INTERNATIONAL

Designation: ~~B236 – 07~~ B236 – 07 (Reapproved 2015)

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

This standard is issued under the fixed designation B236; 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 A complete metric companion to Specification B236 has been developed—B236M; therefore, no metric equivalents appear in this specification.

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 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
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
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 (Withdrawn 2011)[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

2.3 *ANSI Standards:*
H35.1/H35.1(M) Alloy and Temper Designation Systems for Aluminum
H35.2 Dimensional Tolerances for Aluminum Mill Products

[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 ~~June 1, 2007~~Oct. 1, 2015. Published ~~July 2007~~October 2015. Originally approved in 1948. Last previous edition approved in ~~2006~~2007 as ~~B236~~B236 – 07.~~–00 (2006).~~ DOI: ~~10.1520/B0236-07.~~10.1520/B0236-07R15.

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

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

TABLE 1 Tensile Property Limits[A,B]

Temper	Specified Thickness, in.	Tensile Strength, min, ksi	Yield Strength (0.2 % offset), min, ksi
H12	0.125–1.000	12.0	8.0
H112	0.125–0.499	11.0	6.0
	0.500–1.000	10.0	4.0
	1.001–3.000	9.0	3.5
H111	All	8.5	3.5

[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 in accordance with the rounding method of Practice E29.
[B]See Annex A1.

2.4 *Military Standard:Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.*

MIL-STD-129 Marking for Shipment and Storage

2.5 *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),

4.1.2 Quantity in pieces or pounds,

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 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 3—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 *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 semifinished product, a sample shall be taken to represent each 4000 lb, or fraction thereof, in the shipment, except that not 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, or clipping a representative piece or pieces to obtain a prepared sample of 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 taken by methods suitable for the form of material being analyzed and the type of analytical method used.

7.4 *Methods 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 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 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.

9. Bend Properties

9.1 *Limits:*

TABLE 2 Chemical Composition Limits[A]

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.

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. 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 (thckness) 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 0.097 lb/in.^{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 Copper Standard. To determine conformance with this specification, each value for electrical resistivity shall be rounded to the nearest unit in the last right-hand place of figures, in accordance with the rounding method of Practice E29.

11.2 *Number of Specimens*—One specimen shall be taken from a random bar representing each 3000 lb of bar, or fraction thereof, of the same temper and thickness in the inspection lot.

11.3 *Test Specimens*—Specimens for determining resistivity or conductivity shall preferably be a full section of the material, but may be of any suitable size or shape appropriate to the instrument used in making the determination.

11.4 *Test Methods*—Electrical resistivity or conductivity shall be determined in accordance with Test Methods B193 or E1004, provided that, in case of dispute, the results secured by Test Method B193 shall be the basis for acceptance.

12. Edge Contours

12.1 Unless otherwise specified, bar shall be furnished with square corners. When specified, bar shall be furnished with rounded corners, rounded edges or full rounded edges, as shown in Table 19.1.11 for rolled bar and Table 19.3.4 for extruded bar or with corners and edges for sawed-plate bar as shown in Table 19.2.4, of ANSI H35.2.

13. Dimensional Tolerances

13.1 Bars ordered to this specification shall meet the requirements of ANSI H35.2. Table 4 lists the dimensions involved and the applicable H35.2 table numbers.

14. Length

14.1 When stock lengths are specified, short lengths per Table 5 may be furnished.

15. General Quality

15.1 The bars shall be supplied with as-sawed square ends. The edges of sawed plate bus bar shall be as sawed. Unless otherwise specified, the bars shall be supplied in the mill finish and shall be uniform as defined by the requirements of this specification and shall be commercially sound. Any requirement not so covered is subject to negotiation between producer and purchaser.

TABLE 3 Edgewise Bend Radii

Specified Width, in.	Mandrel Radius, in.
0.500 and under	½
0.501–1.000	1
1.001–1.500	1½
1.501–2.000	2
2.001–2.500	2½
2.501–3.000	3
3.001–3.500	3½
3.501–4.000	4