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.

Designation: B236/B236M – 23

Standard Specification for Aluminum Bars for Electrical Purposes (Bus Bars)[1]

This standard is issued under the fixed designation B236/B236M; 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 specification covers Aluminum 1350 bar for electric conductors in the tempers shown in Table 1.

1.2 Aluminum and temper designations are in accordance with ANSI H35.1/H35.1(M). The equivalent Unified Numbering System designation is A91350 in accordance with Practice E527.

NOTE 1—For Alloy 6101 bus conductors, refer to Specification B317/B317M.

NOTE 2—Prior to 1975, Aluminum 1350 was designated as EC aluminum.

1.3 The values stated in either SI or inch-pound 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.

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

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 date of order acceptance form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*[2]

B193 Test Method for Resistivity of Electrical Conductor Materials

B317/B317M Specification for Aluminum-Alloy Extruded Bar, Rod, Tube, Pipe, Structural Profiles, and Profiles for Electrical Purposes (Bus Conductor)

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)

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

B985 Practice for Sampling Aluminum Ingots, Billets, Castings and Finished or Semi-Finished Wrought Aluminum Products for Compositional Analysis

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

E290 Test Methods for Bend Testing of Material for Ductility

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

E716 Practices for Sampling and Sample Preparation of Aluminum and Aluminum Alloys for Determination of Chemical Composition by Spark Atomic Emission Spectrometry

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

E3061 Test Method for Analysis of Aluminum and Aluminum Alloys by Inductively Coupled Plasma Atomic Emission Spectrometry (Performance Based Method)

[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.

Current edition approved Dec. 1, 2023. Published January 2024. Originally approved in 1948. Last previous edition approved in 2015 as B236 – 07 (2015). DOI: 10.1520/B0236_B0236M-23.

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

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

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

TABLE 1 Tensile Property Limits[A,B] (US Customary [Metric SI])

US Customary				[Metric SI]			
Temper	Specified Thickness, in.	Tensile Strength, min, ksi	Yield Strength (0.2 % offset), min, ksi	Specified Thickness, mm		Tensile Strength, min,	Yield Strength, min (0.2 % Offset),
				Over	Through	MPa	MPa
H12	0.125–1.000	12.0	8.0	3.20	25.00	85	55
H112	0.125–0.499	11.0	6.0	3.20	12.50	75	40
	0.500–1.000	10.0	4.0	12.50	25.00	70	30
	1.001–3.000	9.0	3.5	25.00	40.00	60	25
H111	All	8.5	3.5	All		60	25

[A] For purposes of determining conformance with this specification, each value for tensile strength and yield strength shall be rounded to the nearest 0.1 ksi [1 MPa] in accordance with the rounding method of Practice E29.
[B] See Annex A1.

2.3 *The Aluminum Association:*[3]
AS&D Aluminum Standards & Data
PK-1 Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Castings and Ingots (Pink Sheets)
TAN-1 Tempers for Aluminum and Aluminum Alloy Products Metric Edition (Tan Sheets)
TEAL-1 International Alloy Designations and Chemical Composition Limits for Wrought Aluminum and Wrought Aluminum Alloys (Teal Sheets)
YL-1 Tempers for Aluminum and Aluminum Alloy Products (Yellow Sheets)
2.4 *ANSI Standards:*[4]
H35.1/H35.1(M) Alloy and Temper Designation Systems for Aluminum
H35.2 Dimensional Tolerances for Aluminum Mill Products
H35.2M Dimensional Tolerances for Aluminum Mill Products (Metric)
2.5 *CEN Standard:*[5]
CEN EN 14242 Aluminium and Aluminium Alloys - Chemical Analysis - Inductively Coupled Plasma Optical Emission Spectrometric Analysis
2.6 *Military Standard:*[6]
MIL-STD-129 Marking for Shipment and Storage
2.7 *Federal Standard:*
Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

3. Terminology

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

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 testing by the purchaser establish that the material does not meet these requirements, the material shall be subject to rejection.

4. Ordering Information

4.1 Orders for material to this specification shall include the following information:
4.1.1 This specification designation (which includes the number, the year, and the revision letter, if applicable),

NOTE 3—For inch-pound orders, specify Specification B236; for metric orders specify Specification B236M. Do not mix units.

4.1.2 Quantity in pieces or pounds [kilograms],
4.1.3 Temper (8.1),
4.1.4 Edge contour (Section 12),
4.1.5 Diameter for rounds; distance across flats for square-cornered squares, hexagons, or octagons; width and depth for square-cornered rectangles,
4.1.6 Length (specific or stock) (Section 14),

4.2 Additionally, orders for material to this specification shall include the following information when required by the purchaser:
4.2.1 Whether inspection or witness of inspection and tests by the purchaser's representative is required prior to material shipment (16.1),
4.2.2 Whether marking for identification is required (18.1),
4.2.3 Whether Practices B660 applies and, if so, the levels of preservation, packaging, and packing required (19.3), and
4.2.4 Whether certification of the material by the producer is required (Section 20).

5. Manufacture

5.1 The products covered by this specification shall be produced by extruding or rolling, at the option of the producer, provided that the production method results in material that meets all requirements of this specification.

5.2 Bars in the H12 temper shall be furnished with a rolled mill finish; bars in the H111 temper, with an as-extruded mill finish; and bars in the H112 temper, with a rolled mill finish except that the edges shall be as sawed.

6. Responsibility for 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. Except as otherwise specified in the contract or order, 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

[3] Available from Aluminum Association, 1400 Crystal Dr., Suite 430, Arlington, VA 22202, http://www.aluminum.org.
[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.
[5] Available from European Committee for Standardization (CEN), Rue de la Science 23, B-1000, Brussels, Belgium, http://www.cen.eu.
[6] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

the purchaser. 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 consist of an identifiable quantity of material of the same aluminum designation, temper, and thickness subjected to inspection at one time.

7. Chemical Composition Requirements

7.1 The material shall conform to the composition in Table 2. Conformance shall be determined by the producer by analyzing samples taken at the time the ingots or continuously cast bars are poured, or samples taken from the finished or semifinished product. If the producer has determined the 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 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 If it becomes necessary to analyze bars, rod or wire for conformance to chemical composition limits, the method used for determination of chemicals composition shall be by agreement between the producer and purchaser. Analysis shall be performed in accordance with Practices E716, Test Methods E1251 or E3061, or CEN EN 14242 (ICP Method). The number of samples taken for determination of chemical composition shall be as follows:

TABLE 2 Chemical Composition Limits[A,E]

Element	Composition, %
Silicon, max	0.10
Iron, max	0.40
Copper, max	0.05
Manganese, max	0.01
Chromium, max	0.01
Zinc, max	0.05
Boron, max	0.05
Gallium, max	0.03
Vanadium + titanium, total, max	0.02
Other elements, each,[B] max	0.03
Other elements, total,[B,C] max	0.10
Aluminum,[D] min	99.50

[A] Analysis shall be made for the elements for which limits are shown in this table.
[B] *Others* includes all 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.
[C] *Other Elements*—Total shall be the sum of unspecified metallic elements 0.010 % or more, rounded to the second decimal before determining the sum.
[D] The aluminum content shall be calculated by subtracting from 100.00 % the sum of all metallic elements present in amounts of 0.010 % or more each, rounded to the second decimal before determining the sum.
[E] In case of any discrepancy in the values listed in this table when compared to those listed in the "Teal Sheets" (International Alloy Designations and Chemical Composition Limits for Wrought Aluminum and Wrought Aluminum Alloys), the composition limits registered with The Aluminum Association and published in the "Teal Sheets" shall be considered the controlling composition. The "Teal Sheets" are available at http://www.aluminum.org/tealsheets.

7.2.1 *Methods of Sampling*—Samples for chemical analysis shall be taken in accordance with Practice B985.

7.2.2 *Methods of Analysis*—Analysis shall be performed in accordance with Test Methods E1251, E3061, or CEN EN 14242 (ICP Method).

7.3 Other methods of analysis or in the case of dispute may be by agreement between the producer and purchaser.

8. Tensile Properties

8.1 *Limits*—The bars shall conform to the requirements for tensile properties as specified in Table 1.

8.2 *Number of Specimens*—One tension test specimen shall be taken from a random bar representing each 3000 lb [1500 kg] of bar, or fraction thereof, of the same temper, thickness, and width in the shipment.

8.3 *Test Methods*—The tension test shall be made in accordance with Test Methods B557 [B557M].

9. Bend Properties

9.1 *Limits:*

9.1.1 *Flatwise Bend*—Bars in the H12, and H111, and H112 tempers shall be capable of being bent flatwise at room temperature, through an angle of 90° around a pin or mandrel having a radius equal to the thickness of the specimen, without cracking or evidence of slivers or other imperfections. For a flatwise bend, the pin or mandrel shall be 90° from the working (extrusion or rolling) direction, and across the greater (width) dimension of the bar. The required 90° bend shall be in the working (extrusion or rolling) direction. This is a longitudinal bend as defined and shown in Test Methods E290, Fig. 1.

9.1.2 *Edgewise Bend*—Bars in the H12 and H111 tempers whose width-to-thickness ratios are not in excess of 12 and whose width is 4 in. or less, shall be capable of being bent at room temperature edgewise 90° around a mandrel having the radius shown in Table 3 without cracking or localized thinning to less than 90 % of the maximum thickness within the central 60° of the bend when measured along the outer edge of the bend. Bending requirements for bar wider than 4 in. [100 mm] shall be as agreed upon by the producer and the purchaser. For an edgewise bend, the pin or mandrel shall be 90° from the working (extrusion or rolling) direction, and across the lesser (thickness) dimension of the bar. This is also a longitudinal bend as defined and shown in Test Methods E290, Fig. 1.

9.2 *Test Specimens*—Bend test specimens shall be a full section of the material.

9.3 *Test Methods*—Bend tests shall be made in accordance with Test Methods E290.

10. Density

10.1 The density of aluminum 1350 shall be taken as 0.0975 lb/in.^{3} [2.705 kg/m^3 x 10^3].

11. Electrical Properties

11.1 *Limits*—The resistivity of specimens selected shall not exceed 0.0283 Ω·mm^2/m at 20 °C corresponding to a conductivity not less than 61.0 % of the International Annealed