



Designation: **B918/B918M – 17a** **B918/B918M – 20**

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*

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~~ AMS2772.

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 1 ~~Table 2~~, by ~~Footnote~~ 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; it only covers the requirements of artificial aging, annealing and associated pyrometry of those processes for products solution heat treated in accordance with Practices B807/B807M and B947. (Refer to Practice B807/B807M for extrusion press solution heat treatment of aluminum alloys and to Practice B947 for hot rolling mill solution heat treatment of aluminum alloys.) alloys and associated pyrometry.

1.4 *Units*—The values stated in either 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, health, and environmental 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~~ practice to the extent referenced herein:

2.2 *ASTM Standards:*²

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)

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

B881 Terminology Relating to Aluminum- and Magnesium-Alloy Products

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

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.

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



TABLE 21 Recommended Heat Treatment for Wrought Aluminum Alloys^{A,W}

Product	Solution Heat Treatment		Precipitation Heat Treatment ^B			
	Metal Temperature, ±10°F [$\pm 6^{\circ}\text{C}$] ±10 °F [$\pm 6^{\circ}\text{C}$] ^{C,D,V}	Quench Temperature, °F [$^{\circ}\text{C}$] ^E	Temper	Metal Temperature, ±10°F [$\pm 6^{\circ}\text{C}$] ±10 °F [$\pm 6^{\circ}\text{C}$] ^V	Time at Temperature, h	Temper
2011 Alloy^A						
Gold-finished wire, rod, Cold-finished wire, rod, and bar	945–995 [507–535]	110 [43] max	T3 ^F	320 [160]	14	T8 ^F
	945–995 [507–535]	110 [43] max	T3	320 [160]	14	T8
			T4	...	...	...
			T451 ^G	...	...	...
		T451	...	...	...	...
Drawn tube	975 [524]	110 [43] max	T3 ^F	320 [160]	14	T8 ^F
Drawn tube and pipe	975 [524]	110 [43] max	T3	320 [160]	14	T8
			T4511 ^G	...	...	...
			T4511	...	...	...
2014 Alloy^A						
Flat sheet, bare	925–945 [496–507]	110 [43] max	T3 ^F	...	...	...
Flat sheet, bare or Alclad	925–945 [496–507] 935 [502] ^U	110 [43] max	T3 T42	320 [160] ^U	18–20 ^U	T62 ^U
Coiled sheet, bare or Alclad	925–945 [496–507] 935 [502] ^U	110 [43] max	T4 T42	320 [160] 320 [160] ^U	18 18–20 ^U	T6 T62 ^U
Plate, bare or Alclad	925–945 [496–507]	110 [43] max	T451 ^G	320 [160]	18	T651 ^G
Plate, bare or Alclad	925–945 [496–507] 935 [502] ^U	110 [43] max	T451 T42	320 [160] 350 [177] ^U	18 8–9 ^U	T651 T62 ^U
Cold-finished wire, rod, and bar	925–945 [496–507]	110 [43] max	T4	350 [177]	9	T6
			T451 ^H	350 [177]	9	T651 ^H
			T451	350 [177]	9	T651
	935 [502] ^U		T42	350 [177] ^U	8–9 ^U	T62 ^U
Extruded wire, rod, bar, profiles, and tube profiles, tube, and pipe	925–945 [496–507]	110 [43] max	T4	350 [177]	9	T6
			T4510 ^H	350 [177]	9	T6510 ^H
			T4510	350 [177]	9	T6510
			T4511 ^H	350 [177]	9	T6511 ^H
			T4511	350 [177]	9	T6511
	935 [502] ^U		T42	350 [177] ^U	8–9 ^U	T62 ^U
Drawn tube and pipe	925–945 [496–507] 935 [502] ^U	110 [43] max	T4 T42	350 [177] 350 [177] ^U	9 8–9 ^U	T6 T62 ^U
Die forgings	925–945 [496–507]	140–180 [60–82]	T4	350 [177]	9	T6
Hand forgings and rolled rings	925–945 [496–507]	140–180 [60–82]	T4	350 [177]	9	T6
rings	935 [502] ^U		T452 ^I	350 [177]	10	T652 ^I
			T452	350 [177] ^U	10 ^U	T652 ^U
2017 Alloy^A						
Cold-finished wire, rod, and bar	925–950 [496–510]	110 [43] max	T4	...	...	...
			T451 ^H	...	...	...
			T451	...	...	...
			T42	...	...	...
2018 Alloy^A						
Die forgings	940–970 [504–521]	212 [100]	T4	340 [171]	10	T61
Die forgings	940–970 [504–521]	Boiling Water ^J	T4	340 [171]	10	T61
2024 Alloy^A						
Flat sheet, bare	910–930 [488–499]	110 [43] max	T3 ^F	375 [191]	12	T81 ^F
Flat sheet, bare or Alclad	910–930 [488–499] 920 [493]	110 [43] max	T3 T361 ^V	375 [191] 375 [191]	12 8	T81 T861 ^V
or Alclad	920 [493] ^U		T361	375 [191] ^U	8 ^U	T861 ^U
			T42	375 [191] ^U	9–10 ^U	T62 ^U
			T42	375 [191] ^U	16–18 ^U	T72 ^U
Coiled sheet, bare or Alclad	910–930 [488–499] 920 [493] ^U	110 [43] max	T4 T42 T42	375 [191] 375 [191] ^U 375 [191] ^U	9–10 9 ^U 16–18 ^U	T6 T62 ^U T72 ^U
Plate, bare or Alclad	910–930 [488–499]	110 [43] max	T351 ^G	375 [191]	12	T851 ^G
Plate, bare or Alclad	910–930 [488–499] 920 [493]	110 [43] max	T351 T361 ^V	375 [191] 375 [191]	12 8	T851 T861 ^V
	920 [493] ^U		T361	375 [191] ^U	8 ^U	T861 ^U
			T42	375 [191] ^U	9–10 ^U	T62 ^U
Cold-finished wire, rod, and bar	910–930 [488–499]	110 [43] max	T351 ^H	375 [191]	12	T851 ^H
Cold-finished wire, rod, and bar	910–930 [488–499]	110 [43] max	T351	375 [191]	12	T851

**B918/B918M – 20****TABLE 1 Continued**

Product	Solution Heat Treatment		Precipitation Heat Treatment ^B			
	Metal Temperature, $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] ^{C,D,V}	Quench Temperature, $^{\circ}\text{F}$ [$^{\circ}\text{C}$] ^E	Temper	Metal Temperature, $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] ^V	Time at Temperature, h	Temper
and bar			T36 ^U	...	...	...
and bar			T36	...	...	...
			T4	375 [191]	12	T6
	920 [493] ^U		T42	375 [191] ^U	12–13 ^U	T62 ^U
Extruded wire, rod, bar,	910–930 [488–499]	110 [43] max	T3 ^E	375 [191]	12	T81 ^E
Extruded wire, rod, bar,	910–930 [488–499]	110 [43] max	T3	375 [191]	12	T81
profiles, and tube			T3510 ^H	375 [191]	12	T8510 ^H
profiles, tube, and pipe			T3510	375 [191]	12	T8510
			T3511 ^H	375 [191]	12	T8511 ^H
			T3511	375 [191]	12	T8511
	920 [493] ^U		T42	375 [191] ^U	12–13 ^U	T62 ^U
Drawn tube	910–930 [488–499]	110 [43] max	T3 ^E	375 [191]	12	T8 ^E
Drawn tube and pipe	910–930 [488–499]	110 [43] max	T3	375 [191]	12	T8
	920 [493] ^U		T42	375 [191] ^U	9–10 ^U	T62 ^U
Die Forgings	910–930 [488–499]	110 [43] max	T3 ^E	375 [191]	11	T81 ^E
		2025 Alloy^A				
Die forgings	950–970 [510–521]	140–160 [60–71]	T4	350 [177]	9	T6
		2117 Alloy^A				
Cold-finished, wire or rod	925–950 [496–510]	110 [43] max	T4	...	...	...
		2124 Alloy^A				
Plate	910–930 [488–499]	110 [43] max	T3 ^E	375 [191]	12	T8 ^E
Plate	910–930 [488–499]	110 [43] max	T3	375 [191]	12	T8
			T31 ^G	370 [188]	12	T8151 ^G
			T31	370 [188]	12	T8151
			T4	375 [191]	9	T6
	920 [493]		T3 ^E	375 [191]	12	T82 ^E
	920 [493] ^U		T3	375 [191] ^U	12 ^U	T82 ^U
			T42	375 [191] ^U	10 ^U	T62 ^U
		2218 Alloy^A				
Die forgings	940–960 [504–516]	212 [100]	T4	340 [171]	10	T61
Die forgings	940–960 [504–516]	Boiling Water ^T	T4	340 [171]	10	T61
			T4	460 [238]	6	T7
	950 [510] ^U		T4	340 [171] ^U	10 ^U	T62 ^U
			T4	460 [238] ^U	6 ^U	T72 ^U
		2219 Alloy^A				
Flat sheet, bare	985–1005 [529–541]	110 [43] max	T31 ^E	350 [177]	18	T81 ^E
Flat sheet, bare	985–1005 [529–541]	110 [43] max	T31	350 [177]	18	T81
or Alclad			T37 ^K	325 [163]	24	T87 ^K
or Alclad			T37	325 [163]	24	T87
	995 [535] ^U		T42	375 [191] ^U	17–19 ^U	T62 ^U
Plate	985–1005 [529–541]	110 [43] max	T37 ^K	325 [163]	17–19	T87 ^K
Plate	985–1005 [529–541]	110 [43] max	T37	325 [163]	17–19	T87
			T351 ^G	350 [177]	18	T851 ^G
			T351	350 [177]	18	T851
	995 [535] ^U		T42	375 [191] ^U	35–37 ^U	T62 ^U
Cold-finished wire, rod, and bar	985–1005 [529–541]	110 [43] max	T4	375 [191]	18	T6
and bar			T351 ^H	375 [191]	18	T851 ^H
and bar			T351	375 [191]	18	T851
Extruded wire, rod, bar,	985–1005 [529–541]	110 [43] max	T31 ^E	375 [191]	18	T81 ^E
Extruded wire, rod, bar,	985–1005 [529–541]	110 [43] max	T31	375 [191]	18	T81
profiles, and tube			T3510 ^H	375 [191]	18	T8510 ^H
profiles, tube, and pipe			T3510	375 [191]	18	T8510
			T3511 ^H	375 [191]	18	T8511 ^H
			T3511	375 [191]	18	T8511
	995 [535] ^U		T42	375 [191] ^U	35–37 ^U	T62 ^U
			T3	375 [191] ^U	17–19 ^U	T82 ^U
Die forgings and rolled rings	985–1005 [529–541]	110 [43] max	T4	375 [191]	26	T6
	995 [335] ^U		T42	375 [191] ^U	25–27 ^U	T62 ^U
			T352 ^I	350 [177]	17–19	T82 ^I
			T352	350 [177] ^U	17–19 ^U	T82 ^U

**B918/B918M – 20****TABLE 1 Continued**

Product	Solution Heat Treatment		Precipitation Heat Treatment ^B			
	Metal Temperature, $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] ^{C,D,V}	Quench Temperature, $^{\circ}\text{F}$ [$^{\circ}\text{C}$] ^E	Temper	Metal Temperature, $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] ^V	Time at Temperature, h	Temper
Hand forgings	985–1005 [529–541] 995 [335] ^U	110 [43] max	T4 T42 T352 ^I	375 [191] 375 [191] ^U 350 [177] ^U	26 25–27 ^U 17–19 17–19 ^U	T6 T62 ^U T852 ^U T852 ^U
2618 Alloy^A						
Die, hand, and rolled	975–995 [524–535]	212 [100]	T4	390 [199]	20	T64
Die, hand, and rolled	975–995 [524–535]	Boiling Water ^T	T4	390 [199]	20	T61
ring forgings	985 [529] ^U		T42	390 [199] ^U	19–21 ^U	T62 ^U
4032 Alloy						
Die forgings	940–970 [504–521] 955 [513] ^U	140–180 [60–82]	T4 T42	340 [171] 340 [171] ^U	10 9–11 ^U	T6 T62 ^U
6005 Alloy						
Extruded rod, bar, profiles, and tube	... ^L	...	T1	350 [177]	8	T5
6005A Alloy						
Extruded rod, bar, profiles, and tube	... ^L	...	T1 T4	350 [177] 350 [177]	8 8	T5 T64
profiles, tube, and pipe			T4	350 [177]	8	T61
6013 Alloy^A						
Sheet, bare	1045–1065 [563–574] 1000 [538] ^U	110 [43] max	T4 T42	375 [191] or 345 [174] 375 [191] ^U	4 8 4–5 ^U	T6 T62 ^U
Plate, bare	1020–1050 [549–566]	110 [43] max	...	345 [174]	8–16	T654 ^G
Plate, bare	1020–1050 [549–566]	110 [43] max	...	345 [174]	8–16	T651
Gold-finished wire, rod, Cold-finished wire, rod, and bar	1040–1060 [560–574] 1040–1060 [560–571]	110 [43] max 110 [43] max	... ... ...	375 [191] 375 [191] 375 [191]	4 4 4	T654 ^H T651 T8 ^E
and bar			...	375 [191]	4	T8
6020 Alloy^A						
Rod, bar & extrusion	1010–1050 [543–566]	110 [43] max	W ^U	355 [176]	8–10	T6511 ^H
Rod, bar & extrusion	1010–1050 [543–566]	110 [43] max	W ^I	355 [179]	8–10	T6511
Wire, rod, & bar	1010–1050 [543–566]	110 [43] max	W ^U	355 [176]	8–10	T8 ^E
Wire, rod, & bar	1010–1050 [543–566]	110 [43] max	W ^I	355 [179]	8–10	T8
6041 Alloy						
Extruded rod, bar, and profiles	1010–1050 [543–566]	110 [43] max	T4 T4511	350 [176] 350 [176]	8 8	T6 T6511
6042 Alloy						
Extruded rod, bar, and profiles	1010–1050 [543–566]	110 [43] max	T1 T1	350 [176] 350 [176]	8 8	T5 T5511
6053 Alloy^A						
Cold-finished wire and rod	960–980 [516–527]	110 [43] max	T4	355 [179]	8	T61
Die forgings	960–980 [516–527] 970 [521] ^U	110 [43] max	T4 T42	340 [171] 340 [171] ^U	10 10 ^U	T6 T62 ^U
6061 Alloy^A						
Sheet, bare or Alclad	960–1075 [516–579] ^M	110 [43] max	T4	320 [160]	18	T6
Sheet, bare or Alclad	960–1075 [516–579] ^F 985 [529] ^U	110 [43] max	T4 T42 T42 ^Z T42 ^P	320 [160] 350 [177] ^U 320 [160] ^Z 320 [160] ^{P,U}	18 8–10 ^U 17–19 ^Z 17–19 ^{P,U}	T6 T62 ^U T62 ^Z T62 ^{P,U}
6061 Alloy^A (Continued)						
Plate	960–1075 [516–579]	110 [43] max	T4511 ^G	320 [160]	18	T654 ^G
Plate	960–1075 [516–579] 985 [529] ^U	110 [43] max	T451 T42	320 [160] 350 [177] ^U	18 18 ^U	T651 T62 ^U
Tread Sheet and Plate ^{N,O}	960–1075 [516–579]	110 [43] max	T4	320 [160]	18	T6
Tread Sheet and Plate ^G	960–1075 [516–579]	110 [43] max	T4	320 [160]	18	T6

**B918/B918M – 20****TABLE 1 Continued**

Product	Solution Heat Treatment		Precipitation Heat Treatment ^B			
	Metal Temperature, ±10°F [$\pm 6^{\circ}\text{C}$] ±10 °F [$\pm 6^{\circ}\text{C}$] ^{C,D,V}	Quench Temperature, °F [$^{\circ}\text{C}$] ^E	Temper	Metal Temperature, ±10°F [$\pm 6^{\circ}\text{C}$] ±10 °F [$\pm 6^{\circ}\text{C}$] ^V	Time at Temperature, h	Temper
Gold finished wire, rod, Cold finished wire, rod, and bar	960–1075 [516–579]	110 [43] max ^E	T4	350 [177]	8	T6
	960–1075 [516–579]	110 [43] max ^H	T4	350 [177]	8	T6
			T3 ^E	340 [171]	8	T89 ^{Q,B}
			T3	340 [171]	8	T89
				or 320 [160]	18	
			T4	350 [177]	8	T94 ^S
			T4	350 [177]	8	T94
			T451 ^H	350 [177]	8	T651 ^H
			T451	350 [177]	8	T651
		985 [529] ^U	T42	350 [177] ^U	8–10 ^U	T62 ^U
Extruded rod, bar, profiles, and tube profiles, tube, and pipe	960–1075 [516–579] ^L	110 [43] max ^E	T1	350 [177]	8	T51
	960–1075 [516–579] ^L	110 [43] max ^H	T4	350 [177]	8	T6
			T4	350 [177]	8	T6
			T4510 ^H	350 [177]	8	T6510 ^H
			T4510	350 [177]	8	T6510
			T4511 ^H	350 [177]	8	T6511 ^H
			T4511	350 [177]	8	T6511
			T4511	350 [177]	8	T6511
		985 [529] ^U	T42	350 [177] ^U	8–10 ^U	T62 ^U
Structural profiles	960–1075 [516–579] ^L	110 [43] max ^E	T4	350 [177]	8	T6
Structural profiles	960–1075 [516–579] ^L	110 [43] max ^H	T4	350 [177]	8	T6
Pipe	960–1075 [516–579] ^L	110 [43] max ^E	T4	350 [177]	8	T6
Drawn tube and pipe	960–1075 [516–579] ^L	110 [43] max	T4	320 [160]	18	T6
	985 [529] ^U		T42	340 [171] ^U	8 ^U	T62 ^U
Die and hand forgings	960–1075 [516–579]	110 [43] max	T4	350 [177]	8	T6
				or 340 [171]	10	
Rolled rings	960–1075 [516–579]	110 [43] max	T4	350 [177]	8	T6
	985 [529]		T452 ^I	350 [177]	8–10	T652 ^I
	985 [529] ^U		T452	350 [177] ^U	8–10	T652 ^U
6063 Alloy						
Extruded rod, bar, tube, and profiles	960–1010 [516–543] ^L	110 [43] max ^E	T1	400 [204]	1–2	T5
	960–1010 [516–543] ^L	110 [43] max ^H	T1	400 [204]	3	T52 ^U
				or 360 [182] ^U	1–2 ^U	
				or 360 [182] ^U	3 ^U	
				or 360 [182]	6	
Drawn tube and pipe	960–1010 [516–543] ^L	110 [43] max	T4	350 [177]	8	T6
			T3 ^E	350 [177]	8	T83 ^B
			T3	350 [177]	8	T83
			T3 ^E	350 [177]	8	T831 ^B
			T3	350 [177]	8	T831
			T3 ^E	350 [177]	8	T832 ^B
			T3	350 [177]	8	T832
			T31 ^E	350 [177]	8	T831
		985 [529] ^U	T42	350 [177] ^U	8–10 ^U	T62 ^U
6064 Alloy						
Pipe	960–1010 [516–543] ^L	110 [43] max ^E	T4	360 [182]	6	T6
Extruded rod, bar, profiles, tube, and pipe	960–1010 [516–543] ^L	110 [43] max	T4	350 [177]	8	T6
				or 350 [177]	8	
			T4511	350 [177]	8	T6511
6066 Alloy						
Extruded rod, bar, profiles, and tube profiles, tube, and pipe	960–1010 [516–543] ^L	110 [43] max	T4	350 [177]	8	T6
			T4510 ^H	350 [177]	8	T6510 ^H
			T4510	350 [177]	8	T6510
			T4511 ^H	350 [177]	8	T6511 ^H
			T4511	350 [177]	8	T6511
		985 [529] ^U	T42	350 [177] ^U	8–10 ^U	T62 ^U
Die forgings	960–1010 [516–543]	110 [43] max	T4	350 [177]	8	T6
6070 Alloy						

**B918/B918M – 20****TABLE 1 Continued**

Product	Solution Heat Treatment		Precipitation Heat Treatment ^B			
	Metal Temperature, ±10°F [±6°C]±10 °F [±6 °C] ^{C,D,V}	Quench Temperature, °F [°C] ^E	Temper	Metal Temperature, ±10°F [±6°C]±10 °F [±6 °C] ^V	Time at Temperature, h	Temper
Extruded rod, bar, profiles, and tube	1015 [546] ^L	110 [43] max	T4	320 [160]	18	T6
profiles, tube, and pipe			F42	320 [160]	18	F62
			T42	320 [160] ^U	18 ^U	T62 ^U
6082 Alloy						
Extruded rod, bar, profiles, and tube	980 [527] ^L	...	T4	350 [177]	8	F5
profiles, tube, and pipe	980 [527] ^L	...	T1	350 [177]	8	T6
			F4	350 [177]	8	F5511 ^H
			T1	350 [177]	8	T6511
6101 Alloy						
Extruded rod, bar, profiles, and tube	970 [521] ^L	110 [43] max ^E	T4	390 [199]	10	F6
profiles, tube, and pipe	970 [521] ^L	110 [43] max ^H	T4	390 [199]	10	T6
			F4	440 [227]	5	F64
			T4	440 [227]	5	T61
			T4	410 [210]	9	T63
			T4	535 [279]	7	T64
			T4	430 [221]	3	T65
6105 Alloy						
Extruded rod, bar, profiles, and tube	... ^L	...	T1	350 [177]	8	T5
profiles, tube, and pipe			F4	350 [177]	8	F6
			T4	350 [177]	8	T6
6110 Alloy						
Gold-finished wire, rod, Cold-finished wire, rod, and bar	980–1050 [527–566]	110 [43] max	F4 ^S	380 [193]	8	F9 ^S
	980–1050 [527–566]	110 [43] max	T4	380 [193]	8	T9
6151 Alloy						
Die forgings	950–980 [510–527]	110 [43] max	T4	340 [171]	10	T6
Rolled rings	960 [516]	110 [43] max	T4	340 [171]	10	T6
			F452 ^L	340 [171]	10	F652 ^L
	965 [518] ^U		T452	340 [171] ^U	10	T652 ^U
6162 Alloy						
Extruded rod, bar, profiles, and tube	... ^L	...	T1	350 [177]	8	T5
profiles, tube, and pipe			F1510	350 [177]	8	F5510
			T1510	350 [177]	8	T5510
	980 [527] ^L	...	T4	350 [177]	8	T6
			T4510	350 [177]	8	T6510
			T4511	350 [177]	8	T6511
6201 Alloy						
Wire	950 [510]	110 [43] max	F3	320 [160]	4	F81 ^H
Wire	950 [510]	110 [43] max	T3	320 [160]	4	T81
6262 Alloy						
Cold-finished wire, rod, and bar	960–1050 [516–566]	110 [43] max	T4	340 [171]	8	T6
rod, and bar			F4	340 [171]	8	F9 ^S
			T4	340 [171]	8	T9
			F451 ^H	340 [171]	8	F651 ^H
	1005 [541] ^U		T451	340 [171]	8	T651
			T42	340 [171] ^U	8 ^U	T62 ^U
6201 Alloy						
Extruded rod, bar, profiles, and tube	960–1050 [516–566] ^L	110 [43] max	T4	350 [177]	12	T6
profiles, tube, and pipe			F4510 ^H	350 [177]	12	F6510 ^H
			T4510	350 [177]	12	T6510
			F4511 ^H	350 [177]	12	F6511 ^H
	1005 [541] ^U		T4511	350 [177]	12	T6511
			T42	350 [177] ^U	11–13 ^U	T62 ^U
6201 Alloy						
Drawn tube and pipe	960–1050 [516–566]	110 [43] max	T4	340 [171]	8	T6
			F4 ^S	340 [171]	8	F9 ^S
			T4	340 [171]	8	T9
	1005 [541] ^U		T42	340 [171] ^U	8 ^U	T62 ^U
6351 Alloy						
Extruded rod, bar, profiles, and tube	... ^L	...	T1	350 [177]	8	T5
profiles, tube, and pipe				350 [177]	8	F54
				350 [177]	8	T51
	... ^L	...	T11	250 [121]	10	T54
				or 350 [177]	8	
	960–1010 [516–543] ^L	110 [43] max ^E	F4	350 [177]	8	F6
	960–1010 [516–543] ^L	110 [43] max ^H	T4	350 [177]	8	T6

**B918/B918M – 20****TABLE 1 Continued**

Product	Solution Heat Treatment		Precipitation Heat Treatment ^B			
	Metal Temperature, ±10°F [$\pm 6^{\circ}\text{C}$] ±10 °F [$\pm 6^{\circ}\text{C}$] ^{C,D,V}	Quench Temperature, °F [$^{\circ}\text{C}$] ^E	Temper	Metal Temperature, ±10°F [$\pm 6^{\circ}\text{C}$] ±10 °F [$\pm 6^{\circ}\text{C}$] ^V	Time at Temperature, h	Temper
6463 Alloy						
Extruded rod, bar, profiles, and tube profiles, tube, and pipe	...	...	T1	400 [204] or 360 [182]	1 3	T5
	970 [521] ^L	110 [43] max ^P	T4	360 [182]	3	T6
	970 [521] ^L	110 [43] max ^H	T4	350 [177] or 360 [182]	8 8 6	T6
7005 Alloy						
Extruded rod, bar, and profiles	...	...	T1	room temperature 225 [107] 300 [149]	72 plus 8 plus 16	T53
7049 Alloy^A						
Extruded rod, bar, Extruded rod, bar, and profiles	860-900 [460-482]	110 [43] max	W511 ^{H,U}	room temperature	48 plus	T76511 ^H
	860-900 [460-482]	110 [43] max	W511 ^I	room temperature	48 plus	T76511
				250 [121] 375 [163]	24 plus 13	
			W511 ^{H,U}	room temperature	48 plus	T73511 ^H
			W511 ^I	room temperature	48 plus	T73511
				250 [121] 330 [166]	24 plus 17	
Die and hand forgings	860-900 [460-482]	140-160 [60-71]	W ^U	room temperature	48 plus	T73
Die and hand forgings*	860-900 [460-482]	140-160 [60-71]	W ^I	room temperature	48 plus	T73
				250 [121] 340 [171]	8-24 6-16	
			W51 ^{L,U}	room temperature	8-24 plus	T7351 ^I
			W51 ^I	room temperature	8-24 plus	T7351
				250 [121] 335 [168]	8-24 plus 6-16	
	875 [468]		W52 ^{L,U}	room temperature	24 plus	T7352 ^I
	875 [468] ^U		W52 ^I	room temperature ^U	24 plus ^U	T7352 ^U
				250 [121] ^U	8-24 plus ^U 8-24 plus ^U	
*Continued on next page.						330 plus ^U
7049 Alloy (Continued)^A						
Die and hand forgings (Continued)	875 [468] ^U		W ^U	room temperature	48 min	T732
			W ^I	room temperature ^U	48 min ^U	T732 ^U
				250 [121] ^U 325 [163] ^U	24 min plus ^U 13-14 ^U	
7050 Alloy^A						
Plate	880-900 [471-482]	110 [43] max	W51 ^{G,U}	250 [121]	4-24 plus	T7351 ^G
Plate	880-900 [471-482]	110 [43] max	W51 ^I	250 [121] 350 [177]	4-24 plus 8-16	T7351
			W51 ^{G,U}	250 [121]	3-6 plus	T7451 ^G
			W51 ^I	250 [121] 325 [163]	3-6 plus 24-30	T7451
			W51 ^{G,U}	250 [121]	3-6 plus	T7651 ^G
			W51 ^I	250 [121] 325 [163]	3-6 plus 12-15	T7651
	890 [477]		W51 ^{G,U}	250 [121]	6-8 plus	T742
	890 [477] ^U		W51 ^I	250 [121] ^U 350 [177] ^U	6-8 plus ^U 6-8 ^U	T742 ^U
			W51 ^{G,U}	250 [121]	6-8 plus	T762
			W51 ^I	250 [121] ^U 350 [177] ^U	6-8 plus ^U 6.5-7 ^U	T762 ^U
Gold-finished wire, rod	880-900 [471-482]	110 [43] max	W ^U	250 [121]	4-24 plus	T7
Cold-finished wire, rod	880-900 [471-482]	110 [43] max	W ^I	250 [121] 350 [177]	4-24 plus 6-12	T7
Extruded rod, bar, Extruded rod, bar, and profiles	880-900 [471-482]	110 [43] max	W510 ^{H,U}	250 [121]	24 plus	T73510 ^H
	880-900 [471-482]	110 [43] max	W510 ^I	250 [121] 350 [177]	24 plus 12-15	T73510
			W510 ^{H,U}	250 [121]	24 plus	T74510 ^H
			W510 ^I	250 [121] 340 [171]	24 plus 8-12	T74510
			W510 ^{H,U}	250 [121]	3-8 plus	T76510 ^H

**B918/B918M – 20****TABLE 1 Continued**

Product	Solution Heat Treatment		Precipitation Heat Treatment ^B			
	Metal Temperature, $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] ^{C,D,V}	Quench Temperature, $^{\circ}\text{F}$ [$^{\circ}\text{C}$] ^E	Temper	Metal Temperature, $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] ^V	Time at Temperature, h	Temper
			W510'	250 [121] 325 [163]	3–8 plus 15–18	T76510
			W511 ^{H,U}	250 [121]	24 plus	T73511 ^H
			W511'	250 [121] 350 [177]	24 plus 12–15	T73511
			W511 ^{H,U}	250 [121]	24 plus	T74511 ^H
			W511'	250 [121] 340 [171]	24 plus 18–12	T74511
			W511 ^{H,U}	250 [121]	3–8 plus	T76511 ^H
			W511'	250 [121] 325 [163]	3–8 plus 15–18	T76511
	890 [477]		W ^U	250 [121]	6–8 plus	T732
	890 [477] ^U		W'	250 [121] ^U 350 [177] ^U	6–8 plus ^U 11.5–12.5 ^U	T732 ^U
			W ^U	250 [121]	6–8 plus	T742
			W'	250 [121] ^U 350 [177] ^U	6–8 plus ^U 6–8 ^U	T742 ^U
			W ^U	250 [121]	6–8 plus	T762
			W'	250 [121] ^U 350 [177] ^U	6–8 plus ^U 3.5–4.5 ^U	T762 ^U
Die forgings & Die forgings & hand forgings	880–900 [471–482]	140–160 [60–71]	W ^U	250 [121]	3–6 plus	T74
	880–900 [471–482]	140–160 [60–71]	W'	250 [121] 350 [177]	3–6 plus 6–12	T74
			W51 ^{L,U}	250 [121]	3–6 plus	T7451
			W51'	250 [121] 350 [177]	3–6 plus 6–10	T7451
			W52 ^{L,U}	250 [121]	3–6 plus	T7452
			W52'	250 [121] 350 [177]	3–6 plus 6–10	T7452
			W ^U	room temperature	72 plus	T6
			W'	room temperature 250 [121]	72 plus 48	T6
	890 [477]		W ^U	250 [121]	6–8 plus	T742
	890 [477] ^U		W'	250 [121] ^U 350 [177] ^U	6–8 plus ^U 6–8 ^U	T742 ^U
			W ^U	250 [121]	6–8 plus	T762
			W'	250 [121] ^U 350 [177] ^U	6–8 plus ^U 3.5–4.5 ^U	T762 ^U
7075 Alloy^A						
Sheet, bare or Alclad	860–930 [460–499] ^V	110 [43] max	W ^U	250 [121]	24	T6
Sheet, bare or Alclad	860–930 [460–499] ^U	110 [43] max	W'	250 [121]	24	T6
			W ^U	225 [107]	6–8 plus	T73 ^X
			W'	225 [107] 325 [163]	6–8 plus 24–30	T73 ^M
				or 225 [107]	6–8 plus	
				335 [168] ^W	14–18	
				335 [168] ^K	14–18	
			W ^U	250 [121]	3–5 plus	T76 ^X
			W'	250 [121] 325 [163]	3–5 plus 15–18	T76 ^M
	870 [466] ^{V,Y}		W ^U	250 [121]	23–25	T62
	870 [466] ^U		W'	250 [121] ^U	23–25 ^U	T62 ^U
Plate, bare or Alclad	860–930 [460–499] ^{V,Y}	110 [43] max	W51 ^{G,U}	250 [121]	24	T651 ^G
Plate, bare or Alclad*	860–930 [460–499] ^{V,N}	110 [43] max	W51'	250 [121] or 205 [96]	24 4 plus	T651
				315 [157]	8	
			W51 ^{G,U}	225 [107]	6–8 plus	T7351 ^{G,X}
			W51'	225 [107] 325 [163]	6–8 plus 24–30	T7351 ^M
				or 225 [107]	6–8 plus	
				335 [168] ^W	14–18	
				335 [168] ^K	14–18	
			W51 ^{G,U}	250 [121]	24	T7651 ^{G,X}
			W51'	250 [121] or 250 [121]	24 3–5 plus	T7651 ^M
						3251 ^{B-608}
						250 [121]
				870 [466] ^{V,Y,AA}		250 [121]

* Continued on next page.



TABLE 1 Continued

Product	Solution Heat Treatment		Temper	Precipitation Heat Treatment ^B		
	Metal Temperature, $\pm 10^\circ\text{F}$ [$\pm 6^\circ\text{C}$] $\pm 10^\circ\text{F}$ [$\pm 6^\circ\text{C}$] ^{C,D,V}	Quench Temperature, $^\circ\text{F}$ [$^\circ\text{C}$] ^E		Metal Temperature, $\pm 10^\circ\text{F}$ [$\pm 6^\circ\text{C}$] $\pm 10^\circ\text{F}$ [$\pm 6^\circ\text{C}$] ^V	Time at Temperature, h	Temper
				or 205 [96] 315 [157]	4 plus 8	
7075 Alloy^A (Continued)						
Plate, bare or Alclad* (Continued)	870 [466] ^{R,U}		W'	250 [121] ^U or 205 [96] ^U 315 [157] ^U	23–25 ^U 4 plus ^U 8 ^U	T62 ^U
Gold-finished wire, rod, Cold-finished wire, rod, and bar and bar	860–930 [460–499] ^{V,Y} 860–930 [460–499] ^{J,N}	110 [43] max 110 [43] max	W ^U W' W ^U W' W51 ^{G,U} W51' W51 ^{G,U} W51' W ^U W'	250 [121] 250 [121] 225 [107] 225 [107] 350 [177] 250 [121] 250 [121] 225 [107] 225 [107] 350 [177] 225 [107] 225 [107]	24 24 6–8 plus 6–8 plus 8–10 24 24 6–8 plus 6–8 plus 8–10 23–25 23–25 ^U	T6 T6 T73 ^X T73 ^M T651 ^H T651 T7351 ^{H,X} T7351 ^M T62 T62 ^U
Extruded rod, bar, Extruded rod, bar, profiles, and tube profiles, tube, and pipe	860–930 [460–499] ^{V,Y} 860–930 [460–499] ^{J,N}	110 [43] max 110 [43] max	W ^U W' W ^U W' W ^U W' W ^U W' W510 ^{H,U} W510' W510 ^{H,U} W510' W510 ^{H,U} W510' W510 ^{H,U} W510' W511 ^{H,U} W511' W511 ^{H,U} W511' W511 ^{H,U} W511' W511 ^{H,U} W511'	250 [121] 250 [121] or 210 [99] or 210 [99] 250 [121] 300 [149] 225 [107] 225 [107] 350 [177] or 225 [107] 335 [168] ^W 335 [168] ^K 250 [121] 250 [121] 325 [163] or 250 [121] or 250 [121] 320 [160] 250 [121] 250 [121] or 210 [99] 250 [121] 300 [149] 225 [107] 225 [107] 350 [177] or 225 [107] 335 [168] ^W 335 [168] ^K 250 [121] 250 [121] 325 [163] or 250 [121] 320 [160] 250 [121] 250 [121] or 210 [99] 250 [121] 300 [149] 225 [107] 225 [107] 350 [177] or 225 [107] 335 [168] ^W 335 [168] ^K 250 [121] 250 [121] 325 [163] or 250 [121] 320 [160] 250 [121] 250 [121] or 210 [99] 250 [121] 300 [149] 225 [107] 225 [107] 350 [177]	24 24 5 plus 5 plus 4 plus 4 6–8 plus 6–8 plus 6–8 6–8 plus 14–18 14–18 3–5 plus 3–5 plus 15–18 3–5 plus 3–5 plus 18–21 24 24 5 plus 4 plus 4 6–8 plus 6–8 plus 6–8 plus 14–18 plus 14–18 plus 3–5 plus 3–5 plus 15–18 3–5 plus 18–21 24 24 5 plus 4 plus 4 6–8 plus 6–8 plus 6–8 6–8 plus 14–18 14–18 3–5 plus 3–5 plus 15–18 3–5 plus 18–21 24 24 5 plus 4 plus 4 6–8 plus 6–8 plus 6–8 6–8 plus 14–18 14–18 3–5 plus 3–5 plus 15–18	T6 T6 T73 ^X T73 ^M T651 ^H T651 T7351 ^{H,X} T7351 ^M T62 T62 T6510 ^H T6510 T73510 ^{H,X} T73510 ^M T76510 ^{H,X} T76510 ^M T6511 ^H T6511 T73511 ^{H,X} T73511 ^M T76511 ^{H,X} T76511 ^M

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**B918/B918M – 20****TABLE 1 Continued**

Product	Solution Heat Treatment		Temper	Precipitation Heat Treatment ^B		
	Metal Temperature, $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] ^{C,D,V}	Quench Temperature, $^{\circ}\text{F}$ [$^{\circ}\text{C}$] ^E		Metal Temperature, $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] $\pm 10^{\circ}\text{F}$ [$\pm 6^{\circ}\text{C}$] ^V	Time at Temperature, h	Temper
	870 [466] ^{V,Y} 870 [466] ^U		W ^U W ^I	or 225 [107] 320 [160] 250 [121] 250 [121] ^U	3–5 plus 18–21 23–25 23–25 ^U	F62 T62 ^U
Drawn tube	870 [466]	110 [43] max	W ^U	250 [121]	24	T6
Drawn tube and pipe	870 [466]	110 [43] max	W ^I W ^U W ^I	250 [121] 225 [107] 225 [107] 350 [177]	24 6–8 plus 6–8 plus 6–8	T6 T73 ^X T73 ^M
	870 [466] ^U		W ^U W ^I	or 225 [107] 335 [168] ^W 335 [168] ^K 250 [121] 250 [121] ^U	6–8 plus 14–18 14–18 23–25 23–25 ^U	F62 T62 ^U
Die forgings	860–900 [460–482]	140–160 [60–71]	W ^U	250 [121]	24	T6
Die forgings	860–900 [460–482]	140–160 [60–71]	W ^I W ^U W ^I	250 [121] 225 [107] 225 [107] 350 [177]	24 6–8 plus 6–8 plus 8–10	T6 T73 ^X T73 ^M
			W51 ^{LU} W51 ^I	225 [107] 225 [107] 350 [177]	6–8 plus 6–8 plus 6–8	T7351 ^{UX} T7351 ^M
			W52 ^{LU} W52 ^I	225 [107] 225 [107] 350 [177]	6–8 plus 6–8 plus 6–8	T7352 ^{UX} T7352 ^M
			W ^U W ^I	225 [107] 225 [107] 350 [177]	6–8 plus 6–8 plus 6–8	T74 T74
	870 [466] ^{V,Y} 870 [466] ^U		W ^U W ^I	250 [121] 250 [121] ^U	23–25 23–25 ^U	F62 T62 ^U
7075 Alloy^A (Continued)						
Hand forgings	860–900 [460–482]	140–160 [60–71]	W ^U	250 [121]	24	T6
Hand forgings*	860–900 [460–482]	140–160 [60–71]	W ^I W ^U W ^I	250 [121] 225 [107] 225 [107]	24 6–8 plus 6–8 plus	T6 T73 ^X T73 ^M
						350 [177]
7075 Alloy^A (Continued)						
Hand forgings (Continued)			W51 ^{LU} W51 ^I	225 [107] 225 [107] 350 [177]	6–8 plus 6–8 plus 6–8	T7351 ^{UX} T7351 ^M
			W52 ^{LU} W52 ^I	225 [107] 225 [107] 350 [177]	6–8 plus 6–8 plus 6–8	T7352 ^{UX} T7352 ^M
			W ^U W ^I	225 [107] 225 [107] 350 [177]	6–8 plus 6–8 plus 6–8	T74 T74
	870 [466] ^{V,Y} 870 [466] ^U		W52 ^{LU} W52 ^I	250 [121] 250 [121] ^U	23–25 23–25 ^U	F652 ^I T652 ^U
			W ^U W ^I	250 [121] 250 [121] ^U	23–25 23–25 ^U	F62 T62 ^U
			W ^U W ^I	225 [107] 225 [107] ^U	6–7 plus 6–7 plus ^U	T732 T732 ^U
			W ^U W ^I	350 [177] 225 [107] 225 [107] ^U	8–10 ^U 6–7 plus 6–7 plus ^U	T7362 T7362 ^U
			W ^U W ^I	325 [163] ^U 250 [121] ^U	16–18 ^U 24	T6 T652 ^I
Rolled rings	860–900 [460–482]	110 [43] max	W ^U	250 [121]	24	T6
Rolled rings	860–900 [460–482] 870 [466] ^{V,Y}	110 [43] max	W ^I W52 ^{LU}	250 [121] 250 [121]	24 24	T6 T652 ^I

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TABLE 1 Continued

Product	Solution Heat Treatment		Temper	Precipitation Heat Treatment ^B		
	Metal Temperature, ±10°F [$\pm 6^{\circ}\text{C}$] ±10 °F [$\pm 6^{\circ}\text{C}$] ^{C,D,V}	Quench Temperature, °F [$^{\circ}\text{C}$] ^E		Metal Temperature, ±10°F [$\pm 6^{\circ}\text{C}$] ±10 °F [$\pm 6^{\circ}\text{C}$] ^V	Time at Temperature, h	Temper
	870 [466] ^U		W52 ^I	250 [121] ^U	24 ^U	T652 ^U
			7116 Alloy^A			
Extruded rod, bar,	...	...	W ^U	215 [102]	5 plus	T5
Extruded rod, bar,	...	...	W ^I	215 [102]	5 plus	T5
profiles, and tube				330 [166]	5	
profiles, tube, and pipe				330 [166]	5	
			7129 Alloy^A			
Extruded rod, bar,	...	...	W ^U	215 [102]	5 plus	T5
Extruded rod, bar,	...	...	W ^I	215 [102]	5 plus	T5
profiles, and tube				320 [160]	5	
profiles, tube, and pipe				320 [160]	5	
	900 [482] ^L	110 [43] max	W ^U	215 [102]	5 plus	T6
	900 [482] ^L	110 [43] max	W ^I	215 [102]	5 plus	T6
				320 [160]	5	
			7175 Alloy^A			
Extruded rod, bar,	880-910 [471-488]	...	W ^U	225 [107]	6-8 plus	T74
Extruded rod, bar,	880-910 [471-488]	...	W ^I	225 [107]	6-8 plus	T74
profiles, and tube				350 [177]	6-8	
profiles, tube, and pipe				350 [177]	6-8	
Die and hand forgings	880-910 [471-488]	180 [82]	W ^U	225 [107]	6-8 plus	T74
Die and hand forgings	880-910 [471-488]	140 [60-71]	W ^I	225 [107]	6-8 plus	T74
			W52 ^{L,U}	350 [177]	6-8	T7452 ^I
			W52 ^I	225 [107]	6-8 plus	T7452 ^I
				350 [177]	6-8	
			W ^U	250 [151]	24	T6
			W ^I	250 [151]	24	T6
			7475 Alloy^A			
Sheet	880-970 [471-521]	140-160 [60-71]	W ^U	250 [121]	3 plus	T61
Sheet	880-970 [471-521]	140-160 [60-71]	W ^I	250 [121]	3 plus	T61
				320 [160]	3	
			W ^U	250 [121]	3 plus	T761
			W ^I	250 [121]	3 plus	T761
				325 [163]	8-10	
Alclad Sheet	880-970 [471-521] ^{AB}	140-160 [60-71]	W ^U	280 [138]	3	T6
Alclad Sheet	880-970 [471-521] ^C	140-160 [60-71]	W ^I	280 [138]	3	T6
Plate	880-970 [471-521]	140-160 [60-71]	W ^U	250 [121]	24	T6
Plate	880-970 [471-521]	140-160 [60-71]	W ^I	250 [121]	24	T6
			W51 ^{G,U}	240 [116]	24	T651 ^G
			W51 ^I	240 [116]	24	T651
			W51 ^{G,U}	250 [121]	6-8 plus	T7351 ^{G,X}
			W51 ^I	250 [121]	6-8 plus	T7351 ^M
				325 [163]	24-30	
			W51 ^{G,U}	250 [121]	4-8 plus	T7651 ^{G,X}
			W51 ^I	250 [121]	4-8 plus	T7651 ^M
				310 [154]	26-32	
Red	880-970 [471-521]	140-160 [60-71]	W ^U	250 [121]	3 plus	T62
Rod	880-970 [471-521]	140-160 [60-71]	W ^I	250 [121]	3 plus	T62
				325 [163]	3	

^A For specific aerospace applications, refer to SAE-AMS heat-treating and material specifications.⁴

^B Typical or nominal time at temperature. Actual practice may vary depending on material requirements.

^C Recommended soaking times to achieve specified metal temperature appear in Table 8 Table 3.

^D Where a temperature range exceeding 20°F [12°C] ±20 °F [12 °C] is shown, a temperature within that range shall be selected and adhered to within the ±10°F [±6°C] within the ±10 °F [±6 °C] limits. For solution heat treatment of those 6xxx alloys for which the table specifies a range of 30°F [17°C] ±30 °F [17 °C] degrees or more, a range of 30°F [17°C] ±30 °F [17 °C] may be used. Limits thus derived must lie totally within the range specified.

^E Unless otherwise indicated, when material is quenched by total immersion in water, the water should be at room temperature not exceeding 100°F [43°C] at the start of quenching and suitably cooled to remain below 110°F [43°C] ±110 °F [43 °C] during the quenching cycle.

^F Cold-worked in the solution heat-treated condition, prior to precipitation heat treatment to obtain specified mechanical properties.

^G Stress-relieved by cold stretching to a permanent set of 1½ to 3 % in the solution heat-treated condition.

^H Stress-relieved by cold stretching to a permanent set of 1 to 3 % in the solution heat-treated condition for wire, rod, bar, profiles, and extruded tube, and 3 % for drawn tubular products.

^I Stress relieved by cold compressing 1 to 3 % after solution heat treatment.

^J Approximately 6 % cold-worked in the solution heat-treated condition.

^K Approximately 7 % cold-worked in the solution heat-treated condition.

^L With suitable control of extruding temperature and quench rate, product may be quenched upon emerging from an extrusion press instead of being furnace heat treated.

^M For Alclad sheet the maximum temperature is 1000°F [538°C] ±1000 °F [538 °C].

^N "Tread Plate" is a generic term and includes thicknesses below 0.250 in. [6.35 mm].