8511 ^H T62 T8 ^F T62
Extruded wire, rod, bar, profiles, and tube Drawn tube Die Forgings	910–930 [488–499] 920 [493] 910–930 [488–499] 920 [493] 910–930 [488–499] 920 [493]	110 [43] max 2025 Alloy ⁴ 140–160 [60–71]	T36 ^J T4 T42 T3 ^F T3510 ^H T3511 ^H T42 T3 ^F T42	375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191]	12 12-13 	T6 T62 T81 ^f T8510 ^H T8511 ^H T62 T8 ^f T62
Drawn tube	910–930 [488–499] 920 [493] 910–930 [488–499] 920 [493] 910–930 [488–499] 910–930 [488–499]	110 [43] max 110 [43] max 110 [43] max 110 [43] max 2025 Alloy ⁴	T36 ^J T4 T42 T3 ^F T3510 ^H T3511 ^H T42 T3 ^F T42	375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191]	12 12-13 	T6 T62 T81 ^f T8510 ^H T8511 ^H T62 T8 ^f T62



TABLE 2 Continued

_	Sc	lution Heat Treatment		Precipitat	Precipitation Heat Treatment ^B		
Product	Metal Temperature, ±10°F [±6°C] ^{C,D}	Quench Temperature, °F [°C] ^E	Temper	Metal Temperature, ±10°F [±6°C]	Time at Temperature, h	Temper	
		2124 Alloy ^A			·		
Plate	910-930 [488-499]	110 [43] max	T3 ^F	375 [191]	12	T8 ^F	
			T31 ^{<i>G</i>}	370 [188]	12	T8151 ^G	
			T4	375 [191]	9	T6	
	920 [493]		T3 ^F	375 [191]	12	T82 ^F	
			T42	375 [191]	10	T62	
		2218 Alloy ^A					
Die forgings	940-960 [504-516]	212 [100]	T4	340 [171]	10	T61	
			T4	460 [238]	6	T7	
	950 [510]		T4	340 [171]	10	T62	
			T4	460 [238]	6	T72	
		2219 Alloy ^A					
Flat sheet, bare	985–1005 [529–541]	110 [43] max	T31 ^F	350 [177]	18	T81 ^F	
or Alclad			T37 ^K	325 [163]	24	T87 ^K	
	995 [535]		T42	375 [191]	17–19	T62	
Plate	985–1005 [529–541]	110 [43] max	T37 ^K	325 [163]	17–19	T87 ^K	
			T351 ^{<i>G</i>}	350 [177]	18	T851 ^{<i>G</i>}	
	995 [535]		T42	375 [191]	35–37	T62	
Cold-finished wire, rod,	985–1005 [529–541]	110 [43] max	T4	375 [191]	18	_T6	
and bar			T351 ^H	375 [191]	18	T851 ^H	
Extruded wire, rod, bar,	985–1005 [529–541]	110 [43] max	T31 ^F	375 [191]	18	T81 ^F	
profiles, and tube			T3510 ^H	375 [191]	18	T8510 ^H	
			T3511 ^H	375 [191]	18	T8511 ^H	
	995 [535]		T42	375 [191]	35–37	T62	
			Т3	375 [191]	17–19	T82	
		Trebe-Starmada					
Die forgings and rolled		110 [43] max		375 [191]	26	T6	
rings	995 [335]		T42	375 [191]	25–27	T62	
			T352 ¹	350 [177]	17–19	T82 ¹	
			18-1-10 -				
Hand forgings	985–1005 [529–541]	110 [43] max	T4	375 [191]	26	T6	
	995 [335]		T42	375 [191]	25–27	T62	
		cument Pr	T352'	350 [177]	17–19	T852 ¹	
		2618 Alloy ^A		<u> </u>			
Die, hand, and rolled							
	975–995 [524–535]	212 [100]	T4	390 [199]	20	T61	
ring forgings	975–995 [524–535] 985 [529]		T4 T42	390 [199] 390 [199]	20 19–21	T62	
ring forgings	985 [529]	A STIME 4032 Alloy STIME	T42	390 [199]	19–21	T62	
ring forgings Die forgings	985 [529] 940–970 [504–521]	4032 Alloy 140–180 [60–82]	T42 170 T4	390 [199] 340 [171]	19–21 10	T62	
ring forgings Die forgings	985 [529]	4032 Alloy 140–180 [60–82]	T42	390 [199]	19–21 10	T62	
ring forgings Die forgings https://standards.ii	985 [529] 940–970 [504–521] 16h a / 2955 [513]	4032 Alloy 140–180 [60–82]	T42 	390 [199] 340 [171] 14 8 340 [171] ast	19–21 10 m–h ⁰ 9–11 h ⁰]	T62 T6 T62	
ring forgings Die forgings https://standards.il	985 [529] 940–970 [504–521]	4032 Alloy 140–180 [60–82]	T42 170 T4	390 [199] 340 [171]	19–21 10	T62	
ring forgings Die forgings https://standards.ii	985 [529] 940–970 [504–521] 16h a / 2955 [513]	4032 Alloy 140–180 [60–82] 6005 Alloy	T42 -17a T4 a-b4/T4279a	390 [199] 340 [171] 14 8 340 [171] ast	19–21 10 m–h ⁰ 9–11 h ⁰]	T62 T6 T62	
ring forgings Die forgings HUDS // Standards.if Extruded rod, bar, profiles, and tube	985 [529] 940–970 [504–521] 16h av ca 955 [513] and ards.	4032 Alloy 140–180 [60–82] 6005 Alloy 	T42 17a T4 a-b4/T42792 T1	390 [199] 340 [171] 340 [171] 350 [177]	19–21 10 9–11 59 8	T62 T6 T62 T5	
ring forgings Die forgings The system dards if Extruded rod, bar, profiles, and tube Extruded rod, bar,	985 [529] 940–970 [504–521] 16h a / 2955 [513]	4032 Alloy 140–180 [60–82] 6005 Alloy	T42 T4	390 [199] 340 [171] 340 [171] 350 [177]	19–21 10 9–11 h 9 } 8	T62 T6 T62 T5	
ring forgings Die forgings HUDS // Standards.if Extruded rod, bar, profiles, and tube	985 [529] 940–970 [504–521] 16h av ca 955 [513] and ards.	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy	T42 17a T4 a-b4/T42792 T1	390 [199] 340 [171] 340 [171] 350 [177]	19–21 10 9–11 59 8	T62 T6 T62 T5	
ring forgings Die forgings https://standards.it Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube	985 [529] 940–970 [504–521] teh avca 955 [513] and ards. t	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A	T42 T4 A T4 T1 T1 T1 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177]	19–21 10 10 8 8 8	T62 T6 T62 T5 T5 T61	
ring forgings Die forgings	985 [529] 940–970 [504–521] 16h av ca 955 [513] and ards.	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy	T42 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191]	19–21 10 9–11 h 0 1 9 8 8 8 8	T62 T6 T62 T5	
ring forgings Die forgings https://standards.it Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube	985 [529] 940–970 [504–521] 955 [513] 1045–1065 [563–574]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A	T42 T4 T4 T4 T1 T1 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] or 345 [174]	19–21 10 9–11 50 13 8 8 8 8 8	T62 T6 T62 T5 T5 T61 T6	
ring forgings Die forgings https://standards.it Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube	985 [529] 940–970 [504–521] teh avca 955 [513] and ards. t	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A	T42 T4 A T4 T1 T1 T1 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191]	19–21 10 9–11 h 0 1 9 8 8 8 8	T62 T6 T62 T5 T5 T61	
ring forgings Die forgings Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare	985 [529] 940–970 [504–521] 1045–1065 [563–574] 1000 [538]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A 110 [43] max	T42 T4 T4 T4 T1 T1 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 375 [191] or 345 [174] 375 [191]	19–21 10 9–11 9 8 8 8 8 8 8 4 8 4–5	T62 T6 T62 T5 T5 T61 T6 T62	
ring forgings Die forgings https://standards.it Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube	985 [529] 940–970 [504–521] 955 [513] 1045–1065 [563–574]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A	T42 T4 T4 T4 T1 T1 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] or 345 [174]	19–21 10 9–11 50 13 8 8 8 8 8	T62 T6 T62 T5 T5 T61 T6	
ring forgings Die forgings https://standards.if Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare	985 [529] 940–970 [504–521] 1041–1065 [563–574] 1045–1065 [563–574] 1020–1050 [549–566]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A 110 [43] max	T42 T4 T4 T4 T1 T1 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 375 [191] or 345 [174] 345 [174]	19–21 10 9–11 h 9 } 8 8 8 8 8 4 4 8 4–5 8–16	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G	
ring forgings Die forgings Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Plate, bare Cold-finished wire, rod,	985 [529] 940–970 [504–521] 1045–1065 [563–574] 1000 [538]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A 110 [43] max	T42 T4 T4 T4 T1 T1 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] 375 [191] 345 [174] 375 [191]	19–21 10 9–11 0 1 8 8 8 8 8 4 8 4–5 8–16	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G T651 ^H	
ring forgings Die forgings https://standards.if Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare	985 [529] 940–970 [504–521] 1041–1065 [563–574] 1045–1065 [563–574] 1020–1050 [549–566]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6005A Alloy 110 [43] max 110 [43] max	T42 T4 T4 T4 T1 T1 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 375 [191] or 345 [174] 345 [174]	19–21 10 9–11 h 9 } 8 8 8 8 8 4 4 8 4–5 8–16	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G	
ring forgings Die forgings Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Plate, bare Cold-finished wire, rod, and bar	985 [529] 940–970 [504–521] 940–970 [504–521] 1045–1065 [563–574] 1045–1065 [563–574] 1020–1050 [549–566] 1040–1060 [560–571]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A 110 [43] max 110 [43] max	T42 T4 T4 T1 T1 T1 T4 T4 T4 T4 T4 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] 345 [174] 375 [191] 375 [191]	19–21 10 9–11 b 9 l 8 8 8 8 4 8 4–5 8–16 4 4	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G T651 ^H T8 ^F	
ring forgings Die forgings Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Plate, bare Cold-finished wire, rod,	985 [529] 940–970 [504–521] 1041–1065 [563–574] 1045–1065 [563–574] 1020–1050 [549–566]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6005A Alloy 110 [43] max 110 [43] max	T42 T4 T4 T4 T1 T1 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] 375 [191] 345 [174] 375 [191]	19–21 10 9–11 0 1 8 8 8 8 8 4 8 4–5 8–16	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G T651 ^H	
ring forgings Die forgings Intipsy/standards.if Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Cold-finished wire, rod, and bar Rod, bar & extrusion	985 [529] 940–970 [504–521] 1040–955 [513] and ards. 1045–1065 [563–574] 1000 [538] 1020–1050 [549–566] 1040–1060 [560–571]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 110 [43] max 110 [43] max 110 [43] max 6020 Alloy ^A 110 [43] max	T42 T4 T4 T1 T1 T1 T4 T4 T4 T4 TWU WU	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191]	19–21 10 9–11 9 8 8 8 8 4 8 4–5 8–16 4 4	T62 T6 T62 T5 T5 T61 T6 T62 T6511 ^H T8 ^F T6511 ^H	
ring forgings Die forgings Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Plate, bare Cold-finished wire, rod, and bar	985 [529] 940–970 [504–521] 940–970 [504–521] 1045–1065 [563–574] 1045–1065 [563–574] 1020–1050 [549–566] 1040–1060 [560–571]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A 110 [43] max	T42 T4 T4 T1 T1 T1 T4 T4 T4 T4 T4 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] 345 [174] 375 [191] 375 [191]	19–21 10 9–11 b 9 l 8 8 8 8 4 8 4–5 8–16 4 4	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G T651 ^H T8 ^F	
ring forgings Die forgings https://www.standards.ii Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Plate, bare Cold-finished wire, rod, and bar Rod, bar & extrusion Wire, rod, & bar	985 [529] 940–970 [504–521] 955 [513] 1045–1065 [563–574] 1000 [538] 1020–1050 [549–566] 1040–1060 [560–571] 1010–1050 [543–566] 1010–1050 [543–566]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A 110 [43] max 6020 Alloy ^A 110 [43] max 6053 Alloy ^A	T42 T4 T4 T1 T1 T4 T4 T4 T4 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] 375 [191] 345 [174] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 355 [176]	19–21 10 10 9–11 b 0 18 8 8 8 4 8 4–5 8–16 4 4 8–10	T62 T6 T62 T5 T61 T6 T62 T651 ^G T6511 ^H T8 ^F T6511 ^H T8 ^F	
ring forgings Die forgings Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Plate, bare Cold-finished wire, rod, and bar Rod, bar & extrusion Wire, rod, & bar Cold-finished wire and	985 [529] 940–970 [504–521] 1040–955 [513] and ards. 1045–1065 [563–574] 1000 [538] 1020–1050 [549–566] 1040–1060 [560–571]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A 110 [43] max	T42 T4 T4 T1 T1 T1 T4 T4 T4 T4 TWU WU	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191]	19–21 10 9–11 9 8 8 8 8 4 8 4–5 8–16 4 4	T62 T6 T62 T5 T5 T61 T6 T62 T6511 ^H T8 ^F T6511 ^H	
ring forgings Die forgings https://www.standards.ii Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Plate, bare Cold-finished wire, rod, and bar Rod, bar & extrusion Wire, rod, & bar	985 [529] 940–970 [504–521] 955 [513] 1045–1065 [563–574] 1000 [538] 1020–1050 [549–566] 1040–1060 [560–571] 1010–1050 [543–566] 1010–1050 [543–566]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A 110 [43] max 6020 Alloy ^A 110 [43] max 6053 Alloy ^A	T42 T4 T4 T1 T1 T4 T4 T4 T4 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] 375 [191] 345 [174] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 375 [191] 355 [176]	19–21 10 10 9–11 b 0 18 8 8 8 4 8 4–5 8–16 4 4 8–10	T62 T6 T62 T5 T61 T6 T62 T651 ^G T6511 ^H T8 ^F T6511 ^H T8 ^F	
ring forgings Die forgings Interpretation of the profiles of	985 [529] 940–970 [504–521] 1045–1065 [563–574] 1045–1065 [563–574] 1020–1050 [549–566] 1040–1060 [560–571] 1010–1050 [543–566] 1010–1050 [543–566]	6005 Alloy 6005 Alloy 6005 Alloy 6005 Alloy 6013 Alloy 110 [43] max 110 [43] max 6020 Alloy 110 [43] max	T42 T4 T4 T1 T1 T4 T4 T4 T4 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] 375 [191] 345 [174] 375 [191] 375 [191] 355 [176] 355 [176]	19–21 10 10 9–11 b 9 - 11 b 9 8 8 8 4 8 4–5 8–16 4 4 8–10 8–10	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G T6511 ^H T8 ^F T61	
ring forgings Die forgings Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Plate, bare Cold-finished wire, rod, and bar Rod, bar & extrusion Wire, rod, & bar Cold-finished wire and	985 [529] 940–970 [504–521] 1040–955 [513] and ards. 1045–1065 [563–574] 1000 [538] 1020–1050 [549–566] 1040–1060 [560–571] 1010–1050 [543–566] 960–980 [516–527]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6013 Alloy ^A 110 [43] max 6020 Alloy ^A 110 [43] max 6053 Alloy ^A	T42 T4 T4 T1 T1 T4 T4 T4 T4 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 375 [191] 375 [191] 345 [174] 375 [191] 355 [176] 355 [176] 355 [179]	19–21 10 9–11 59 8 8 8 8 4 8 4–5 8–16 8–10 8	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G T6511 ^H T8 ^F T61 T61 T61	
ring forgings Die forgings Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Plate, bare Cold-finished wire, rod, and bar Rod, bar & extrusion Wire, rod, & bar Cold-finished wire and rod	985 [529] 940–970 [504–521] 1045–1065 [563–574] 1045–1065 [563–574] 1020–1050 [549–566] 1040–1060 [560–571] 1010–1050 [543–566] 1010–1050 [543–566]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005 Alloy 6005 Alloy 110 [43] max	T42 T4 T4 T1 T1 T4 T4 T4 T4 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] 375 [191] 345 [174] 375 [191] 375 [191] 355 [176] 355 [176]	19–21 10 10 9–11 b 9 - 11 b 9 8 8 8 4 8 4–5 8–16 4 4 8–10 8–10	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G T6511 ^H T8 ^F T61	
ring forgings Die forgings https://www.standards.ii Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Plate, bare Cold-finished wire, rod, and bar Rod, bar & extrusion Wire, rod, & bar Cold-finished wire and rod Die forgings	985 [529] 940–970 [504–521] 955 [513] 1045–1065 [563–574] 1000 [538] 1020–1050 [549–566] 1040–1060 [560–571] 1010–1050 [543–566] 1010–1050 [543–566] 960–980 [516–527] 960–980 [516–527] 970 [521]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6005A Alloy 110 [43] max 110 [43] max 110 [43] max 6020 Alloy 110 [43] max 110 [43] max 110 [43] max 6053 Alloy 110 [43] max 6053 Alloy 110 [43] max 6061 Alloy	T42 T4 T4 T1 T1 T4 T4 T4 T4 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] 375 [191] 345 [174] 375 [191] 375 [191] 355 [176] 355 [176] 355 [176] 340 [171]	19–21 10 10 9–11 b) 18 8 8 8 8 4 8 4–5 8–16 4 4 8–10 8–10 8 10 10	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G T6511 ^H T8 ^F T6511 ^H T8 ^F T61	
ring forgings Die forgings Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Plate, bare Cold-finished wire, rod, and bar Rod, bar & extrusion Wire, rod, & bar Cold-finished wire and rod	985 [529] 940–970 [504–521] 955 [513] 1045–1065 [563–574] 1000 [538] 1020–1050 [549–566] 1040–1060 [560–571] 1010–1050 [543–566] 1010–1050 [543–566] 960–980 [516–527] 960–980 [516–527] 960–980 [516–527]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005 Alloy 6005 Alloy 110 [43] max	T42 T4 T4 T1 T1 T4 T4 T4 T4 T42 W'' T4 T4 T4 T4 T4 T4 T4 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 375 [191] 345 [174] 375 [191] 345 [174] 375 [191] 355 [176] 355 [176] 340 [171] 340 [171] 320 [160]	19–21 10 10 9–11 b 9 15 8 8 8 4 8 4–5 8–16 4 4 8–10 8–10 10 10	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G T6511 ^H T8 ^F T6511 ^H T61 T61 T62 T6516	
ring forgings Die forgings https://www.standards.ii Extruded rod, bar, profiles, and tube Extruded rod, bar, profiles, and tube Sheet, bare Cold-finished wire, rod, and bar Rod, bar & extrusion Wire, rod, & bar Cold-finished wire and rod Die forgings	985 [529] 940–970 [504–521] 955 [513] 1045–1065 [563–574] 1000 [538] 1020–1050 [549–566] 1040–1060 [560–571] 1010–1050 [543–566] 1010–1050 [543–566] 960–980 [516–527] 960–980 [516–527] 970 [521]	4032 Alloy 140–180 [60–82] 6005 Alloy 6005A Alloy 6005A Alloy 110 [43] max 110 [43] max 110 [43] max 6020 Alloy 110 [43] max 110 [43] max 110 [43] max 6053 Alloy 110 [43] max 6053 Alloy 110 [43] max 6061 Alloy	T42 T4 T4 T1 T1 T4 T4 T4 T4 T4 T4	390 [199] 340 [171] 340 [171] 350 [177] 350 [177] 375 [191] 375 [191] 345 [174] 375 [191] 375 [191] 355 [176] 355 [176] 355 [176] 340 [171]	19–21 10 10 9–11 b) 18 8 8 8 8 4 8 4–5 8–16 4 4 8–10 8–10 8 10 10	T62 T6 T62 T5 T5 T61 T6 T62 T651 ^G T6511 ^H T8 ^F T6511 ^H T8 ^F T61	

TABLE 2 Continued

		IABLE 2 Continue	ea			
_	5		Precipitation Heat Treatment ^B			
Product	Metal Temperature, ±10°F	Quench Temperature,	Temper	Metal Temperature,		Temper
	[±6°C] ^{C,D}	°F [°C] ^E	·	±10°F [±6°C]	Temperature, h	
Plate	960–1075 [516–579]	6061 Alloy ^A (Continue 110 [43] max	7451 ^{<i>G</i>}	320 [160]	18	T651 ^G
riale	985 [529]	110 [45] Illax	T42	350 [177]	18	T62
Tread Sheet and Plate ^{N,O}	960–1075 [516–579]	110 [43] max	T4	320 [160]	18	Т6
	960–1075 [516–579]	 110 [43] max ^P		350 [177]	 8	 T6
and bar	900-1073 [310-379]	110 [43] IIIAX	14	or 320 [160]	18	
			T3 ^F	340 [171]	8	T89 ^{Q,R}
				or 320 [160]	18	0
			T4 T451 ^{<i>H</i>}	350 [177]	8 8	T94 ^S T651 ^H
	985 [529]		T42	350 [177] 350 [177]	8–10	T62
Extruded rod, bar,	^L	110 [43] max ^P	T1 T4	350 [177]	8	T51
profiles, and tube	960–1075 [516–579] ^L	110 [43] max	T4510 ^H	350 [177] 350 [177]	8 8	T6 T6510 ^H
			T4510	350 [177]	8	T6511 ^H
	985 [529]		T42	350 [177]	8–10	T62
	960-1075 [516-579] ^L	110 [43] max ^P	T4	350 [177]	8	T6
	960–1075 [516–579] ^L	 110 [43] max ^P	T4	350 [177]	8	 T6
	960–1075 [516–579]	 110 [43] max	T4	320 [160]	18	 T6
Diawii tube	900-1073 [310-379]	110 [45] Illax	14	or 340 [171]	8	10
	985 [529]		T42	340 [171]	8	T62
 Die and hand forgings	960–1075 [516–579]	110 [43] max	T4)	350 [177]	8	 Тб
Dio ana nana longingo		To [10] max		or 340 [171]	10	10
 Rolled rings	960–1075 [516–579]	110 [43] max	0 S T4 C	350 [177]	8	T6
	985 [529]	6063 Alloy	T452 ^T	350 [177]	8–10	T652 ^T
Extruded rod, bar, tube,	^L		CAV T1AVV	400 [204]	1–2	T5
and profiles				or 360 [182]	3	
			T1	400 [204]	1–2	T52
	960-1010 [516-543] ^L	∆ < 110 [43] max ^P ≥ 0 1 ≤ 1	√ 170 T4	or 360 [182] 350 [177]	3 8	Т6
		ASTIVI D910/D9101	<u>vi- i 7 a</u> laa-h44 T42 79a	or 360 [182]	6 m-h98-10 h9 1 s	
nups//standards.i	teh.ai/ca985 [529] landards	8/8181/36342a/3-3111-42 	.aa-044 (42 /9a.	d8e350 [177]/ast 	11-096-10091	T62
Drawn tube	960-1010 [516-543]	110 [43] max	T4_	350 [177]	8	T6
			T3 ^F T3 ^F	350 [177]	8	T83 ^R T831 ^R
			T3 ^F	350 [177] 350 [177]	8 8	T832 ^R
			T31 ^{<i>F</i>}			
	985 [529]		T42	350 [177]	8–10	T62
	960–1010 [516–543] ^L	110 [43] max ^P	T4	360 [182]	6	T6
Про	300 1010 [310 340]			or 350 [177]	8	10
F. 4	000 1010 [510 540]	6066 Alloy	T.4	050 [477]	0	Т0
Extruded rod, bar, profiles, and tube	960–1010 [516–543]	110 [43] max	T4 T4510 ^H	350 [177] 350 [177]	8 8	T6 T6510 ^H
oronies, and tube			T4510	350 [177]	8	T6511 ^H
	985 [529]		T42	350 [177]	8–10	T62
 Die forgings	960–1010 [516–543]	110 [43] max	T4	350 [177]	8	 Т6
Extruded red her	1015 [EACTL	6070 Alloy	T4	200 [160]	18	T6
Extruded rod, bar, profiles, and tube	1015 [546] ^L	110 [43] max	T42	320 [160] 320 [160]	18	T62
Extruded rod, bar,	9 80 [527]^L	6082 Alloy	T4	350 [177]	8	T6
Extruded rod, bar,	980 [527] ^L		T1	350 [177] 350 [177]		10 T5
profiles, and tube	300 [02.]	<u></u>	T4511 ^H	350 [177] 350 [177]	<u>8</u>	T6511 ^H
profiles, and tube		2/2/ 4/1	<u>T1</u>	350 [177]	8	T5511 ^H
Extruded rod, bar,	970 [521] ^L	6101 Alloy 110 [43] max ^P	T4	390 [199]	10	T6
profiles, and tube	v f-=-1	[]	T4	440 [227]	5	T61
			T4	410 [210]	9	T63
			T4	535 [279]	7	T64
			T4	430 [221]	3	T65

TABLE 2 Continued

nperature, ±10°F ±6°C] ^{C,D} ^L 050 [527–566] 80 [510–527] 60 [516] ^L 80 [527] ^L 950 [510] 050 [516–566]	Solution Heat Treatment Quench Temperature, "F ["C]" 6105 Alloy 6110 Alloy 110 [43] max 6151 Alloy 110 [43] max 6162 Alloy 6201 Alloy 110 [43] max 6262 Alloy 110 [43] max	T4 ^S T4 T4 T4 T452 ^t T1 T1510 T1511 T4 T4510 T45111	Metal Temperature, ±10°F [±6°C] 350 [177] 350 [177] 380 [193] 340 [171] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177]	on Heat Treatment Time at Temperature, h 8 8 8 10 10 10 8 8 8 8 8 8	Temper T5 T6 T9 T6 T6 T6 T55510 T5511
250 [527] ^L 250 [527–566] 280 [510–527] 260 [516] 250 [527] ^L 250 [510]	°F [°C] ^E 6105 Alloy 6110 Alloy 110 [43] max 6151 Alloy 110 [43] max 110 [43] max 6162 Alloy 6201 Alloy 110 [43] max 6262 Alloy	T1 T4 T4 T4 T4 T4 T452' T1 T1510 T1511 T4 T4510 T45111 T3	±10°F [±6°C] 350 [177] 350 [177] 380 [193] 340 [171] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177]	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	T5 T6 T9 ^S T6 T6 T652' T5 T5510
050 [527–566] 180 [510–527] 160 [516] ^L 180 [527] ^L 150 [510] 1550 [516–566]	6110 Alloy 110 [43] max 6151 Alloy 110 [43] max 110 [43] max 6162 Alloy 6201 Alloy 110 [43] max 6262 Alloy	T4 T4S T4 T4 T452' T1 T1510 T1511 T4 T4510 T45111 T3	350 [177] 380 [193] 340 [171] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177]	8 8 10 10 10 10 8 8 8 8 8	T6 T9 ^S T6 T6 T652' T5 T5510
050 [527–566] 180 [510–527] 160 [516] ^L 180 [527] ^L 150 [510] 1550 [516–566]	6110 Alloy 110 [43] max 6151 Alloy 110 [43] max 110 [43] max 6162 Alloy 6201 Alloy 110 [43] max 6262 Alloy	T4 T4S T4 T4 T452' T1 T1510 T1511 T4 T4510 T45111 T3	350 [177] 380 [193] 340 [171] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177]	8 8 10 10 10 10 8 8 8 8 8	T6 T9 ^s T6 T6 T652' T5 T5510
80 [510–527] 	110 [43] max 6151 Alloy 110 [43] max 110 [43] max 6162 Alloy 6201 Alloy 110 [43] max 6262 Alloy	T4 ^S T4 T4 T4 T452 ^t T1 T1510 T1511 T4 T4510 T45111	340 [171] 340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177]	10 10 10 8 8 8 8	T6 T6 T652' T5 T5510
80 [527] ^L	110 [43] max 110 [43] max 6162 Alloy 6201 Alloy 110 [43] max 6262 Alloy	T4 T4 T452' T1 T1510 T1511 T4 T4510 T45111 T3	340 [171] 340 [171] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177]	10 10 8 8 8 8	T6 T652 [/] T5 T5510
80 [527] ^L 950 [510] 950 [516–566]	6162 Alloy 6201 Alloy 110 [43] max 6262 Alloy	T452 ¹ T1 T1510 T1511 T4 T4510 T45111	340 [171] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177] 350 [177]	8 8 8 8	T652 ¹ T5 T5510
80 [527] ^L 	6201 Alloy 110 [43] max 6262 Alloy	T1510 T1511 T4 T4510 T45111	350 [177] 350 [177] 350 [177] 350 [177] 350 [177]	8 8 8	T5510
80 [527] ^L 	6201 Alloy 110 [43] max 6262 Alloy	T1510 T1511 T4 T4510 T45111	350 [177] 350 [177] 350 [177] 350 [177] 350 [177]	8 8 8	T5510
50 [510] 050 [516–566]	6201 Alloy 110 [43] max 6262 Alloy	T4 T4510 T45111 T3	350 [177] 350 [177] 350 [177]	8	T5511
050 [516–566]	110 [43] max 6262 Alloy	Т3			T6 T6510
050 [516–566]	110 [43] max 6262 Alloy	T3		8	T6511
			320 [160]	4	T81 ^R
005 [5/1]		T4 T4	340 [171]	8	T6 T9 ^s
005 [5/11]		T451 ^H	340 [171] 340 [171]	8 8	T651 ^H
JOJ [J41]		T42	340 [171]		T62
)50 [516–566] ^L	110 [43] max	T4	350 [177]	12	T6
		T4510 ^H	350 [177]	12	T6510 ^H
005 [541]		T4511 ^H T42	350 [177] 350 [177]	12 11–13	T6511 ^H T62
- 050 [516–566]	110 [43] max	T4	340 [171]	8	T6
005 [541]	ocument	T45 T42	340 [171] 340 [171]	8 8	T9 ^S T62
		T1	050 [477]		
			350 [177]	8	T5 T51
			or 350 [177]	8	T54
010 [516–543]		42aa-b44 !4 /9a	0 8 = 350 [177] as m	m-09185-091	8m-T6/a
^L		T1	400 [204]	1	T5
			or 360 [182]	3	
70 [521] ^L			350 [177] or 360 [182]	8 6	T6
L			room tommerature	70 plus	T53
		11	225 [107]	8 plus	153
				-	
00 [460-482]	110 [43] max	W511 ^{<i>H</i>,<i>U</i>}	room temperature 250 [121]	48 plus 24 plus	T76511 ^H
		W511 ^{<i>H,U</i>}	room temperature 250 [121] 330 [166]	48 plus 24 plus 17	T73511 ^H
000 [460–482]	140–160 [60–71]		room temperature 250 [121]	48 plus 8–24	T73
		W51 ^{<i>I,U</i>}	room temperature 250 [121]	8–24 plus 8–24 plus	T7351 [/]
75 [468]		W52 ^{<i>i,U</i>}	room temperature 250 [151]	24 plus 8–24 plus	T7352 ¹
		$W^{\scriptscriptstyle U}$	330 [166] room temperature	6–16 48 min	T732
	050 [516–566] 005 [541] ^L 10 [516–543] ^L 70 [521] ^L ^L 00 [460–482]	110 [43] max 1005 [541] 6351 Alloy 4 10 [516–543] ^L 110 [43] max 6463 Alloy 70 [521] ^L 110 [43] max 7005 Alloy 7049 Alloy 00 [460–482] 140–160 [60–71]	110 [43] max T4 T4S 142 6351 Alloy L T1 L 110 [516–543]L 110 [43] max T4 T11 110 [516–543]L 110 [43] max T4 6463 Alloy T1 70 [521]L 110 [43] max T4 7005 Alloy L T1 7049 Alloy W511 ^{H,U} W511 ^{H,U} 75 [468] W52 ^{L,U}	100 100	10 [43] max