

NATIONAL AIRCRAFT STANDARDS COMMITTEE

AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA, INC., 610 SHOREHAM BUILDING, WASHINGTON 5, D. C.

SPECIFICATION FOR TUBING FABRICATED

FROM THERMOPLASTIC MATERIALS

This specification covers the material for and fabrication of rigid plastic tubing. All parts of this specification shall apply unless otherwise specified.

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A. APPLICABLE SPECIFICATIONS

A-1. Specifications: The specifications listed below form a part of this specification. Unless modified in the order, or contract, the issues shown shall apply.

A-1a. American Society for Testing Materials:

- D-229-43 Methods of Testing Sheet and Plate Materials Used in Electrical Insulation
- D-256-43T Methods of Test for Impact Resistance of Plastics and Electrical Insulating Materials (Tentative)
- D 543-43 Method of Test for Resistance of Plastics to Chemical Reagents. (Tentative)
- D 570-42 Method of Test for Water Absorption of Plastics.
- D 635-41T Method of Test for Flammability of Plastics over .050 inch in thickness. (Tentative)
- D 638-42T Method of Test for Tensile Properties of Plastics. (Tentative)
- D 648-41T Method of Test for Distortion Under Heat of Molded Electrical Insulating Materials. (Tentative)
- D 674-42T Recommended Practice for Long-Time Tension Tests of Plastics. (Tentative)
- D 675-43T Descriptive Nomenclature of Objects made from Plastics. (Tentative)
- D 695-44T Method of Test for Compressive Strength of Plastics. (Tentative)

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- D 702-43T Specs. for Cast Methacrylate Plastic Sheets, Rods, Tubes and Shapes. (Tentative)
 D 703-44T Specs. for Polystyrene Molding Compounds. (Tentative)
 D 706-43T Specs. for Cellulose Acetate Molding Compounds. (Tentative)
 D 707-43T Specs. for Cellulose Acetate Butyrate Molding Compounds. (Tentative)
 D 729-44T Specs. for Vinylidene Chloride Molding Compounds. (Tentative)

B. TYPES AND CLASSES

B-1 Material shall be furnished in the following types and classes:

B-1a. Type TP-A: Cellulose Derivatives. General purpose materials

Class TP-A-1: Cellulose Acetate (High Acetyl Content)

Class TP-A-2: Cellulose Acetate Butyrate

B-1b. Type TP-B: Ethenoid Resins. Water and chemical resistant materials.

Class TP-B-1: Polymethylmethacrylate. Excellent optional properties.

Class TP-B-2: Polyvinylidene chloride. Brittle at temperatures below -20°F. Excellent solvent resistance.

Class TP-B-3: Polystyrene. Excellent water and acid resistance.

B-1c. Type TP-C: Polyamide Resins. Extremely high temperature resistant materials.

Class TP-C-1: (Nylon). Good mechanical, thermal and chemical properties.

C. MATERIAL AND WORKMANSHIP

C-1. Material: The material shall consist of the specified thermoplastic resin properly formulated with plasticizers, or other ingredients as may be necessary to meet the detailed requirements of this specification.

C-1a. Substitution: If the manufacturer changes his material or process in any manner, after class approval has been granted, the ultimate purchasers and/or approving agency shall immediately be informed, and new test specimens shall be submitted if required by the ultimate purchasers and/or approving agency.

C-2. Workmanship: The workmanship shall be first class in every respect and shall meet every requirement of this specification.

D. GENERAL REQUIREMENTS

D-1. Class Approval: To supply materials under this specification, an approval of materials as to class must have been obtained. The procuring agency reserves the right to reject any bids for materials which have not been prequalified and found satisfactory. Application for such approval shall be made in duplicate to the approving agency. Specimens for test shall be submitted in accordance with the provisions of F-1a (Table II) and in accordance with instructions from the approving agency.

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D-1a. Withdrawal of Approval: The procuring agency and/or approving agency reserves the right to require subsequent qualification tests at any time. Any approval granted under this specification shall be withdrawn upon failure under such retest.

D-1b. Notice of Prior Approval: An intermediate purchaser buying for resale shall notify the manufacturer to that effect so that the manufacturer shall have the opportunity to submit to such purchaser, in lieu of specimens, evidence showing previous approval of the material directly by the ultimate purchaser concerned in such resale.

D-2. Material Properties: These shall be as specified in Section E herein, in terms of standard test specimens and conditioning for each of the several classes of material involved, and as determined by the complete class approval tests outlined in F-4.

D-3. Uniformity: All molded materials of corresponding shape and form of a given class of any one manufacturer shall be uniform in appearance and in the specified properties.

D-4. Stability: Molded materials shall be as physically stable as is customarily found in the class of material involved under fluctuations of temperature and humidity within the ranges specified in F-3.

D-5. Freedom from Defects: Molded materials shall be free from bubbles, blisters, cracks, wrinkles, and reasonably free from other small defects such as scratches, dents, etc.

D-6. Chemical Resistance: Molded materials shall be resistant to such chemicals as are specified in the contract or order when tested as specified in Section F-4b.

D-7. Dimensions and Tolerances: Sizes and weights shall be within the limits specified in the order or contract. If no limits are specified, common commercial tolerances shall apply.

D-8. Machinability: The materials shall be suitable for fabrication by standard machining operations, and shall not crack, split, craze or distort as a result of such machining operations. Machined surfaces shall be smooth and capable of taking a good surface finish when buffed or polished.

D-9. Accuracy of Molding:

D-9a. Dimensions: All molded materials, after proper cooling, shall be within the dimensional tolerances shown on the applicable drawings. The accuracy of molding shall be such, in all cases, as to assure a high degree of interchangeability for all parts furnished under one contract, or made to the same drawing.

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E. DETAIL REQUIREMENTS ON TEST SPECIMENS

E-1. Unless otherwise specified, the average value obtained from measurements of a set of test specimens for any specific property required in Table I, when tested as required in F-4, after being conditioned as required in Table I and F-3, shall be not less than the minimum, nor more than the maximum (whichever is applicable) specified in Table I. If the value obtained for any single specimen deviates from the average of the values obtained from all the other specimens for any specific property, by more than 5 times the average deviation of the values obtained for each of the other specimens, this value shall be disregarded in determining the average value obtained. If more than one specimen is eliminated in determining the average value for any specific property, new specimens for that property shall be furnished by the manufacturer.

F. SAMPLING, INSPECTION AND TESTS ON MOLDED SPECIMENS

F-1: Test Specimens:

F-1a. Number of Specimens: The minimum quantity of test specimens, required for each class of material shall be as indicated in Table II. The form of test specimens shall be as specified in the table and in Figures 1 to 11 inclusive. The test requirement limits of Table III indicate the applicable tests and test procedure.

F-2. Preparation of Specimens:

F-2a. Test specimens shall be formed from production material either by injection, compression, or extrusion molding or by fabricating from sheets using molding temperatures, pressures and techniques (including direction of molding pressure) representative of those to be used in production.

F-2b. Each test specimen shall be suitably identified with the manufacturer's name or trade mark, the manufacturer's grade, and the claimed class under this specification. Flexural, impact, tensile, and creep specimens shall also be identified as to the direction of cutting from the sheet and/or the direction of the molding pressure.

F-2c. When testing materials that may be suspected of anisotropy, duplicate sets of test specimens shall be prepared, one set with the long axis parallel to the direction of anisotropy, and another set with the axis normal to the direction of anisotropy.

F-2d. All test specimens shall be furnished in clear unpigmented composition.

F-3. Standard Conditioning of Test Specimens:

F-3a. As Received: The specimens shall be tested dry, as received from the manufacturer, at the temperature and humidity prevailing in the testing room at the time the tests are made. No special preparation is necessary other than to ascertain that the test specimens are approximately at the temperature of the testing room.

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F-3b. Desiccation: Specimens shall be conditioned for a period of 48 hours in a circulating air oven at a temperature of $50^{\circ} \pm 3^{\circ}\text{C}$ ($122^{\circ} \pm 5.4^{\circ}\text{F}$). The specimens shall then be removed from the oven and cooled in a desiccator over anhydrous calcium chloride to room temperature.

F-3c. Standard Laboratory Atmosphere: Specimens shall be conditioned for a period of not less than 48 hours at a temperature of $25^{\circ} \pm 2^{\circ}\text{C}$ ($77^{\circ} \pm 3.6^{\circ}\text{F}$) and a relative humidity of 50 ± 2 per cent.

F-3d. Water Immersion:

F-3d(1). Room Temperature: Specimens shall be wholly immersed in distilled water at a temperature of $25^{\circ} \pm 2^{\circ}\text{C}$ ($77^{\circ} \pm 3.6^{\circ}\text{F}$) for a period of 48 hours. After the immersion period they shall be removed from the bath and all surface water shall be removed by wiping with a dry cloth.

F-3e. High Humidity:

F-3e.(1) Moderate Temperature: Specimens shall be conditioned for 96 hours at a temperature of $33^{\circ} \pm 2^{\circ}\text{C}$ ($91.40^{\circ} \pm 3.6^{\circ}\text{F}$) and a relative humidity of 90 ± 2 per cent. Tests shall be made in the conditioning chamber.

F-3f. Low Temperature: Specimens shall be placed in air at a temperature of $-55^{\circ} \pm 3^{\circ}\text{C}$ ($-67^{\circ} \pm 5.4^{\circ}\text{F}$) until thermal equilibrium is reached, but in no case for less than two hours. Tests shall be made at the temperature of the conditioning.

F-3g. High Temperature: Specimens shall be placed in a circulating air oven at $85^{\circ} \pm 3^{\circ}\text{C}$ ($185^{\circ} \pm 5.4^{\circ}\text{F}$) for the time specified in the test procedure. Tests shall be made at the temperature of the conditioning.

F-4. Methods of Test: Such tests shall be made as are necessary to assure conformance with this specification. Unless otherwise specified, tests shall be made at room temperature $25^{\circ} \pm 2^{\circ}\text{C}$ ($77^{\circ} \pm 3.6^{\circ}\text{F}$). Tests shall be started within 30 seconds after the completion of the conditioning.

F-4a. Water Absorption: Three specimens, constructed as in Figure 1 shall be tested for net water absorption and solubles extracted, where required in Table I. Conditioning, apparatus, test procedure, and report shall be as described in ASTM D 570-42, 24 hour immersion.

F-4b. Chemical Resistance: Three specimens, constructed as in Figure 1 shall be tested in the as-received condition for resistance to such chemicals as are specified in the contract or order. Apparatus, test procedure, and report shall be as described in ASTM D 543-41T.

F-4c. Heat Distortion Temperature: Three specimens constructed as in Figure 2 shall be tested for the condition specified in F-3b where required in Table I. The load shall be applied in the direction of the molding pressure. Apparatus, test procedure, and report shall be as described in ASTM D 648-41T.

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