Designation: B 211M – 95a
METRIC

Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire [Metric][1]

This standard is issued under the fixed designation B 211M; 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 Department of Defense.

1. Scope *

1.1 This specification covers rolled or cold-finished bar, rod, and wire in alloys (Note 1) and tempers as shown in Table 2.

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

NOTE 2—The term *cold finished* is used to indicate the type of surface finish, sharpness of angles, and dimensional tolerances produced by drawing through a die.

NOTE 3—See Specification B 221M for aluminum and aluminum-alloy extruded bars, rods, wire, shapes, and tubes; and Specification B 316M for aluminum and aluminum-alloy rivet and cold-heading wire and rods.

1.2 Alloy and temper designations are in accordance with ANSI 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 E 527.

1.3 This specification is the metric counterpart of Specification B 211.

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

2. Referenced Documents

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

2.2 *ASTM Standards:*

B 557M Test Methods of Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products [Metric][2]

B 594 Practice for Ultrasonic Inspection of Aluminum-Alloy Wrought Products for Aerospace Applications[2]

B 597 Practice for Heat Treatment of Aluminum Alloys[2]

B 660 Practices for Packaging/Packing of Aluminum and Magnesium Products[2]

B 666/B666M Practice for Identification Marking of Aluminum Products[2]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[3]

E 34 Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys[4]

E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition[4]

E 101 Test Method for Spectrographic Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique[5]

E 227 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique[4]

E 527 Practice for Numbering Metals and Alloys (UNS)[6]

E 607 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique, Nitrogen Atmosphere[7]

E 716 Practices for Sampling Aluminum and Aluminum Alloys for Spectrochemical Analysis[7]

E 1004 Test Method for Electromagnetic (Eddy-Current) Measurements of Electrical Conductivity[8]

E 1251 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Argon Atmosphere, Point-to-Plane, Unipolar Self-Initiating Capacitor Discharge[7]

G 47 Test Method for Determining Susceptibility to Stress-Corrosion Cracking of High-Strength Aluminum-Alloy Products[9]

2.3 *ANSI Standards:*

H35.1M Alloy and Temper Designation Systems for Aluminum[2]

H35.2M Dimensional Tolerances for Aluminum Mill Products[2]

2.4 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)[10]

2.5 *Military Standard:*

[1] This specification is under the jurisdiction of ASTM Committee B-7 on Light Metals and Alloys and is the direct responsibility of Subcommittee B07.03 on Aluminum-Alloy Wrought Products.

Current edition approved Nov. 10, 1995. Published January 1996. Originally published as B 211M – 79. Last previous edition B 211M – 95.

[2] *Annual Book of ASTM Standards*, Vol 02.02.

[3] *Annual Book of ASTM Standards*, Vol 14.02.

[4] *Annual Book of ASTM Standards*, Vol 03.05.

[5] Discontinued. See *1995 Annual Book of ASTM Standards*, Vol 03.05.

[6] *Annual Book of ASTM Standards*, Vol 01.01.

[7] *Annual Book of ASTM Standards*, Vol 03.06.

[8] *Annual Book of ASTM Standards*, Vol 03.03.

[9] *Annual Book of ASTM Standards*, Vol 03.02.

[10] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

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

TABLE 1 Chemical Composition Limits[A,B,C]

Alloy	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Zinc	Bismuth	Lead	Titanium	Other Elements[D]		Aluminum
											Each	Total[E]	
1060	0.25	0.35	0.05	0.03	0.03	...	0.05	...	...	0.03	0.03[F]	...	99.60 min[G]
1100	0.95 Si + Fe		0.05–0.20	0.05	...	...	0.10	...	...	...	0.05	0.15	99.00 min[G]
2011	0.40	0.7	5.0–6.0	...	...	...	0.30	0.20–0.6	0.20–0.6	...	0.05	0.15	remainder
2014	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	remainder
2017	0.20–0.8	0.7	3.5–4.5	0.40–1.0	0.40–0.8	0.10	0.25	...	...	0.15	0.05	0.15	remainder
2024	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	remainder
2219	0.20	0.30	5.8–6.8	0.20–0.40	0.02	...	0.10	...	...	0.02–0.10	0.05[H]	0.15[H]	remainder
3003	0.6	0.7	0.05–0.20	1.0–1.5	...	...	0.10	...	...	...	0.05	0.15	remainder
5052	0.25	0.40	0.10	0.10	2.2–2.8	0.15–0.35	0.10	...	...	...	0.05	0.15	remainder
5056	0.30	0.40	0.10	0.05–0.20	4.5–5.6	0.05–0.20	0.10	...	...	...	0.05	0.15	remainder
Alclad 5056	5056 alloy clad with 6253 alloy				...	...	...	...	...	...	...	...	...
5154	0.25	0.40	0.10	0.10	3.1–3.9	0.15–0.35	0.20	...	...	0.20	0.05	0.15	remainder
6061	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	remainder
6110	0.7–1.5	0.8	0.20–0.7	0.20–0.7	0.50–1.1	0.04–0.25	0.30	...	...	0.15	0.05	0.15	remainder
6253[I]	[J]	0.50	0.10	...	1.0–1.5	0.04–0.35	1.6–2.4	...	...	...	0.05	0.15	remainder
6262	0.40–0.8	0.7	0.15–0.40	0.15	0.8–1.2	0.04–0.14	0.25	0.40–0.7	0.40–0.7	0.15	0.05	0.15	remainder
7075	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	remainder

[A] Limits are in mass percent maximum unless otherwise shown.
[B] Analysis shall be made for the elements for which limits are shown in this table.
[C] For purposes 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 figures used in expressing the specified limit, in accordance with the rounding-off method of Practice E 29.
[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 non-conforming.
[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] Vanadium 0.05 % max.
[G] The aluminum content shall be calculated by subtracting from 100.00 % the sum of all the metallic elements present in amounts of 0.010 % or more each, rounded to the second decimal before determining the sum.
[H] Vanadium 0.05–0.15 % zirconium 0.10–0.25 %. The total for other elements does not include vanadium and zirconium.
[I] Composition of cladding alloy as applied during the course of manufacture. Samples from finished wire shall not be required to conform to these limits.
[J] 45 to 65 % of magnesium content.

MIL-STD-129 Marking for Shipment and Storage[10]

2.1.5 *Military Specification:*

MIL-H-6088 Heat Treatment of Aluminum Alloys[10]

3. Terminology

3.1 *Definitions:*

3.1.1 *bar*—a solid product that is long in relation to cross section, which is square or rectangular (excluding plate and flattened wire) with sharp or rounded corners or edges, or is a regular hexagon or octagon, and in which at least one perpendicular distance between parallel faces is over 10 mm.

3.1.2 *cold-finished bar*—bar brought to final dimensions by cold working to obtain improved surface finish and dimensional tolerances.

3.1.3 *rod*—a solid round section over 10 mm in diameter, whose length is great in relation to its diameter.

3.1.4 *cold-finished rod*—rod brought to final dimensions by cold working to obtain improved surface finish and dimensional tolerances.

3.1.5 *wire*—a solid section long in relation to its cross-sectional dimensions, having a cross section that is round, hexagonal, or octagonal and whose diameter, width, or greatest distance between parallel faces is up through 10 mm, or having a symmetrical cross section that is square or rectangular (excluding flattened wire) with sharp or rounded corners or edges.

3.1.6 *drawn wire*—wire brought to final dimensions by drawing through a die.

3.1.7 *alclad wire*—wire having on its surface a metallurgically bonded aluminum or aluminum-alloy coating that is anodic to the core alloy to which it is bonded, thus electrolytically protecting the core alloy against corrosion.

3.1.8 *flattened wire*—a solid section having two parallel flat surfaces and rounded edges produced by roll-flattening round wire.

3.1.9 *flattened and slit wire*—flattened wire which has been slit to obtain square edges.

3.1.10 *producer*—the primary manufacturer of the material.

3.1.11 *supplier*—includes only the category of jobbers and distributors as distinct from producers.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *capable of*—The term *capable of* as used in this specification means that the test need not be performed by the producer of the material. However, should subsequent testing by the purchaser establish that the material does not meet these requirements, the material shall be subject to rejection.

TABLE 2 Tensile Property Limits[A,B]

Temper	Specified Diameter or Thickness, mm		Tensile Strength, MPa		Yield Strength[C] (0.2 % offset), MPa		Elongation,[C,D] min, %	
	over	through	min	max	min	max	in 50 mm	in 5 × diameter (5.65 $\sqrt{A}$)
Aluminum 1060								
O	...	3.20	55	...	...	...	...	...
	3.20	...	55	...	15	...	25	22
H14	...	10.00	85	...	70	...	...	...
H18	...	10.00	110	...	90	...	...	...
Aluminum 1100								
O	...	3.20	75	105	...	...	...	...
	3.20	...	75	105	20	...	25	22
H12	...	10.00	95	...	...	...	...	...
H14	...	10.00	110	...	...	...	...	...
H16	...	10.00	130	...	...	...	...	...
H18	...	10.00	150	...	...	...	...	...
H112	all		75	...	20	...	...	...
F	all		[E]	...	[E]	...	...	...
Alloy 2011								
T3	3.20	40.00	310	...	260	...	10	9
	40.00	50.00	295	...	235	...	...	10
	50.00	80.00	290	...	205	...	...	12
T4 and T451[F]	3.20	200.00	275	...	125	...	16	14
T8	3.20	80.00	370	...	275	...	10	9
Alloy 2014[G]								
O	...	3.20	...	240	...	...	...	...
	3.20	200.00	...	240	...	...	12	10
T4, T42[H], and T451[F]	...	3.20	380	...	...	...	...	...
	3.20	200.00[I]	380	...	220	...	16	14
T6, T62[H], and T651[F]	...	3.20	450	...	...	...	...	...
	3.20	200.00[I]	450	...	380	...	8	7
Alloy 2017[G]								
O	...	3.20	...	240	...	...	...	...
	3.20	200.00	...	240	...	...	16	14
T4, T42[H], and T451[F]	...	3.20	380	...	...	...	...	...
	3.20	200.00[I]	380	...	220	...	12	10
Alloy 2024[G]								
O	...	3.20	...	240	...	...	...	...
	3.20	200.00	...	240	...	...	16	14
T36	...	3.20	475	...	...	...	...	...
	3.20	10.00	475	...	360	...	10	...
T4[J]	...	3.20	425	...	...	...	...	...
	3.20	12.50	425	...	310[J]	...	10	...
	12.50	120.00	425	...	290	...	...	9
	120.00	160.00[K]	425	...	275	...	...	9
	160.00	200.00	425	...	260	...	...	9
T42[H]	...	3.20	400	...	...	...	...	...
	3.20	25.00[K]	425	...	255	...	10	9
	25.00	160.00	425	...	275	...	...	9
T351[F]	12.50	160.00[K]	425	...	310	...	...	9
T6	...	3.20	425	...	...	...	...	...
	3.20	160.00[K]	425	...	345	...	5	4
T62[H]	...	3.20	415	...	...	...	...	...
	3.20	160.00[K]	415	...	315	...	5	4
T851[F]	12.50	160.00[K]	455	...	400	...	...	4
Alloy 2219								
T851[F]	12.50	50.00	400	...	275	...	...	3
	50.00	100.00	395	...	270	...	...	3
Alloy 3003								
O	...	3.20	95	130	...	...	...	...
	3.20	...	95	130	35	...	25	22
H12	...	10.00	115	...	...	...	...	...
H14	...	10.00	140	...	...	...	...	...

TABLE 2 *Continued*

Temper	Specified Diameter or Thickness, mm		Tensile Strength, MPa		Yield Strength[C] (0.2 % offset), MPa		Elongation,[C,D] min, %	
	over	through	min	max	min	max	in 50 mm	in 5 × diameter (5.65 $\sqrt{A}$)
H16	...	10.00	165	...	...	...	...	...
H18	...	10.00	185	...	...	...	...	...
H112	all		95	...	35	...	...	...
F	all		[E]	...	[E]	...	...	...
				Alloy 5052				
O	...	3.20	170	220	...	...	...	...
	3.20	...	170	220	65	...	25	22
H32	...	3.20	215	...	...	...	...	...
	3.20	10.00	215	...	160	...	...	...
H34	...	3.20	235	...	...	...	...	...
	3.20	10.00	235	...	180	...	...	...
H36	...	3.20	255	...	...	...	...	...
	3.20	10.00	255	...	200	...	...	...
H38	...	10.00	270	...	...	...	...	...
F	all		[E]	...	[E]	...	...	...
				Alloy 5056				
O	...	3.20	...	320	...	...	...	...
	3.20	...	...	320	...	...	20	18
H111	...	10.00	300	...	...	...	...	...
H12	...	10.00	315	...	...	...	...	...
H32	...	10.00	300	...	...	...	...	...
H14	...	10.00	360	...	...	...	...	...
H34	...	10.00	345	...	...	...	...	...
H18	...	10.00	400	...	...	...	...	...
H38	...	10.00	380	...	...	...	...	...
H192	...	10.00	415	...	...	...	...	...
H392	...	10.00	400	...	...	...	...	...
				Alclad Alloy 5056				
H192	...	10.00	360	...	...	...	...	...
H392	...	10.00	345	...	...	...	...	...
H393	3.20	5.00	375	...	325	...	...	...
				Alloy 5154				
O	...	3.20	205	285	...	...	...	...
	3.20	...	205	285	75	...	25	22
H32	...	10.00	250	...	...	...	...	...
H34	...	10.00	270	...	...	...	...	...
H36	...	10.00	290	...	...	...	...	...
H38	...	10.00	310	...	...	...	...	...
H112	all		205	...	75	...	...	...
				Alloy 6061[G]				
O	...	3.20	...	155	...	...	...	...
	3.20	200.00	...	155	...	...	18	16
T4 and T451[F]	...	3.20	205	...	...	...	...	...
	3.20	200.00[L]	205	...	110	...	18	16
T42[H]	3.20	200.00[L]	205	...	95	...	18	16
T6, T62[H], and T651[F]	...	3.20	290	...	...	...	...	...
	3.20	200.00[L]	290	...	240	...	10	9
T89 and T94	...	10.00	370	...	325	...	...	...
				Alloy 6110				
T9	...	10.00	450	...	435	...	2	...
				Alloy 6262				
T6 and T651[F]	3.20	200.00[G]	290	...	240	...	10	9
T9	3.20	50.00	360	...	330	...	5	4
	50.00	80.00	345	...	315	...	...	4
				Alloy 7075[G]				
O	...	3.20	...	275	...	...	...	...
	3.20	200.00	...	275	...	...	10	9
T6, T62[H], and T651[F]	...	3.20	530	...	...	...	...	...
	3.20	100.00[M]	530	...	455	...	7	6
T73 and T7351[F]	...	3.20	470	...	...	...	...	...

TABLE 2 *Continued*

Temper	Specified Diameter or Thickness, mm		Tensile Strength, MPa		Yield Strength[C] (0.2 % offset), MPa		Elongation,[C,D] min, %	
	over	through	min	max	min	max	in 50 mm	in 5 × diameter (5.65 $\sqrt{A}$)
	3.20	80.00	470	...	385	...	10	9

[A] To determine conformance to this specification, each value for tensile strength and for yield strength shall be rounded to the nearest 1 MPa and each value for elongation to the nearest 0.5 %, both in accordance with the rounding-off method of Practice E 29.
[B] The basis for establishment of tensile property limits is shown in Annex A1.
[C] The measurement of yield strength and elongation is not required for wire up through 3.20 mm in thickness or diameter.
[D] Elongations in 50 mm apply to rectangular bar up through 12.5 mm thickness from which a standard rectangular tension test specimen is machined. The 5 × diameter (5.65 $\sqrt{A}$) requirements, where *D* and *A* are diameter and cross-sectional area of the specimen, respectively, apply to round specimens tested in full-section or to standard or proportional, round-machined, tension test specimens.
[E] There are no tensile requirements for material in the F temper but it usually can be expected that material 40 mm or less in thickness or diameter (except sections over 100 mm in width) will have a strength about equivalent to the H14 or H34 temper. As size increases the strength decreases to nearly that of the O temper.
[F] For stress-relieved tempers, characteristics and properties other than those specified may differ somewhat from the corresponding characteristics and properties of material in the basic tempers.
[G] Also available in the F temper for which no properties are specified and no tension tests are performed but for which tests are performed for confirmation of heat-treat response as required by Section 10.
[H] Material in the T42 or T62 tempers is not available from the materials producers. These properties can usually be obtained by the user when material is properly solution heat treated or solution and precipitation heat treated from O or F temper. These properties also apply to samples of material in the O or F temper that are solution heat treated or solution and precipitation heat treated by the producer to determine that the material will respond to proper heat treatment. Properties attained by the user, however, may be lower than those listed if the material has been formed or otherwise cold or hot worked, particularly in the O temper, prior to solution heat treatment.
[I] For rounds, maximum diameter is 200 mm; for square, rectangular, hexagonal, or octagonal bar, maximum thickness is 100 mm and maximum cross-sectional area is 23 000 mm^2.
[J] Minimum yield strength of coiled 2024-T4 wire and rod over 3.20 mm in thickness or diameter is 275 MPa.
[K] Properties listed for this size increment are applicable to rod with a maximum diameter of 160 mm and to square, rectangular, hexagonal or octagonal bar having a maximum thickness of 100 mm and maximum cross-sectional area of 23 000 mm^2.
[L] For bar, maximum cross-sectional area is 32 000 mm^2.
[M] For rounds, maximum diameter is 100 mm; for square, hexagonal, or octagonal bar, maximum thickness is 90 mm; for rectangular bar, maximum thickness is 80 mm, with corresponding maximum width of 150 mm; for rectangular bar less than 80 mm in thickness, maximum width is 250 mm.

4. Ordering Information

4.1 Orders for material to this specification shall include the following information:

4.1.1 This specification number,

4.1.2 Quantity in pieces or kilograms,

4.1.3 Alloy (Section 7),

4.1.4 Temper (Section 9),

4.1.5 Diameter for rounds; distance across flats for square-cornered squares, hexagons, or octagons; width and depth for square-cornered rectangles (orders for squares, hexagons, octagons, or rectangles with rounded corners usually require a drawing),

4.1.6 Length,

4.2 Additionally, orders for material to this specification shall include the following information when required by the purchaser:

4.2.1 Whether heat treatment in accordance with Practice B 597 is required (8.2),

4.2.2 Whether 7075-O material is required to develop requirements for T73 temper (see 10.1.2),

4.2.3 When specified finish of bar and rod is not required (Section 15),

4.2.4 Whether marking for identification is required (Section 16),

4.2.5 Whether ultrasonic inspection is required (Section 17, Table 3),

4.2.6 Whether inspection or witness of inspection and tests by the purchaser's representative is required prior to material shipment (Section 19),

4.2.7 Whether certification is required (Section 21), and

4.2.8 Whether Practices B 660 applies, and if so, the levels of preservation, packaging, and packing required (Section 22).

TABLE 3 Ultrasonic Discontinuity Limits for Rolled or Cold-Finished Bar[A]

Alloys	Size: Thickness, mm		Maximum Mass per Piece, kg	Discontinuity Class[B]
	over	through		
2014, 9221; 2024, 7075	12.50	35.00	300	B
	35.00	80.00	300	A
	80.00	155.00	500	B

[A] Discontinuities in excess of those listed in this table shall be allowed if it is established that they will be removed by machining or that they are in noncritical areas.
[B] The discontinuity class limits are defined in Section 11 of Method B 594.

5. Manufacture

5.1 The products covered by this specification shall be produced either by hot extruding and cold finishing or by hot rolling with or without cold finishing, at the option of the producer.

6. Quality Assurance

6.1 *Responsibility for Inspection and Tests*—Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. The producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser in the order at the time of contract signing. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to assure that material conforms to prescribed requirements.

6.2 *Lot Definition*— An inspection lot shall be defined as follows:

6.2.1 For heat-treated tempers, an inspection lot shall consist of an identifiable quantity of material of the same mill form, alloy, temper, and nominal dimensions traceable to a heat-treat lot or lots, and subjected to inspection at one time.

6.2.2 For nonheat-treated tempers, an inspection lot shall consist of an identifiable quantity of material of the same mill form, alloy, temper, and nominal dimensions subjected to inspection at one time.

7. Chemical Composition

7.1 *Limits*—The bar, rod and wire shall conform to the chemical composition limits specified in Table 1. Conformance shall be determined by the producer by analyzing samples taken at the time the ingots are poured, or samples taken from the finished or semifinished product. If the producer has determined the chemical composition of the material during the course of manufacture, he shall not be required to sample and analyze the finished product.

NOTE 4—It is standard practice in the United States aluminum industry to determine conformance to the chemical composition limits prior to further processing of ingots into wrought products. Due to the continuous nature of the process, it is not practical to keep a specific ingot analysis identified with a specific quantity of finished material.

7.2 *Number of Samples*—The number of samples taken for determination of chemical composition shall be as follows:

7.2.1 When samples are taken at the time the ingots are poured, at least one sample shall be taken for each group of ingots poured simultaneously from the same source of molten metal.

7.2.2 When samples are taken from the finished or semi finished product, a sample shall be taken to represent each 2000 kg, or fraction thereof, in the lot, except that no more than one sample shall be required per piece.

7.3 *Methods of Sampling*—Samples for determination of chemical composition shall be taken in accordance with one of the following methods:

7.3.1 Samples for chemical analysis shall be taken from the material by drilling, sawing, milling, turning, clipping, etc., a representative piece or pieces to obtain a mass of prepared sample not less than 75 g. Sampling shall be in accordance with Practice E 55.

7.3.2 Sampling for spectrochemical analysis shall be in accordance with Practices E 716. Samples for other methods of analysis shall be suitable for the form of material being analyzed and the type of analytical method used.

NOTE 5—It is difficult to obtain a reliable analysis of each of the components of clad materials using material in its finished state. A reasonably accurate determination of the core composition can be made if the cladding is substantially removed prior to analysis. The cladding composition is more difficult to determine because of the relatively thin layer and because of diffusion of core elements to the cladding. The correctness of cladding alloy used can usually be verified by a combination of metallographic examination and spectrochemical analysis of the surface at several widely separated points.

7.4 *Method of Analysis*—The determination of chemical composition shall be made in accordance with suitable chemical (Test Methods E 34), or spectrochemical (Test Methods E 101, E 227, E 607 and E 1251), methods. Other methods may be used only when no published ASTM method is available. In case of dispute, the methods of analysis shall be agreed upon between the producer and the purchaser.

8. Heat Treatment

8.1 Unless otherwise specified in 8.2, producer or supplier heat treatment for the applicable tempers designated in Table 2 shall be in accordance with MIL-H-6088.

8.2 When specified, heat treatment of applicable tempers in Table 2 shall be in accordance with Practice B 597.

9. Tensile Properties of Material as Supplied

9.1 *Limits*—The bar, rod, and wire shall conform to the tensile requirements in Table 2.

9.2 *Number of Specimens*:

9.2.1 For material having a nominal mass up through 1.7 kg/linear m, one tension test specimen shall be taken for each 500 kg or fraction thereof in the lot. Only one specimen shall be taken from any one piece when more than one piece is available.

9.2.2 For material having a nominal mass over 1.7 kg/linear m, one tension test specimen shall be taken for each 300 m or fraction thereof in the lot. Only one specimen shall be taken from any one piece when more than one piece is available.

9.3 *Test Specimens*— Geometry of test specimens and the location in the product from which they are taken shall be as specified in Test Methods B 557M.

9.4 *Test Methods*— The tension tests shall be made in accordance with Test Methods B 557M.

10. Producer Confirmation of Heat-Treat Response

10.1 In addition to the requirements of 9.1, material in Alloys 2014, 2017, 2024, and 6061 produced in the O or F temper (within the size limits specified in Table 2) shall, after proper solution heat treatment and natural aging for not less than 4 days at room temperature, conform to the properties specified in Table 2 for T42 temper material. The heat-treated samples may be tested prior to 4 days natural aging but if they fail to conform to the T42 temper properties, the tests may be repeated after completion of 4 days natural aging without prejudice.

10.1.1 Alloy 7075 material produced in the O or F temper (within the size limits specified in Table 2) shall, after proper solution heat treatment and precipitation heat treatment, conform to the properties specified in Table 2 for T62 temper material.

10.1.2 When specified, 7075-O material (within the size limits specified in Table 2) shall, after proper solution and precipitation heat treatment, conform to the properties specified for T73 temper in Table 2 and Section 12.

10.2 *Number of Specimens*—The number of specimens from each lot of O temper material and F temper material to verify conformance with 10.1 shall be as specified in 9.2.

11. Heat Treatment and Reheat Treatment Capability

11.1 As-received material in the O or F temper and in Alloys 2014, 2017, 2024, and 6061 (within the size limitation specified in Table 2 and without the imposition of cold work) shall,