



Designation: F942 – 18 (Reapproved 2023)^{ε1}

Standard Guide for Selection of Test Methods for Interlayer Materials for Aerospace Transparent Enclosures¹

This standard is issued under the fixed designation F942; 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.

^{ε1} NOTE—Editorial changes made in 3.2 in June 2023.

1. Scope

1.1 This guide summarizes the standard test methods available for determining physical and mechanical characteristics of interlayer materials used in multi-ply aerospace transparent enclosures.

1.2 Interlayer materials are used to laminate glass-to-glass, glass-to-plastic, and plastic-to-plastic. Interlayer materials are basically transparent adhesives with high-quality optical properties. They can also serve as an energy absorbing medium, a fail-safe membrane to contain cockpit pressure and to prevent entry of impact debris; a strain insulator to accommodate different thermal expansion rates of members being laminated and as an adherent to prevent spalling of inner surface ply material fragments. The relative importance of an interlayer characteristic will be a function of the prime use it serves in its particular application.

1.3 This guide, as a summary of various methods in Section 2, is intended to facilitate the selection of tests that can be applied to interlayer materials.

1.4 The test methods listed are for use in determining basic design characteristics and in assuring lot-to-lot uniformity of the materials being tested except as noted in 3.3.

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.*

¹ This guide is under the jurisdiction of ASTM Committee F07 on Aerospace and Aircraft and is the direct responsibility of Subcommittee F07.08 on Transparent Enclosures and Materials.

Current edition approved May 1, 2023. Published June 2023. Originally approved in 1985. Last previous edition approved in 2018 as F942 – 18. DOI: 10.1520/F0942-18R23E01.

2. Referenced Documents

2.1 ASTM Standards:²

- C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
- D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
- D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- D542 Test Method for Index of Refraction of Transparent Organic Plastics
- D570 Test Method for Water Absorption of Plastics
- D696 Test Method for Coefficient of Linear Thermal Expansion of Plastics Between –30°C and 30°C with a Vitreous Silica Dilatometer
- D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics
- D1004 Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheet
- D1045 Test Methods for Sampling and Testing Plasticizers Used in Plastics
- D1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheet or Film at Elevated Temperature
- D1824 Test Method for Apparent Viscosity of Plastics and Organosols at Low Shear Rates
- D2240 Test Method for Rubber Property—Durometer Hardness
- D2766 Test Method for Specific Heat of Liquids and Solids (Withdrawn 2018)³
- D2857 Practice for Dilute Solution Viscosity of Polymers

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.

- D3167 Test Method for Floating Roller Peel Resistance of Adhesives
- D3418 Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry
- D3465 Guide for Purity of Monomeric Plasticizers by Gas Chromatography
- D3835 Test Method for Determination of Properties of Polymeric Materials by Means of a Capillary Rheometer
- E313 Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates
- E1530 Test Method for Evaluating the Resistance to Thermal Transmission by the Guarded Heat Flow Meter Technique
- E1640 Test Method for Assignment of the Glass Transition Temperature By Dynamic Mechanical Analysis
- F520 Test Method for Environmental Resistance of Aerospace Transparencies to Artificially Induced Exposures
- F521 Test Methods for Bond Integrity of Transparent Laminates
- F1164 Test Method for Evaluation of Transparent Plastics Exposed to Accelerated Weathering Combined with Biaxial Stress
- F1316 Test Method for Measuring the Transmissivity of Transparent Parts
- F1362 Test Method for Shear Strength and Shear Modulus of Aerospace Glazing Interlayer Materials

3. Significance and Use

3.1 This guide is intended for use by material suppliers, aircraft transparent enclosure fabricators, airframe manufacturers, government agencies, and others that may become involved in the testing of transparent interlayer mate-

rials. These test methods provide data on both individual interlayer materials and material combinations commonly used in the fabrication of aerospace transparent enclosures and provide a means of evaluating the performance of one interlayer material against another.

3.2 Primary characteristics and their long-term stability are critical to the performance of an interlayer material. Basic tests define the as-manufactured material characteristics of the interlayer material. Aging procedures provide for representative exposure to environments that induce changes in material characteristics. Tests performed before and after ageing exposure provide a means of estimating the potential useable life-span of an interlayer material or to compare the durability of one interlayer material with another.

3.3 When employing these test methods for the comparison of interlayer materials after exposure to selected environmental conditions, the user shall be aware that many factors influencing degradation due to weathering vary from one location and exposure period to another location and exposure period. For direct weathering comparisons, the interlayer materials to be compared shall be subjected to the exposure and have the tests performed at the same time. It is emphasized that the test values obtained under these simultaneously applied conditions are for comparative use and their use as design characteristics shall be made with caution.

3.4 The test methods listed include those considered critical to the performance of aircraft transparent enclosures. The user is advised to use the latest revision of any test method.

4. Keywords

4.1 aerospace; interlayer materials; laminates; transparent enclosures

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/