



Standard Test Method for Stress Crazeing of Acrylic Plastics in Contact with Liquid or Semi-Liquid Compounds¹

This standard is issued under the fixed designation F484; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method covers determination of the crazing effect that a liquid or semi-liquid test compound will have on transparent acrylic plastic material that is under bending stress.

1.2 Three types of acrylic material are covered. One, two, or all of the materials shall be used in the test, as specified by the procuring agency. When not specified otherwise, all three types of acrylic shall be used in the test.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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 *ASTM Standards:*²

D1193 Specification for Reagent Water

2.2 *Military Standards:*

MIL-PRF-5425 Plastic Sheet, Acrylic, Heat Resistant³

MIL-PRF-8184 Plastic Sheet, Acrylic, Modified³

MIL-PRF-25690 Plastic, Sheets and Formed Parts, Modified Acrylic-Basic, Monolithic, Crack Propagation Resistant³

3. Terminology

3.1 *Definitions:*

¹ This test method is under the jurisdiction of ASTM Committee F07 on Aerospace and Aircraft and is the direct responsibility of Subcommittee F07.07 on Qualification Testing of Aircraft Cleaning Materials.

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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 Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, Attn: NPODS.

3.1.1 *craze*—a minute surface crack, sometimes hairline in size.

NOTE 1—Hairline craze cracks are very difficult to see except with careful inspection under properly oriented light.

3.1.2 *crack*—a fracture or tear.

4. Types

4.1 *Type A*, cast acrylic material shall conform to MIL-PRF-5425, Finish A.

4.2 *Type B*, cast acrylic material shall conform to MIL-PRF-8184, Finish B.

4.3 *Type C*, stretched acrylic material shall conform to MIL-PRF-25690.

5. Apparatus

5.1 *Stress Apparatus*—The means of stressing the acrylic plastic test specimen bars shall be as shown in Fig. 1.

6. Test Specimens

6.1 The test specimens shall be machined from 0.25 ± 0.025 in. (6.4 ± 0.64 mm) thick polished acrylic plastic sheet conforming to the applicable specification.

6.2 The test specimens shall be 1 ± 0.03 in. (25.4 ± 0.8 mm) wide by 7 ± 0.05 in. (177.8 ± 1.27 mm) long by 0.25 ± 0.025 in. (6.4 ± 0.64 mm) thick. Edges shall be a smooth machined surface without cracks.

7. Conditioning

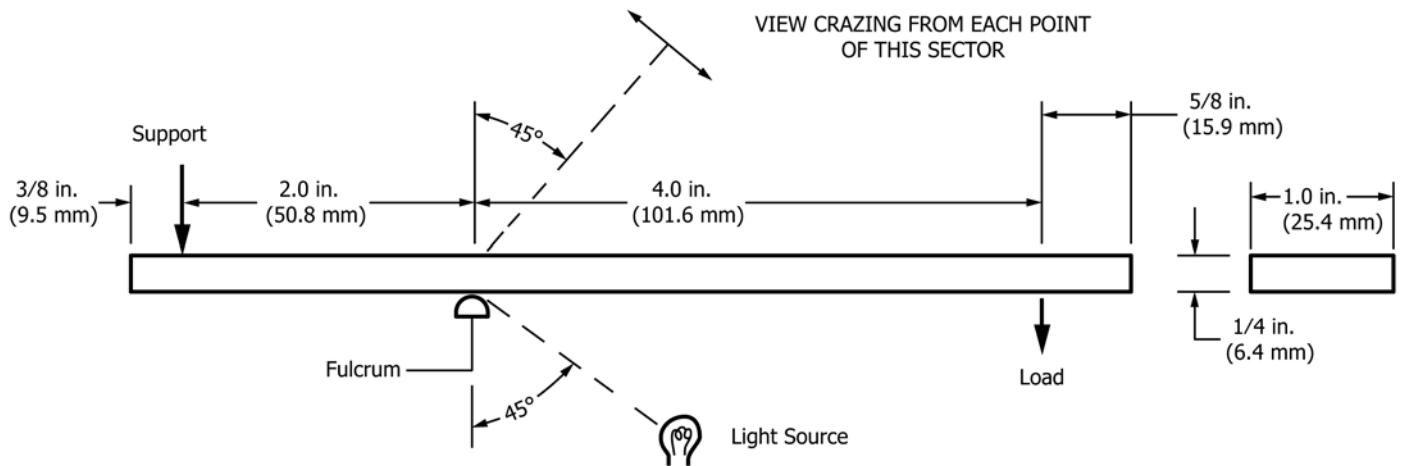
7.1 Do not anneal Type C acrylic specimens.

7.2 Anneal Type A and Type B acrylic test specimens after machining by heating in a circulating air oven at $195 \pm 5^\circ\text{F}$ ($91 \pm 3^\circ\text{C}$) for $5\frac{1}{2}$ h. Cool the specimens to room temperature in the oven using a uniform cooling rate of 50°F (28°C)/h.

7.3 Condition all specimens at $75 \pm 10^\circ\text{F}$ and $50 \pm 5\%$ relative humidity for a minimum of 24 h just before testing.

8. Procedure

8.1 Test two specimens of each acrylic material specified for each of the test compounds being evaluated.



Load: outer fiber stress 3000 psi (20 685 kPa) Type A acrylic
 outer fiber stress 3500 psi (24 132 kPa) Type B acrylic
 outer fiber stress 4500 psi (31 027 kPa) Type C acrylic

Formula: load, lb = $w \times t^2 \times \frac{\text{stress in psi}}{24}$
 load, g = $w \times t^2 \times \frac{\text{stress in kPa}}{5930}$
 where:
 w = width of specimen in inches or millimetres to nearest 0.001 in. or 0.025 mm, respectively, and
 t = thickness of specimen in inches or millimetres to nearest 0.001 in. or 0.025 mm, respectively. Width and thickness shall be measured at the stress area.

Note: The fulcrum radius shall be 1/4 in. (6.4 mm) where it bears on the acrylic specimen.

FIG. 1 Description of Stressing Procedure

8.2 Conduct the test at a temperature of $75 \pm 10^\circ\text{F}$ ($23 \pm 5^\circ\text{C}$).

8.3 Carefully load the acrylic specimen as a cantilever beam as shown in Fig. 1. Unless otherwise specified, the following are recommended stress levels:

8.3.1 Type A specimens shall be stressed to an outer fiber stress of 3000 psi (20 685 kPa).

8.3.2 Type B specimens shall be stressed to an outer fiber stress of 3500 psi (24 132 kPa).

8.3.3 Type C specimens shall be stressed to an outer fiber stress of 4500 psi (31 027 kPa).

8.4 Allow the specimen to remain under the designated stress for 10 min; then examine under the lighting and visual inspection conditions shown in Fig. 1 to be sure no crazing has initiated. If crazing has occurred, substitute another acrylic test specimen.

8.5 With the test specimen again under the designated load, place an absorbent cotton or flannel swatch, 1/2 to 5/8 in. (12.7 to 15.9 mm) square, on the tension surface (top) of the craze test specimen directly over the fulcrum. Position the cotton or flannel swatch in the middle of the specimen so there is a clear space along each edge to avoid initiating crazing at the edge.

8.6 Completely soak the cotton or flannel swatch with the test fluid or compound to be evaluated. Keep the swatch moist with the test compound for the duration of the test. Take care to avoid spreading or smearing the test compound to the edge

of the test specimen. No test compound should contact the acrylic specimen within 1/8 in. (3.2 mm) of the edge.

8.7 The test duration shall be 8 h. After test compound exposures of 30 min, 1 h, 2 h, 4 h, and 8 h, inspect the specimens for crazing or degradation. Do this by sliding the moist swatch approximately 2 in. toward the loaded end. Carefully wipe the test area clean. A clean cloth wet with distilled or deionized water conforming to Specification D1193, Type IV water may be used to remove dry residue if necessary in the cleaning operation.

8.8 Carefully examine the top (tension) surface of the specimen in the manner shown in Fig. 1 for any evidence of crazing, cracks, or etching effect on the polished surface of the acrylic test specimen.

8.8.1 Use a single point source of concentrated colimated light, such as a large-size microscopic illuminator, for inspection.

8.9 Disregard crazing that initiates at the edge of the specimen unless it grows and extends across the specimen. In this case, the time of the meeting of the crazing from the edges shall be taken as the end point of the test. Terminate the test as soon as crazing or degradation is observed, even though the full 8-h duration has not been reached.



8.10 After each examination at the specified intervals during the 8-h period, move the moist swatch back to its original position over the stress area and remoisten it with test compound as required.

9. Report

9.1 The report shall include the following:

9.1.1 Test compound evaluated,

9.1.2 Type of acrylic craze test specimen used,

9.1.3 Description of acrylic craze test surface after test; that is, not affected, light crazing, cracked, rippled, stained, and

9.1.4 Exposure time to craze or degrade surface, when applicable.

10. Precision and Bias

10.1 No statement is made about either precision or bias of this test method for measuring the crazing effect of the candidate test liquid, on acrylic plastic, since the result merely states that there is conformance to the criteria for success. Aerospace industry and multilocation laboratory use and acceptance of this test method indicates a high degree of repeatability.

11. Keywords

11.1 acrylic plastics; hairline craze crack; liquid compounds; outer fiber bending stress; stress crazing

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