Designation: B211M – 03

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

This standard is issued under the fixed designation B211M; 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 B221M for aluminum and aluminum-alloy extruded bars, rods, wire, shapes, and tubes; and Specification B316/B316M 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 E527.

1.3 This specification is the metric counterpart of Specification B211.

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:*[2]

B221M Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

B316/B316M Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods

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

B594 Practice for Ultrasonic Inspection of Aluminum-Alloy Wrought Products for Aerospace Applications

B660 Practices for Packaging/Packing of Aluminum and Magnesium Products

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

B881 Terminology Relating to Aluminum- and Magnesium-Alloy Products

B918 Practice for Heat Treatment of Wrought Aluminum Alloys

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E34 Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys

E55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition

E290 Test Methods for Bend Testing of Material for Ductility

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

E607 Test Method for Atomic Emission Spectrometric Analysis Aluminum Alloys by the Point to Plane Technique Nitrogen Atmosphere[3]

E716 Practices for Sampling and Sample Preparation of Aluminum and Aluminum Alloys for Determination of Chemical Composition by Spectrochemical Analysis

E1004 Test Method for Determining Electrical Conductivity Using the Electromagnetic (Eddy-Current) Method

E1251 Test Method for Analysis of Aluminum and Aluminum Alloys by Spark Atomic Emission Spectrometry

G47 Test Method for Determining Susceptibility to Stress-Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy Products

2.3 *ANSI Standards:*

H35.1M Alloy and Temper Designation Systems for Aluminum[4]

H35.2M Dimensional Tolerances for Aluminum Mill Products[4]

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

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from ANSI, 25 W. 43rd St., 4th Floor, New York, NY 10036.

***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] Each	Other Elements[D] Total[E]	Aluminum
1060	0.25	0.35	0.05	0.03	0.03	...	0.05	...	...	0.03	0.03[F]	...	99.60 min[G]
1100[H]	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[I]	0.15[I]	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
5154[H]	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
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 E29.
[D] *Others* includes listed elements for which no specific limit is shown as well as unlisted metallic elements. The producer may analyze samples for trace elements not specified in the specification. However, such analysis is not required and may not cover all metallic *Others* elements. Should any analysis by the producer or the purchaser establish that an *Others* element exceeds the limit of *Each* or that the aggregate of several *Others* elements exceeds the limit of *Total*, the material shall be considered non-conforming.
[E] Other elements—Total shall be the sum of unspecified metallic elements 0.010 % or more each, rounded to the second decimal before determining the sum.
[F] Vanadium 0.05 % max.
[G] The aluminum content is the difference between 100.00 % and the sum of all the other metallic elements and silicon present in amounts of 0.010 % or more each, rounded to the second decimal before determining the sum.
[H] Beryllium 0.0003 maximum for welding electrode and welding rod only.
[I] Vanadium 0.05–0.15 % zirconium 0.10–0.25 %. The total for other elements does not include vanadium and zirconium.

2.4 *Federal Standard:*
Fed. Std. No. 123 Marking for Shipment (Civil Agencies)[5]
2.5 *Military Standard:*
MIL-STD-129 Marking for Shipment and Storage[5]
2.6 *Aerospace Material Specification:*
AMS 2772 Heat Treatment of Aluminum Alloy Raw Materials[6]

3. Terminology

3.1 *Definitions:* Refer to Terminology B881 for definitions of product terms used in this specification.

3.1.1 *flatten and slit wire*—flatten wire which has been slit to obtain square edges.

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 Mechanical Property Limits[A,B]

Temper	Specified Diameter or Thickness, mm over	Specified Diameter or Thickness, mm through	Tensile Strength, MPa min	Tensile Strength, MPa max	Yield Strength[C] (0.2 % offset), MPa min	Yield Strength[C] (0.2 % offset), MPa max	Elongation,[C,D] min, % in 50 mm	Elongation,[C,D] min, % 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	...	...	...	...	...

[5] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.
[6] Available from the Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, PA 15096-0001.

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 ($5.65\sqrt{A}$)
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	90.00	290	...	205	...	...	12
T4 and T451[F]	3.20	200.00	275	...	125	...	16	14
T6 and T651	10.00	160.00	370	...	275	...	10	9
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,J]	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[K]	...	3.20	425	...	...	...	...	...
	3.20	12.50	425	...	310[K]	...	10	...
	12.50	120.00[L]	425	...	290	...	...	9
	120.00	160.00[M]	425	...	275	...	...	9
	160.00	200.00[M]	425	...	260	...	...	9
T42[H]	...	3.20	400	...	...	...	...	...
	3.20	25.00	425	...	275	...	10	9
	25.00	160.00[L]	425	...	275	...	...	9
T351[F]	12.50	160.00[L]	425	...	310	...	...	9
	160.00	200.00	425	...	310	...	...	8
T6	...	3.20	425	...	...	...	...	...
	3.20	160.00[L]	425	...	345	...	5	4
T62[H]	...	3.20	415	...	...	...	...	...
	3.20	160.00[L]	415	...	315	...	5	4
T851[F]	12.50	160.00[L]	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	...	...	...	...	...
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	...	...	...

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 ($5.65\sqrt{A}$)
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	...	...	...	...	...
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[J]	205	...	110	...	18	16
T42[H]	3.20	200.00[J]	205	...	95	...	18	16
T6, T62[H], and T651[F]	...	3.20	290	...	...	...	...	...
	3.20	200.00[J]	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[L]	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]	...	3.20	530	...	455	...	...	...
	3.20	100.00[N]	530	...	455	...	7	6
T651[F]	...	3.20	530	...	455	...	...	...
	3.20	100.00[N]	530	...	455	...	7	...
	100.00	160.00	515	...	440	...	7	...
	160.00	200.00	505	...	425	...	7	...
T73 and T7351[F]	...	3.20	470	...	...	...	...	...
	3.20	100.00	470	...	425	...	10	9
	100.00	120.00	455	...	380	...	8	9
	120.00	160.00	440	...	360	...	...	7

Temper	Specified Diameter or Thickness, mm		Bend Diameter Factor, N
	over	through	
Alloy 2017			
T4, T42, and T451	...	3.20	3[O]
	3.20	200.00[J]	6[O]
Alloy 2024			
0	...	3.20	1
T351, T4, T42	...	3.20	3

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	160.00					6	
Alloy 3003								
0		all					0	
H12	...	10.00					2	
H14	...	10.00					2	
H16	...	10.00					8	

[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 E29.

[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] For bar, maximum cross-sectional area is 32 000 mm^2.

[K] Minimum yield strength for 2024-T4 wire and rod over 3.20 mm in thickness or diameter, produced in coil form for both straight length and coiled products, is 275 MPa.

[L] 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.

[M] Properties listed for this size increment are listed for rod only.

[N] 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.

[O] Bend diameter factor values stated for this full size increment apply to T4 product only. Values listed also apply to T451 produce in the 12.2-200 mm size range.

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 *Product Form*—Rolled or cold-finished bar, rolled or cold-finished rod, or wire.

4.1.6 *Geometry and Dimensions*—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),

4.1.7 Length,

4.1.8 Tensile property limits and dimensional tolerances for sizes not covered in Table 2 and in ANSI H35.2M, respectively.

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 B918 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 Whether bend testing is required for 2017, 2024, or 3003 (Section 12),

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

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

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

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

4.2.8 Whether certification is required (Section 21), and

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 Practice B594.

4.2.9 Whether Practices B660 applies, and if so, the levels of preservation, packaging, and packing required (Section 22).

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 cast, 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, additional sampling and analysis of the finished product shall not be required.

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 cast, at least one sample shall be taken for each group of ingots cast simultaneously from the same source of molten metal.

7.2.2 When samples are taken from the finished or semifinished 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, and so forth, a representative piece or pieces to obtain a mass of prepared sample not less than 75 g. Sampling shall be in accordance with Practice E55.

7.3.2 Sampling for spectrochemical analysis shall be in accordance with Practices E716. 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 E34), or spectrochemical (Test Methods E607 and E1251), 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 AMS 2772.

8.2 When specified, heat treatment of applicable tempers in Table 2 shall be in accordance with Practice B918.

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 B557M.

9.4 *Test Methods*—The tension tests shall be made in accordance with Test Method B557M.

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