

00-A-1876

July 29, 1974

SUPERSEDING

MIL-A-148E

July 7, 1967

FEDERAL SPECIFICATION

ALUMINUM FOIL

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers uncoated aluminum foil.

1.2 Classification. The aluminum foil shall be supplied in the following types, grades, and classes, as specified (see 6.2):

Types

- I - Rolls
- II - Interfolded flat sheets
- III - Single-ply flat sheets

Classes (applicable to type II only)

- 1 - Flat sheets, 12 x 10-3/4 inches.
- 2 - Flat sheets, 9 x 10-3/4 inches.

Grades

- A - For food handling and processing applications.
- B - For application other than food handling or processing.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

FBI 8135, 9535

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Federal Specification:

UU-R-31 - Paper; General Specifications and Methods of Testing.

Federal Standards:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civilian Agencies).

Fed. Test Method Std. No. 151 - Metals; Test Methods.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Office in Boston, New York, Washington, D.C., Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, Wash.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-129 - Marking for Shipment and Storage.

MIL-STD-649 - Aluminum Products, Preparation for Shipment and Storage of.

(Copies of Military Specifications and Standards required by Contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the Contracting Officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

Dept. of Health, Education, and Welfare Regulations:

Federal Food, Drug, and Cosmetic Act, Food Additive Amendment, and Regulations for its enforcement.

(Applications for copies should be addressed to the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402)

3. REQUIREMENTS

3.1 Chemical composition.

3.1.1 Grade A. Grade A foil shall be produced from material of not less than 98.6 percent aluminum content, and shall contain less than 0.01 percent each of lead, arsenic, or cadmium.

3.1.2 Grade B. Grade B foil shall be produced from material of not less than 99.00 percent aluminum content.

3.2 Temper. Foil shall be in the annealed temper. In addition, for Grade A foil the flexibility and strength characteristics shall be such as to permit the folding and shaping ordinarily encountered in manual and machine packaging operations and in food processing and handling without damage to the foil.

3.3 Surface finish.

3.3.1 Grade A. Grade A foil shall have a slightly slick finish.

3.3.2 Grade B. Grade B foil shall be furnished with either a dry-annealed finish or a slick-annealed finish, as specified by the procuring agency (see 6.2).

3.4 Thickness and covering area. The thickness of plain foil (not interleaved) shall be as shown in table I. The resulting covering area is also shown.

Table I. Foil thickness and covering area.

Foil thickness, inch	Covering area, sq. in. per pound
0.00025	41,000
.0003	34,200
.00035	29,300
.0004	25,600
.0005	20,500
.00065	15,800
.0007	14,600
.0008	12,800
.0010	10,200
.0015	6,800
.0020	5,100
.0030	3,400
.0040	2,560
.0050	2,150

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3.5 Mullen bursting strength (Grade B only). The bursting strength of Grade B foil 0.0008 inch and over in thickness shall be as specified in table II.

Table II. Bursting strength

Nominal thickness, inch	Mullen bursting strength, psi	
	Minimum	Maximum
0.0008	8	23
.0010	11	31
.0015	22	55
.0020	40	90
.0030	75	150
.0040	110	220
.0050	140	280

3.6 Size.

3.6.1 Type I.

3.6.1.1 Grade A. Type I, grade A foil shall be furnished in thicknesses from 0.0007 to 0.002 inch inclusive and in widths of 12, 15, 18, or 24 inches, as specified in the contract or order (see 6.2).

3.6.1.2 Grade B. Type I, grade B foil shall be furnished in thicknesses and widths as specified in the contract or order (see 6.2).

3.6.2 Type II, grade A.

3.6.2.1 Class 1. Type II, grade A, class 1 foil shall be interfolded flat sheets 12 inches by 10-3/4 inches by 0.0007 inch thick.

3.6.2.2 Class 2. Type II, grade A, class 2 foil shall be interfolded flat sheets 9 inches by 10-3/4 inches by 0.0005 inch thick.

3.6.3 Type III. The size and thickness of all type III foil shall be as specified in the contract or order (see 6.2).

3.7 Dimensional tolerances.

3.7.1 Thickness. The permissible variation of the computed thickness or measured covering area from the nominal thickness or covering area, respectively shall be not more than ± 10 percent average per roll.

3.7.2 Width and length. The permissible variation in width and length of foil shall be as shown in table III.

Table III. Permissible variation in width and length of foil

Type and size	Tolerance (plus and minus), inch
Type I, 12 in. wide and over	$1/32$ ^{1/}
Type I, less than 12 in. wide	$1/64$ ^{1/}
Type II, classes 1 and 2	$1/16$
Type III, all sizes	$1/16$

^{1/} Width only.

3.8 Interleaving (type III only). Type III foil shall be interleaved with neutral paper having a pH rating in the range of 6.0 to 8.0.

3.9 Toxicity. Grade A foil shall conform in every respect to the provisions of the Federal Food, Drug and Cosmetic Act, Food Additive Amendment, and regulations promulgated thereunder. Grade B foil shall be free of objectional or noticeable nondissipating odors and free of toxic residues.

3.10 Workmanship. Foil shall be of uniform quality and condition. Defects including cuts, tears, pinholes, roughness, or dirt that effect serviceability shall not occur in excess of the acceptable quality level (AQL) specified herein.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Lot. Unless otherwise specified in the contract or order, a lot shall consist of material of one type, grade, class, size, thickness, and finish offered for delivery at one time.

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4.3 Sampling.

4.3.1 For chemical analysis. At least one sample shall be taken from each group of ingots of the same alloy poured simultaneously from the same source of molten metal by the producer and analyzed to determine conformance with 3.1 except that analysis for As, Pb and Cd need be made only once in each 24 hour period, provided that if the amount of As, Pb or Cd present equals or exceeds the maximum prescribed in 3.1, all samples taken during the 24 hour periods immediately preceding and following the off analysis sample shall be analyzed for the element. Ingots not conforming to the requirements of this specification shall be rejected. Complete ingot analysis records shall be available to the procuring agency at the producer's plant.

4.3.1.1 Finished product analysis. When compliance with 4.3.1 cannot be established, one sample shall be selected from each 4000 pounds, or fraction thereof, of foil in the lot for analysis to determine conformance with 3.1.

4.3.2 For bursting strength test (Grade B only). A sample for the bursting strength test shall be taken from each 2,000 pounds or less of foil comprising the lot.

4.3.3 For determination of pH of interleaving of type III foil. One sample of interleaving paper shall be taken from each 2,000 pounds or less of type III foil comprising the lot for the purpose of determination of pH.

4.3.4 For determination of toxic residues (Grade B only). Sampling for the determination of toxic residues shall be as required by the procuring agency.

4.3.5 For visual and dimensional examination. From each lot of material, samples shall be selected in accordance with MIL-STD-105, at inspection level I and an acceptable quality level of 6.5 percent defective. Lot size shall be expressed in terms of sheets or rolls, as applicable. For type I material, samples shall be taken from the end of each roll so selected. The samples selected for dimensional examination may be the same as those selected for visual examination.

4.4 Test procedures.

4.4.1 Chemical analysis. Chemical analysis shall be made by a nonemission method in accordance with method 111 of Fed. Test Method Std. No. 151 or the spectrochemical method in accordance with method 112 of Fed. Test Method Std. No. 151 to determine conformance with 3.1. In case of dispute, the chemical analysis by a nonemission method (method 111) shall be the basis for acceptance.

4.4.2 Bursting strength test (Grade B only). The bursting strength of grade B foil 0.0008 inch and over in thickness shall be determined in accordance with method 112, bursting strength, of UU-P-31.

4.4.3 Determination of pH of interleaving. The pH of interleaving of type III foil shall be determined in accordance with method 200, acidity, pH, of UU-P-31.

4.4.4 Determination of toxic residues (Grade B only). The method of determination of toxic residues shall be as required by the procuring agency. Alternatively, if acceptable to the procuring agency, a certificate of compliance shall be furnished by the producer.

4.5 Visual and dimensional examination. Each sample selected in accordance with 4.3.5 shall be subjected to surface examination for workmanship and dimensional requirements.

4.5.1 Width. The width of type I foil and the width and length of type II and type III foil shall be measured.

4.5.2 Thickness. The thickness shall be determined by weighing a known area of not less than 8 square inches on an analytical balance or other weighing device of comparable accuracy, and calculating the thickness therefrom. When the weight is ascertained in grams, the thickness in inches shall be determined by the following formula:

Thickness in inches =

$$\frac{0.0226 \times \text{weight of sample in grams}}{\text{area of sample in sq. in.}}$$

4.5.3 Surface condition. When dry-annealed finish is specified (see 3.3), water shall be applied to the surface of a specimen having an area of 10 square inches or larger. Dry-annealed foil will support an unbroken water film.

4.5.4 Preparation for shipment. Examination of the packaging, packing, and marking for shipment shall be made for conformance with the requirements of section 5.

4.6 Rejection.

4.6.1 Examination defects. Any sample unit having one or more defects shall be rejected. If the number of nonconforming sample units in the sample exceeds the acceptance number specified in 4.3.5 for that sample size, the entire lot shall be rejected subject to the provisions of the section on "Acceptance and Rejection" of MIL-STD-105.

4.6.2 Test failures. A lot shall be rejected for failure to meet any of the test requirements when tested in accordance with 4.4, subject to the provisions of the section on "Rejection and Retests" of Test Method Std. No. 15.

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5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, and packing.

5.1.1 Grade A.

5.1.1.1 Type I small rolls (not exceeding 5 pounds per roll).

5.1.1.1.1 Packaging.

5.1.1.1.1.1 Level A. Type I foil in rolls not exceeding 5 pounds in weight shall be wound about paperboard cores and individually packaged in paperboard or fiberboard boxes.

5.1.1.1.1.2 Level C. Type I foil (small rolls) shall be packaged in accordance with manufacturer's commercial practice.

5.1.1.1.2 Packing. Packing of individually packaged rolls shall be in accordance with the requirements of MIL-STD-649. The procuring agency shall specify the level of packing required (see 6.2). Unless otherwise specified in the contract or order, material shall be packed in accordance with level C.

5.1.1.1.2.1 Level C. The products shall be separated by type, class, grade, and thickness and packed in accordance with the manufacturer's standard practice into containers of a type and size commonly used for the purpose, in such a manner as to insure acceptance by carrier for transportation at the lowest rate applicable and to afford maximum protection from normal hazards of transportation.

5.1.1.2 Type I large rolls (over 5 pounds per roll) and type II. Type I (large rolls) and type II foil shall be preserved and packaged in accordance with level C. Packing shall be in accordance with the requirements of MIL-STD-649. The procuring agency shall specify the level of packing required (see 6.2). Unless otherwise specified in the contract or order, material shall be packed in accordance with level C.

5.1.1.2.1 Level C. See 5.1.1.1.2.1.

5.1.2 Grade B.

5.1.2.1 Type I small rolls (not exceeding 5 pounds per roll). Type I (small rolls) shall be packaged and packed in accordance with 5.1.1.1.1.1 and 5.1.1.1.2, and 5.1.1.1.2.

5.1.2.1.1 Level C. See 5.1.1.1.2.1.

5.1.2.2 Type I large rolls (over 5 pounds per roll) and type III. Type I (large rolls) and type III foil shall be preserved, packaged, and packed in accordance with the requirements of MIL-STD-649. The procuring agency shall specify the level of preservation, packaging, and packing required

(see 6.2). Unless otherwise specified in the contract or order, material shall be preserved, packaged, and packed in accordance with level C.

5.1.2.2.1 Level C. See 5.1.1.1.2.1..

5.2 Marking.

5.2.1 Special marking (Grade B only). All unit packages and shipping containers containing Grade B foil shall be conspicuously marked as follows: "NOT FOR USE WITH FOOD".

5.2.2 Civil agencies. In addition to markings required by the contract or order and 5.2.1, shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.2.3 Military agencies. In addition to markings required by the contract or order and 5.2.1, shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use.

6.1.1 Grade A foil 0.0007 to 0.002 inch is suitable for the wrapping of foods during cooking processes. The thickness of the foil to be used will be determined by the product to be wrapped and the purpose for which it is wrapped.

6.1.2 Grade B foil 0.0005 inch and less is suitable for aircraft applications such as the shielding or insulation of components. It is not satisfactory for fabrication of aluminum core for sandwich construction. MIL-A-81596 should be used for that purpose.

6.1.3 Foil 0.0010 inch and heavier is suitable in many applications for use as a noncorrosive barrier between surfaces which have been coated with preservative compounds and wood or dunnage or between treated surfaces and other surfaces which would cause corrosive action.

6.2 Order data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

- a. Title, number, and date of this specification.
- b. Type, grade, and class required (see 1.2).
- c. Finish required (see 3.3).
- d. Size and thickness required (see 3.4 and 3.6).
- e. Sampling and tests for determination of toxic residues for Grade B foil or when a certificate of compliance is acceptable (see 4.3.4 and 4.4.4).
- f. Level of preservation, packaging, and packing required (see sec. 5).
- g. Weight of foil per roll.

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6.3 Covering area. The covering area is determined from the weight of a measured area of foil by the following formula:

Covering area in sq. in./lb. =

$$\frac{453.6 \times \text{area of sample in sq. in.}}{\text{weight of sample in grams}}$$

6.4 Definitions.

6.4.1 Dry-annealed foil is foil from which the residual oil from rolling is removed in the final annealing operation.

6.4.2 Slick-annealed foil is foil annealed in such manner that a thin residual film of oil remains on the surface.

6.5 Precaution. Direct contact of aluminum foil with metals other than cadmium, magnesium, aluminum, or zinc, shall be avoided in applications which may be exposed to water, to prevent galvanic action.

6.6 Supersession Data. This specification includes the requirements of MIL-A-148E dated July 7, 1967.

MILITARY CUSTODIANS:

Army - MR
Navy - AS
Air Force - 84

Preparing activity:

Army - MR

CIVIL AGENCY COORDINATING ACTIVITIES:

Review activities:

Army - MI, MU, AT, MD, GL, EA, PA, SL, SH
Navy - None
Air Force - 69, 71, 84
DSA - IS

USDA - AMS, APS
COM - NBS
GSA - PSS
NASA - GSF
NASA - JFK
NASA - MSP
POS

User activities:

Army - MD
Navy - MC, SH, SA, YD, EC
Air Force - 80

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