



Designation: F791 – 18 (Reapproved 2023)

Standard Test Method for Stress Cracking of Transparent Plastics¹

This standard is issued under the fixed designation F791; 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 the determination of the critical crazing stress for a transparent plastic material when exposed to a specific solvent, chemical, or compound at a specific temperature.

1.2 *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.*

1.3 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D618 Practice for Conditioning Plastics for Testing

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.2 *Other Method:*

ARTC (Aircraft Research and Testing Committee of the Aircraft Industries Association of America, Inc.) Conditioning Method³

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *crazing*—a group of surface fissures that appear to be small cracks in the material, although they are not.

¹ This test method 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.

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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 Aircraft Industries Association, 1725 DeSales St. NW, Washington, DC 20034.

3.1.1.1 *Discussion*—Crazing is a form of yielding in polymers characterized by a spongy void filled fibrillar structure. The density in the craze changes resulting in a change in the index of refraction, which causes light to be reflected off of the crazes. This light reflection causes the crazes to sparkle when viewed from certain angles. The crazes are sometimes random and scattered with varied lengths and depths but usually are oriented perpendicular to a tensile stress. Crazing is difficult to detect. It becomes more pronounced when viewed with a light source that is at an oblique angle.

4. Significance and Use

4.1 This test method provides a guide for evaluating whether a specific solvent, chemical, or compound is detrimental to a transparent plastic as a result of a manufacturing process, a fabrication operation, or the operational environment. All transparent plastics are susceptible to crazing, though in widely varying degree and from a variety of causes. This test method is intended to allow establishment of the crazing stress when the simultaneous action of both load and a material that will cause crazing is applied, producing non-reversible damage that limits the usage of that transparent plastic in a specific application.

5. Apparatus

5.1 *Test Fixture*, with fluorescent light source illustrated and constructed as shown in Figs. 1 and 2.

5.2 *Drill Fixture* constructed as shown in Fig. 3.

5.3 *Marking Fixture*, constructed as shown in Fig. 3.

5.4 *Portable Specimen Rack*, constructed in the manner as shown in Fig. 4 for handling and conditioning test specimens.

5.5 *Weights*—A container and shot for the application of weight on the rack as shown in Fig. 1.

5.6 *Filter Paper*, quantity of 0.50 in. by 1.0 in. (12.7 mm by 25.4 mm) pieces of filter, medium-retention filter paper.

6. Test Specimens

6.1 The test specimen shall be machined from the transparent plastic material to be evaluated. A minimum of six

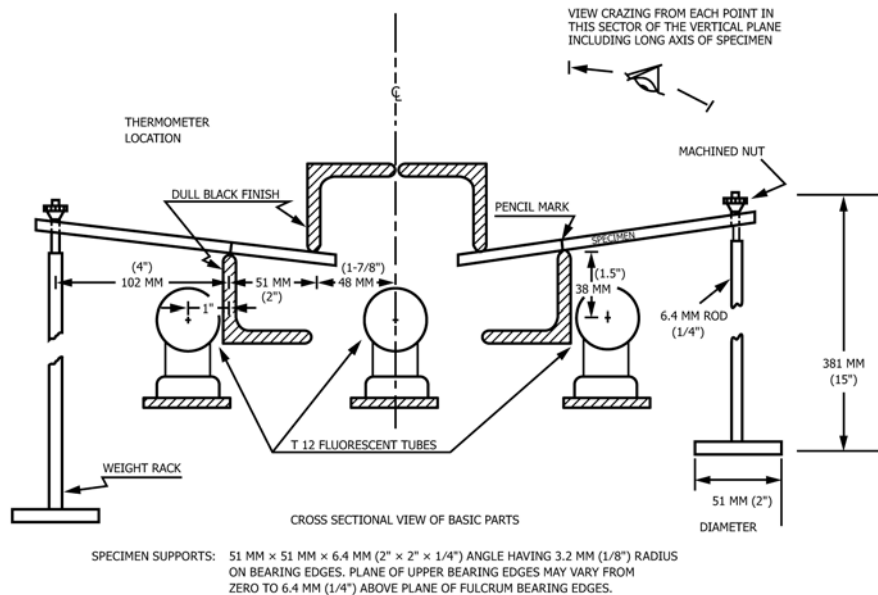


FIG. 1 Accelerated Craze Test Fixture

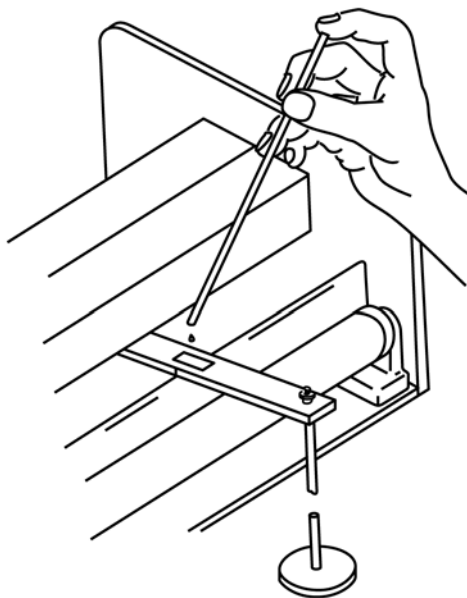


FIG. 2 Application of Test Liquid to Piece of Filter Paper on Top Surface of Test Specimen

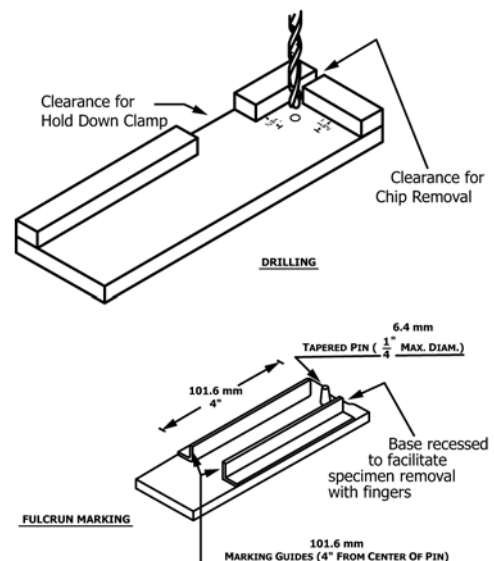


FIG. 3 Fixtures for Specimen Preparation

specimens for each solvent, chemical, or compound is required. The preferred transparent plastic sheet material thickness is $6.35 \text{ mm} \pm 0.64 \text{ mm}$ ($0.250 \text{ in.} \pm 0.025 \text{ in.}$). Other thickness material is acceptable, but the actual thickness must be recorded. Orientation of each test specimen within the test sheet or part must be recorded.

6.2 The test specimens shall be $25.4 \text{ mm} \pm 0.8 \text{ mm}$ ($1.00 \text{ in.} \pm 0.03 \text{ in.}$) wide by $177.8 \text{ mm} \pm 1.27 \text{ mm}$ ($7.00 \text{ in.} \pm 0.05 \text{ in.}$) long by thickness.

6.3 The edges shall be smooth machined surfaces without cracks, and the test specimen surface shall be free of defects or irregularities. If the test specimen has been machined to thickness, the non-machined surface shall be the test surface.

7. Preparation of Apparatus

7.1 Once the load for a particular stress is calculated, that load will be the sum of the individual weights of the weight rack, rod, lead weights, container, shot, and the radiused nut. For convenience of assembly, the weight rack pan may be stamped with the total weight of the pan, rod, and nuts as a unit. A container, such as a $\frac{1}{2}$ pt (0.24 L) paint can with a 6.4 mm ($\frac{1}{4} \text{ in.}$) hole drilled in the center of the bottom and installed so it slides up and down on the rod, can serve as a receptacle for the lead shot (or alternative non-toxic media) to attain required weight.

8. Conditioning

8.1 Precondition the test specimens in accordance with one of the following procedures: