Designation: B 736 – 00 (Reapproved 2006)

Standard Specification for Aluminum, Aluminum Alloy and Aluminum-Clad Steel Cable Shielding Stock[1]

This standard is issued under the fixed designation B 736; 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.

1. Scope

1.1 This specification covers selected aluminum, aluminum-alloy and aluminum clad steel cable shielding stock, both uncoated and coated, for applications such as electrostatic or electromagnetic shielding for insulated power, control, instrumentation and communication cables (including coaxial cable).

NOTE 1—See B 694, Specification for Copper, Copper Alloy, and Copper-Clad Stainless Steel Sheet and Strip for Electrical Cable Shielding for related standards for copper-based shielding materials.

1.2 The materials covered are the following:

Type of Material[A]	Coating
Aluminum 1060	none
Aluminum 1100	none
Aluminum 1145	none
Aluminum 1235	none
Alloy 3003	none
Aluminum 1060	polyolefin
Aluminum 1100	polyolefin
Aluminum 1145	polyolefin
Aluminum 1235	polyolefin
Alloy 3003	polyolefin
Aluminum 1060	vinyl resin
Aluminum 1100	vinyl resin
Aluminum 1145	vinyl resin
Aluminum 1235	vinyl resin
Alloy 3003	vinyl resin
Aluminum Clad Steel[B]	none
Aluminum Clad Steel[B]	polyolefin

[A] Aluminum designations are in accordance with ANSI H35.1. The equivalent Unified Numbering System alloy designations are those shown preceded by A9, for example, A91100 for Aluminum 1100 in accordance with Practice E 527.

[B] Cladding ratio must be specified (see 5.4).

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

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 The following precautionary caveat pertains only to the test method portion, Section 12, of this specification. *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

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

2.2 *ASTM Standards:* [2]

A 568/A 568M Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

B 193 Test Method for Resistivity of Electrical Conductor Materials

B 557 Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products

B 694 Specification for Copper, Copper-Alloy, Copper-Clad Bronze (CCB), Copper-Clad Stainless Steel (CCS), and Copper-Clad Alloy Steel (CAS) Sheet and Strip for Electrical Cable Shielding

D 903 Test Method for Peel or Stripping Strength of Adhesive Bonds

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

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

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

E 227 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique[3]

E 527 Practice for Numbering Metals and Alloys (UNS)

E 607 Test Method for Atomic Emission Spectrometric

[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.

Analysis Aluminum Alloys by the Point to Plane Technique Nitrogen Atmosphere
E 716 Practices for Sampling Aluminum and Aluminum Alloys for Spectrochemical Analysis
E 1251 Test Method for Analysis of Aluminum and Aluminum Alloys by Atomic Emission Spectrometry

2.3 *American National Standards:*
H35.1 Alloy and Temper Designation Systems for Wrought Aluminum
H35.2 Dimensional Tolerances for Aluminum Mill Products
B46.1 Surface Texture[4]

3. Terminology

3.1 *Definitions:*

3.1.1 *cable shielding stock*—a rolled product, rectangular in cross section and form, of nominal thickness 0.004 in. (0.10 mm) through 0.019 in. (0.48 mm) in coils (rolls) or traverse wound on reels or spools, with sheared or slit edges for electrical cable shielding applications.

3.1.2 *cladding ratio*—ratio by percent thickness of the aluminum/steel/aluminum component layers; for example, 20/60/20.

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

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

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 for each item, in pounds (kilograms),

4.1.3 Name of material (cable shielding),

4.1.4 Type of material (bare aluminum, coated aluminum, aluminum clad steel, or coated aluminum clad steel) (see 1.2),

4.1.5 Aluminum designation, when appropriate (see 1.2 and 5.3),

4.1.6 Cladding ratio, when appropriate (see 5.4),

4.1.7 Type of coating, class of coating and number of sides to be coated (see 1.2, 11.1 and Table 1),

4.1.8 Color of coated aluminum (see 11.3),

4.1.9 Temper when non-standard is required (see Section 9),

4.1.10 Dimensions (thickness and width),

4.1.11 How furnished: coils (rolls), traverse wound on reels or spools, etc.,

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

4.2.1 Whether the resistivity test is required for any item (Section 13),

4.2.2 Core requirements (core material, inner core diameter, if required; see 17.2),

4.2.3 Coil dimension (outer coil diameter limitation, if required; see 17.2),

4.2.4 Weight of coils and packages (coil weights and package size limitations, if required; see 17.3),

4.2.5 Certification, if required (see Section 18),

4.2.6 Special tests or exceptions, if any.

5. General Requirements, Materials and Manufacture

5.1 The material and manufacturing methods used shall be such that the resulting products will conform to the properties and characteristics prescribed in this specification.

5.2 Cladding may be bonded to the base metal by any method that will produce a clad material that will conform to this specification.

5.3 For bare or coated aluminum, Aluminum 1100, 1145 and 1235 shall be understood to be interchangeable, unless otherwise agreed upon between the producer and purchaser.

5.4 Unless otherwise stated (4.1.6), the cladding ratio shall be the standard ratio listed in Table 2 and shall be expressed as xx/xx/xx, aluminum/steel/aluminum.

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. 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 or 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 consist of an identifiable quantity of the same material, temper, and nominal dimensions subjected to inspection at one time.

7. General Quality

7.1 All cable shielding stock shall be commercially flat and free of buckles; they shall be free of injurious surface defects and shall have an 80 µin. (2.0 µm) maximum roughness measurement (AA) per ANSI B46.1, unless otherwise agreed upon by the producer and purchaser. Unless otherwise specified, discoloration due to proper annealing shall not be a cause for rejection.

7.2 Each ordered item shall be examined to determine conformance to this specification with respect to general quality and package marking. On approval of the purchaser, however, the producer may use a system of statistical quality control for such examinations.

8. Chemical Composition

8.1 *Limits*—The aluminum for cable shielding shall conform to the chemical composition limits specified in Table 3. Conformance shall be determined by the producer by analyzing samples taken at the time the aluminum 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, the producer shall not be required to sample and analyze the finished product.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

TABLE 1 Property Requirements for Coated Metals

Coating				Performance Requirements, lbf/in. (N/m), min			
Type No.	Description	Class	Sides Coated	Bonding to Metal (12.2)	Heat Sealability (12.3)	Lap-Shear (12.4)	Moisture Resistance (12.5)
I	Polyolefin	1	1	1.5 (260)	5.0 (875)	The coated metal tape fails in tension before the bond between coatings fails in shear.	1.5 (260)
			2				
		2	1	3.5 (610)	10.0 (1750)		3.5 (610)
			2				
II	Vinyl Resin	1	1	N/A	5.0 (875)		N/A
			2				

TABLE 2 Mechanical Property Limits[A,B]

Aluminum Designation	Temper	Specified Thickness in. (mm)	Tensile Strength, ksi (MPa)		Yield Strength (0.2 % offset) ksi (MPa)		Elongation in 2 in. (51 mm) min, %
			min	max	min	max	
1060	0	0.004–0.019 (0.10–0.50)	8.0 (55)	14.0 (95)	2.5 (15)	...	15
1100	0	0.004–0.019 (0.10–0.50)	11.0 (75)	15.5 (105)	3.5 (25)	...	15
1145	0	0.004–0.019 (0.10–0.50)	8.0 (55)	14.0 (95)	3.0 (20)	...	15
1235	0	0.004–0.019 (0.10–0.50)	8.0 (55)	14.0 (95)	3.0 (20)	...	15
3003	0	0.004–0.019 (0.10–0.50)	14.0 (95)	19.0 (130)	5.0 (35)	...	14
Aluminum Clad Steel							
Cladding[C] Ratio		Total Thickness in. (mm)					
33/33/33	Annealed[D]	0.009 (0.225)	20.0 (140)	34.0 (235)	18 (125)	...	15

[A] To determine conformance to this specification, each value for tensile strength shall be rounded to the nearest 0.1 ksi and each value for elongation to the nearest 0.5 %, both in accordance with the round method of Practice E 29.
[B] For aluminum and aluminum alloys, the basis for establishment of mechnical property limits is shown in Annex A1. The listed mechanical property limits are statistically valid only for material thicknesses of 0.006 in. and over (over 15 mm).
[C] Other cladding ratios may be supplied when agreed upon between the producer and purchaser.
[D] Specification A 568/A 568M.

TABLE 3 Chemical Requirements[A,B,C]

Aluminum Designation	Silicon	Iron	Copper	Manganese	Magnesium	Zinc	Vanadium	Titanium	Other Elements[D] Each	Other Elements[D] Total[F]	Aluminum[E]
1060	0.25	0.35	0.05	0.03	0.03	0.05	...	0.03	0.03	...	99.60 min
1100	0.95 Si + Fe		0.05–0.20	0.05	...	0.10	...	...	0.05	0.15	99.00 min
1145	0.55 Si + Fe		0.05	0.05	0.05	0.05	0.05	0.03	0.03	...	99.45 min
1235	0.65 Si + Fe		0.05	0.05	0.05	0.10	0.05	0.06	0.03	...	99.35 min
3003	0.6	0.7	0.05–0.20	1.0–1.5	...	0.10	...	...	0.05	0.15	remainder

[A] Limits are in weight (mass) percent maximum unless stated otherwise.
[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 attained from analysis shall be rounded-off to the nearest unit in the last righthand place of figures used in expressing the specified limit, in accordance with the rounding 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 nonconforming.
[E] By difference.
[F] *Other Elements—Total* shall be the sum of unspecified metallic elements 0.010 % or more, rounded to the second decimal before determining the sum.

NOTE 2—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.

8.2 Aluminum cladding shall be, unless otherwise specified, an aluminum conforming in chemical composition to Aluminum 1100, 1145 or 1235 (Table 3). These aluminums shall be

understood to be interchangeable for cladding purposes, unless otherwise agreed upon between the producer and purchaser.

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

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

8.3.2 When samples are taken from the finished or semifinished product, a sample shall be taken to represent each 4000 lb (1816 kg), or fraction thereof, of material in the lot, except that not more than one sample shall be required per piece.

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

8.4.1 Samples for chemical analysis shall be taken from bare sheet 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 E 55.

8.4.2 Samples for spectrochemical analysis shall be in accordance with Practice E 716. 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.

8.5 *Methods of Analysis*—The determination of chemical composition shall be made in accordance with suitable chemical (Test Methods E 34), or spectrochemical (Test Methods 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.

8.6 Steel cores of aluminum clad steel shall be a steel conforming in chemical composition to UNS designation G10060, per Specification A 568/A 568M, grade 1006.

9. Tempers

9.1 Both coated and uncoated aluminum materials furnished to this specification shall be Temper 0. Both coated and uncoated aluminum clad steel materials furnished to this specification shall be annealed temper. Special or nonstandard tempers are subject to negotiation between the producer and purchaser.

10. Tensile Properties of Material as Supplied

10.1 *Limits*—The cable shielding stock shall conform to the requirements for tensile properties as specified in Table 2. The yield strength need not be determined unless specifically indicated in the contract or order.

10.2 *Number of Specimens*—One sample shall be taken from either end of each coil or strip, but no more than one sample per 4000 lb (1816 kg) or portion thereof in a lot shall be required. Other procedures for selecting samples may be employed if agreed upon by the producer and the purchaser.

10.3 *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 557.

10.4 *Test Methods*—The tension test shall be made in accordance with Test Methods B 557.

11. Coated Metals

11.1 When ordered, the cable shielding stock may be coated on one or both sides with a protective plastic coating of the specified type and class, as agreed upon by the producer and the purchaser.

11.1.1 *Type I: Polyolefin Coating*—The cable shielding stock shall be coated with material meeting the requirements of this specification for the specified class of coating. The coatings are classified based upon requirements of the wire and cable industry as specified in Table 1, when tested in accordance with Section 12 of this specification.

11.1.1.1 The thickness of the coating on each coated side shall be 0.0015 in. (0.038 mm) min.

11.1.2 *Type II: Vinyl Resin Coating*—The cable shielding stock shall be coated with material meeting the requirements of Table 1 of this specification, when tested in accordance with Section 12 of this specification.

11.1.2.1 The thickness of the coating on each coated side shall be 0.0003 in. (0.008 mm) min.

11.2 The surface coating shall be such that the completed product shall have a smooth uniform appearance without inclusions, irregularities, skips, or agglomerates.

11.3 The color of the coated product shall be as agreed upon between the purchaser and supplier.

12. Test Methods for Coated Metal

12.1 *Test Specimens*—Unless otherwise specified, prepare all test specimens in accordance with the following instructions:

12.1.1 All test specimens shall be lengths of coated metal measuring 6 in. (150 mm) in length by 1 in. (25 mm) in width. It is recommended that specimens be prepared using a sample cutter.[5]

12.1.2 For wide material, prepare a minimum of two specimens for each 6 in. (150 mm) of parent material width.

12.1.3 For metal coated on two sides, twice as many specimens will normally be used as for one-side-coated metal.

12.1.4 If necessary, flatten any burr caused by cutting the coated metal by firmly smoothing the surfaces near the cut edges.

12.1.5 In all sample preparation, avoid touching any surface intended to be heat-sealed (12.3 or 12.4).

12.1.6 When necessary or appropriate, label one side of the test specimens near the specimen end.

12.2 *Bonding to Metal*—Test the finished coated metal for bonding between the metal and its coating in accordance with the requirements of Test Method D 903, with the following exceptions and additional provisions.

12.2.1 Prepare specimens in accordance with 12.1. Repeat the additional procedure for preparing specimens as described in 12.2.2-12.2.4 until sufficient specimens are available for test. Test results shall be an average based on a minimum of three tests per coated side.

[5] JDC-SO Precision Sample Cutter, 1 in. (25 mm) wide, has been found suitable for this purpose. Available from Thwing-Albert Instrument Co., 14 W. Collings Ave., West Berlin, NJ 08091.

12.2.2 Score each specimen on one side approximately 1 in. (25 mm) from one end. The score should extend across the width of the material as close as practical to each edge, but should not extend through to either edge. The score should be deep enough to extend through the coating and make a visible notch in the surface of the metal.

12.2.3 Flex the end of the sample along the scored line until the aluminum has completely separated along this line. Elongate the sample with a smooth, steady pull until there is a slight gap between the two pieces of metal.

12.2.4 Beginning at the gap in the metal, peel back the coating from the longer section until sufficient metal has been bared to fasten in the upper clamp of a tensile tester. Various techniques may be used to satisfactorily accomplish this, for example:

12.2.4.1 Mount a length of adhesive tape, adhesive side up, on a flat fixed surface. The adhesive tape should be mechanically strong with a strong pressure-sensitive adhesive. Mount the long end of the specimen, scored side down, on this tape. Peel back by pulling the coating with a smooth steady pull through a 180° bend from the longer section; or

12.2.4.2 Continue to elongate the sample (from 12.2.3) with a smooth, steady pull until the coating has been removed from the longer section far enough to grasp the edge of the bare aluminum along the break with pliers. Continue to peel back by pulling the coating with a smooth, steady pull through a 180° bend from the longer section.

12.2.5 Place the still-coated, 1-in. (25-mm) section in the lower test clamp of a tensile tester. Bend the coating 180° as the specimen is tested and peel the coating from the aluminum.

12.2.6 The speed of tensile tester jaw separation shall be 12 in./min (305 mm/min).

12.2.7 For metals coated on both sides, repeat the foregoing procedure to determine the bonding strength of the coating on the other side of the metal, using an adjacent length of coated metal.

12.3 *Heat Sealability Test*—Heat sealing may be defined as the process of welding plastic films or laminates by the application of heat.

12.3.1 Set up a heat sealer[6] in accordance with the manufacturer's instructions, with top and bottom seal bars having contact surfaces 1 in. (25 mm) wide. Set sealer temperature (both bars) at 392°F (200°C), air pressure at 40 psi (276 kPa) and dwell time at 5 s.

12.3.2 Prepare specimens in accordance with 12.1. A minimum of two specimens are needed for single-side coated tape, while a minimum of four specimens are required for double-coated metal. Avoid touching surfaces to be heat sealed. Label each specimen.

12.3.3 Fold each specimen in half, continuing to avoid contact with surfaces to be sealed.

12.3.4 Insert the folded specimen in the heat sealer and seal each specimen along a line parallel to the end and approximately centered. The unsealed tab ends should be sufficiently long to permit fastening in the jaws of a tensile tester.

12.3.5 After removal from the sealer, allow specimens to cool for 3 to 5 min.

12.3.6 Fold back the unsealed ends of the specimen in opposite direction and at right angles to the plane of sealing. Insert these ends into the jaws of a tensile tester (set initial jaw separation at approximately 2½ in. (64 mm)).

12.3.7 Activate the tensile tester and record the maximum force necessary to separate the seal. The speed of jaw separation shall be 12 in./min (305 mm/min).

12.3.8 Repeat the foregoing procedure for all specimens to be tested.

12.4 *Lap Shear Test*:

12.4.1 Prepare a minimum of one specimen in accordance with 12.1. Label one side of each test specimen near each end. Cut the specimen strip into two sections, each 3 in. (76 mm) long.

12.4.2 Lay one section on top of the other to provide an overlapped area of 0.25 $in.^2$ (161 mm^2, with the coating of side 1 in contact with the coating of side 2 in the overlapped area. Match the edges so that the sample is flat and free of wrinkles.

12.4.3 Place a strip of adhesive tape ⅛ in. (3 mm) in width and 1 in. (25 mm) in length over the top half of the sample in a nearly closed molding press that has been preheated to 392°F (200°C). Leave one end of the sample extending out of the platens approximately 1 in. (25 mm).

12.4.4 Close the press until the pressure gage indicator shows activation. Immediately open the press and remove the sample. To prevent the coating on the outside of the sample from adhering to the molding press, the sample should be placed between polyester film or some other suitable material to which the coating will not adhere.

12.4.5 After the sample has cooled at room temperature, remove the adhesive tape and determine the lap shear strength of the seal in a tensile tester.

12.4.6 The speed of jaw separation shall be 12 in./min (305 mm/min).

12.5 *Moisture Resistance Test*—The ability of plastic coatings to resist moisture shall be determined by the following method:

12.5.1 Prepare a minimum of two specimens in accordance with 12.1.

12.5.2 Immerse the specimens in distilled or deionized water in separate containers (test tubes or similar).

12.5.3 Place the containers of water-immersed specimens in a conditioning bath maintained at a temperature of 154°F (68°C); condition specimens for a period of 7 days.

12.5.4 At the end of the conditioning period, remove the specimens from the water and allow them to equilibrate at normal laboratory ambient conditions for a period of 24 h.

12.5.5 At the end of the ambient conditioning period, test the specimens in accordance with 12.2.

13. Electrical Conductivity

13.1 When specified in the order, the electrical conductivity determined on annealed samples shall have the following value when tested at or corrected to a temperature of 68°F (20°C):

[6] Sentinental Model 12ASL has been found suitable for this purpose. Available from Packaging Industries, P.O. Box S, Hyannis, MA 02601.

Material	Electrical Conductivity % IACS Min.
Aluminum 1060	61.5
Aluminum 1100	58.5
Aluminum 1145	58.5
Aluminum 1235	58.5
Alloy 3003	50.0
Aluminum-Clad Steel, 0.009 in. (0.225 mm) 33/33/33	30.0[A]

[A] Conductivity for other thicknesses or for other cladding ratios shall be as agreed upon between the purchaser and supplier.

13.2 The electrical resistivity of the material shall be determined in accordance with Test Method B 193; the conductivity shall be calculated in accordance with explanatory notes 3 and 4 of Test Method B 193.

14. Dimensions and Permissible Variations

14.1 *General*—For the purpose of determining conformance with the dimensional requirements prescribed in this specification, any measured value outside the specified limiting values for any dimension may be cause for rejection.

14.2 *Thickness*— The thickness of cable shielding stock 0.006 in. (0.15 mm) and greater in thickness shall not vary from that specified by more than the respective permissible variations prescribed in Tables 3.1 and 3.2 of ANSI H35.2. The thickness of material less than 0.006 in. (0.15 mm) nominal thickness shall not vary by more than ±10 %.

14.3 *Width and Lateral Bow*—Cable shielding stock shall not vary in width or in lateral bow from that specified by more than permissible variations prescribed in Tables 3.6 and 3.7 respectively, of ANSI H35.2.

14.4 *Cladding Ratio*—Cladding ratios shall be within± 10 % of nominal; method of test shall be metallurgical microsection of at least three samples per lot.

15. Splices

15.1 Welded splices are permissible under the following conditions:

15.1.1 The ends shall be cut, overlapped ¼ in. (6 mm), welded and then recoated (if the product is coated).

15.1.2 There shall be no more than three welds per coil.

15.1.3 There shall be a minimum of 1000 ft (305 m) between welds.

15.1.4 A maximum of 10 % of the quantity shipped may contain splices.

15.1.5 The minimum tensile strength of a length containing a splice shall be no less than 85 % of an adjacent length not containing a splice.

15.1.6 The maximum resistance of any 3-ft (1-m) section of cable shielding stock containing a factory splice shall exhibit not more than 110 % of the resistance of an equal length section of cable shielding stock that does not contain a splice.

16. Workmanship, Finish, and Appearance

16.1 All material shall be uniform in quality and condition, sound and free from internal and external defects. It shall be well cleaned and free from dirt. A superficial film of residual light lubricant is permissible for uncoated metal, unless otherwise specified.

16.2 Aluminum clad material shall be free of defects including delamination.

17. Packaging and Package Marking

17.1 The slit material shall be wound tightly in a coil with ends secured to prevent unwinding. Tightness shall be sufficient to prevent the coils from "telescoping." The material shall be wound with the edges in a straight line across the coil diameter.

17.2 The slit coils shall be wound on a core of suitable construction (aluminum, steel, fiber, etc., at the discretion of the producer unless otherwise agreed upon by the purchaser or producer), with a core length equal to the slit material width. The inside diameter of the core and the outside diameter of the slit coil package shall be agreed upon by purchaser and producer.

17.3 The material shall be packaged to provide adequate protection during normal handling and transportation, and each package shall contain only one type, size, alloy, and temper of material unless otherwise agreed. The type of packaging and gross weight of containers shall, unless otherwise agreed, be at the producer's or supplier's discretion, provided that they are such as to ensure acceptance by common or other carriers for safe transportation at the lowest rate to the delivery point.

17.4 Each shipping container shall be marked with the purchase order number, material size, specification number, alloy and temper, gross and net weights, and the producer's name or trademark.

18. Certification

18.1 The producer or supplier shall, upon request, furnish to the purchaser a certificate stating that each lot has been sampled, tested and inspected in accordance with this specification, and has met the requirements.

ANNEXES

(Mandatory Information)

A1. BASIS FOR INCLUSION OF PROPERTY LIMITS

A1.1 Limits are established at a level at which a statistical evaluation of the data indicates that 99 % of the population obtained from all standard material meets the limit with 95 % confidence. For the products described, mechanical property limits for the respective size ranges are based on the analyses of at least 100 data from standard production material with no more than ten data from a given lot. All tests are performed in accordance with the appropriate ASTM test methods. For informational purposes, refer to "Statistical Aspects of Mechnical Property Assurance" in the Related Material section of the *Annual Book of ASTM Standards*, Vol 02.02.

A2. ACCEPTANCE CRITERIA FOR INCLUSION OF NEW ALUMINUM AND ALUMINUM ALLOYS IN THIS SPECIFICATION

A2.1 Prior to acceptance for inclusion in this specification, the composition of wrought or cast aluminum or aluminum alloy shall be registered in accordance with ANSI H35.1 or H35.1(M). The Aluminum Association[7] holds the Secretariat of ANSI H35 Committee and administers the criteria and procedures for registration.

A2.2 If it is documented that the Aluminum Association could not or would not register a given composition, an alternative procedure and the criteria for acceptance shall be as follows:

A2.2.1 The designation submitted for inclusion does not utilize the same designation system as described in ANSI H35.1 or H35.1(M). A designation not in conflict with other designation systems or a trade name is acceptable.

A2.2.2 The aluminum or aluminum alloy has been offered for sale in commercial quantities within the prior twelve months to at least three identifiable users.

A2.2.3 The complete chemical composition limits are submitted.

A2.2.4 The composition is, in the judgment of the responsible subcommittee, significantly different from that of any other aluminum or aluminum alloy already in the specification.

A2.2.5 For codification purposes, an alloying element is any element intentionally added for any purpose other than grain refinement and for which minimum and maximum limits are specified. Unalloyed aluminum contains a minimum of 99.00 % aluminum.

A2.2.6 Standard limits for alloying elements and impurities are expressed to the following decimal places:

Less than 0.001 %	0.000X
0.001 to but less than 0.01 %	0.00X
0.01 to but less than 0.10 %	
Unalloyed aluminum made by a refining process	0.0XX
Alloys and unalloyed aluminum not made by a refining process	0.0X
0.10 through 0.55 %	0.XX
(It is customary to express limits of 0.30 through 0.55 % as 0.X0 or 0.X5.)	
Over 0.55 %	0.X, X.X., etc.
(except that combined Si + Fe limits for 99.00 % minimum aluminum must be expressed as 0.XX or 1.XX)	

A2.2.7 Standard limits for alloying elements and impurities are expressed in the following sequence: Silicon; Iron; Copper; Manganese; Magnesium; Chromium; Nickel; Zinc (Note A2.1); Titanium; Other Elements, Each; Other Elements, Total; Aluminum (Note A2.2).

NOTE A2.1—Additional specified elements having limits are inserted in alphabetical order of their chemical symbols between zinc and titanium, or are specified in footnotes.

NOTE A2.2—Aluminum is specified as *minimum* for unalloyed aluminum and as a *remainder* for aluminum alloys.

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APPENDIXES

(Nonmandatory Information)

X1. EXPLANATORY NOTE—CABLE SHIELDING

X1.1 Cable shielding or "cable wrap" is normally used by manufacturers of electrical insulated wire and cable in strips of various widths. The material is wrapped around an insulated wire or group of wires, and may be applied over an intervening layer of wrapping material or over a jacket. The material may be applied in various configurations depending upon the requirements of the finished cable:

X1.1.1 *Helical Wrap*— overlapped, butted, or gapped.

X1.1.2 *Longitudinal Application*—corrugated or smooth, overlapped, butted, gapped, or welded/soldered.

X1.2 The selection of a particular material, the thickness of the material and the coating, if any, to be used is dependent largely upon the specification requirements for the finished wire or cable. Military and Federal specifications, Rural Electrification Administration (REA) specifications, ICEA (Insulated Cable Engineers Association) specifications, among others, typically apply.

X1.3 Electrical conductivity of the material is an important characteristic considered in the selection process, and is affected by the material, its thickness and the method of application. Corrosion resistance is important for various environments. Physical strength requirements may include such features as resistance to tensile stress, resistance to bending stress (including repeated bending), resistance to gopher attack, etc.

X2. PREFERRED THICKNESS

X2.1 It is recommended that wherever possible, material purchased to this specification be ordered in a thickness as listed in Table X2.1.

TABLE X2.1 Preferred Thickness, Nominal

Type of Material		Coating	Metal Thickness in. (mm)
Aluminum	1060		
Aluminum	1100		0.004 (0.10)
Aluminum	1145	none	
Aluminum	1235		0.008 (0.20)
Alloy	3003		
Aluminum	1060		
Aluminum	1100		0.004 (0.10)
Aluminum	1145	polyolefin	
Aluminum	1235		0.008 (0.20)
Alloy	3003		
Aluminum	1060		
Aluminum	1100		0.004 (0.10)
Aluminum	1145	vinyl resin	
Aluminum	1235		0.008 (0.20)
Alloy	3003		
Aluminum	Clad Steel	none	0.009[A] (0.225)[A]
Aluminum	Clad Steel	polyolefin	0.009[A] (0.225)[A]

[A] Total thickness of strip. See Table X3.1 for preferred cladding ratio.

X3. PREFERRED CLADDING RATIOS FOR ALUMINUM-CLAD STEEL

X3.1 It is recommended that wherever possible, material purchased to this specification be ordered in thicknesses and cladding ratios as listed in Table X3.1.

TABLE X3.1 Preferred Cladding Ratios—Aluminum-Clad Steel[A]

Nominal Total Thickness of Strip		Cladding Ratio	Nominal Thickness, in. (mm)		
in.	mm	Al/Steel/Al	Aluminum	Steel	Aluminum
0.009	0.225	33/33/33	0.003 (0.075)	0.003 (0.075)	0.003 (0.075)

[A] Other cladding ratios may be supplied when agreed to by the producer and purchaser.

X4. METRIC EQUIVALENTS

X4.1 The SI unit for strength properties now shown is in accordance with the International System of Units (SI). The derived SI unit for force is the newton (N), which is defined as that force which, when applied to a body having a mass of one kilogram gives it an acceleration of one metre per second squared ($N = kg \cdot m/s^2$). The derived SI unit for pressure or stress is the newton per square metre (N/m^2), which has been named the pascal (Pa) by the General Conference on Weights and Measures. Since 1 ksi = 6,894,757 Pa the metric equivalents are expressed as megapascal (MPa), which is the same as MN/m^2 and N/mm^2.