Designation: F 1293 – 91a

Standard Test Method for Evaluation of Coated Transparent Plastics Subjected to Cyclic Flexural/Thermal Fatigue[1]

This standard is issued under the fixed designation F 1293; 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 test method defines a procedure for evaluating the craze resistance of coated transparent plastics subjected to cyclic bending stresses induced by pressurizing the specimen under ambient, hot, and cold temperature conditions.

1.2 *This standard does not purport to address all of the safety problems, 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.*

1.3 The values stated in SI units are to be regarded as the standard.

2. Referenced Document

2.1 *ASTM Standards:*

F 1164 Test Method for Evaluation of Transparent Plastics Exposed to Accelerated Weathering Combined with Biaxial Stress.[2]

3. Terminology

3.1 *Description of Term Specific to This Standard:*

3.1.1 *crazing*—fine cracks, sometimes hairline in size, which may extend in a network in or under the surface or through a plastic.

4. Summary of Test Method

4.1 This test method consists of mounting an unexposed circular plate test specimen in the test apparatus; subjecting the specimen to alternating cycles of pressure and temperature; and periodically inspecting for evidence of crazing on the coated surface of the specimen.

5. Significance and Use

5.1 Many coated transparent plastics, such as acrylic and polycarbonate commercial aircraft cabin windows and military aircraft canopies having abrasion resistant surface coatings, are exposed to significant flexing and temperature changes during flight. These factors influence the initiation of surface crazing, leading to further optical degradation, and finally to in-service removal and replacement. This test method provides the transparency suppliers and users with a realistic screening test to assess the long-term performance of coatings on transparent plastics prior to in-service exposure, taking into account the influence of biaxial bending stress combined with ambient, elevated, and low temperature.

6. Apparatus

6.1 *Manifold Test Fixture*—The pressure-cell/test-fixture used to flex the specimen is detailed in Test Method F 1164. Safety precautions should be taken to depressurize the test fixture prior to handling, removing, or changing specimens or servicing the heating/cooling chamber, or a combination thereof.

6.2 *Heating/Cooling Chamber*—Details of design and construction of a high/low temperature test chamber are optional. However, the following general guidelines should be implemented to satisfy essential requirements.

6.2.1 Use insulated construction.

6.2.2 The cabinet shall be cooled using expendable refrigerant, either liquid nitrogen vapor or liquid carbon dioxide vapor, and heated using clean air.

6.2.3 Thermocouples are satisfactory for measuring temperature. Control the maximum test temperature fluctuation inside the cabinet to ±4°C (7°F) within 2 in. distant from the test surface midpoint of each specimen.

7. Test Specimens

7.1 Use at least three coated specimens for each coating being tested. The specimen configuration shall be as follows: clean, coated, transparent circular plates, 216 mm (8.50 in.) in diameter, having both sides substantially plane and parallel; coated specimen nominal thickness being 5 m (0.20 in.).

8. Test Conditions

8.1 Conduct tests in the laboratory atmosphere of 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 5 % relative humidity unless otherwise specified.

9. Procedure

9.1 Code mark each specimen and circumferentially clamp specimen in the manifold test fixture using 2.825 J (25 in-lb) bolt torque. The outer tensile test/exposure side of each specimen shall be the coated surface.

9.2 In accordance with Test Method F 1164, calibrate or calculate the required pressure to induce an outer coated surface (tensile) strain 13.8×10^6 $(1-\nu)/E$ m/m in metric units (2000 $(1-\nu)/E$ in./in. in inch pound units in the center of the specimen, where ν = Poisson's ratio at room temperature and E = modulus of elasticity (Pa or psi) at room temperature for the test material.

9.3 Regulate the pressurization controls to provide a

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[2] *Annual Book of ASTM Standards*, Vol 15.03.