Designation: F 736 – 95

Standard Test Method for Impact Resistance of Monolithic Polycarbonate Sheet by Means of a Falling Weight[1]

This standard is issued under the fixed designation F 736; 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 covers the determination of the energy required to initiate failure in monolithic polycarbonate sheet material under specified conditions of impact using a free falling weight.

1.2 Two specimen types are defined as follows:

1.2.1 *Type A* consists of a flat plate test specimen and employs a clamped ring support.

1.2.2 *Type B* consists of a simply supported three-point loaded beam specimen (Fig. 1) and is recommended for use with material which can not be failed using the Type A specimen. For a maximum drop height of 6.096 m (20 ft) and a maximum drop weight of 22.68 kg (50 lb), virgin polycarbonate greater than 12.70 mm (½ in.) thick will probably require use of the Type B specimen.

NOTE 1—See also ASTM Methods: D 1709, D 2444 and D 3029.

1.3 *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.* For specific hazard statement, See Section 7.

2. Referenced Documents

2.1 *ASTM Standards:*

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[2]

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials[2]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *failure (of test specimen)*—failure is signified by the presence of any crack or split in the impact-deformed area that was created by the impact of the falling weight and that can be seen by the naked eye.

4. Summary of Test Method

4.1 The test procedure to cause failure covers a range of impact energies and differs with respect to geometry and support of test specimen Type A and test specimen Type B. Guidelines are established to control drop heights, impact velocity, drop weights, impactor heads, impactor release, impactor rebound, impact location, and specimen configuration which are applicable to a falling weight impact tester designed to accommodate Type A or Type B test specimens, or both, fabricated from monolithic polycarbonate sheet material.

5. Significance and Use

5.1 This practice is applicable for qualitatively evaluating coated and uncoated monolithic polycarbonate sheet material, for monitoring process control, for screening studies, and as an aid in the prediction of hardware performance when exposed to impact service conditions.

5.2 A limitation of Type A specimen testing is that a thick sheet may not fail since the available impact energy is limited by the maximum drop height and falling weight capacity of the test apparatus. Use Specimen Type A for material less than 12.7 mm (0.50 in.) thick.

5.3 Within the range of drop heights of this system, tests employing different velocities are not expected to produce different results. However, for a given series of tests, it is recommended that the drop height be held approximately constant so that velocity of impact (strain rate) will not be a variable.

5.4 As the polycarbonate specimen undergoes large plastic deformation under impact, the down (opposite impact) side is under tensile loading and most influential in initiating failure. Polycarbonate sheet coated on one side may yield significantly different test results when tested with the coated side down versus the coated side up.

5.5 Direct comparison of specimen Type A and specimen Type B test results should not be attempted. For test programs that will require the comparison of interlaboratory test results the specimen type and the approximate drop height must be specified.

5.6 Monolithic polycarbonate sheet is notch sensitive. Data obtained from other test methods, particularly notched Izod/Charpy test results, and extremely high- or low-strain rate test results, should not be compared directly to data obtained from this method. It is noted that Type A specimens, free of flaws,

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[2] *Annual Book of ASTM Standards*, Vol 08.01.

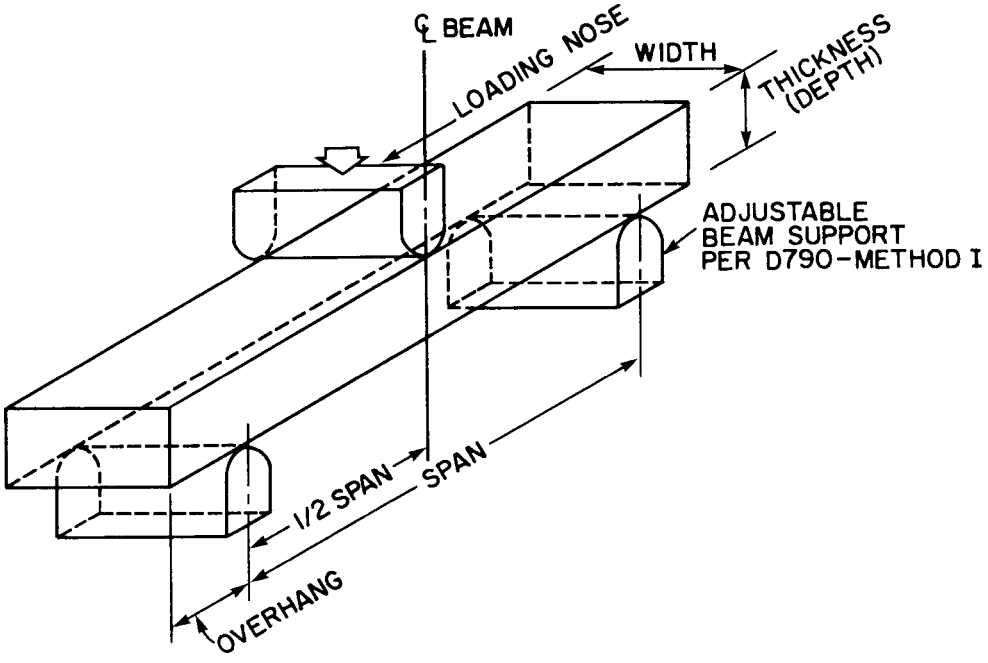

FIG. 1 Type B Specimen Geometry and Loading

have not experienced the characteristic ductile-to-brittle transition between thin, less than 3.18 mm (⅛ in.), and thick, greater than 7.94 mm (5⁄16 in.), sheet as reflected by other test methods.

6. Apparatus

6.1 *Impact Tester*—The apparatus shall be constructed essentially as shown in Fig. 2. Although not specified, materials called out have been found to be satisfactory.

6.1.1 *Drop Height*—A lifting carrier shall be provided to raise or lower the falling weight impactor that will be adjustable within the range of 0.305 m (1 ft) to maximum drop height and measurable to the nearest 25.40 mm (1 in.).

6.1.2 *Drop Weight*—The falling weights shall be detachable, interchangeable, and variable in small known increments from a total of 0.45 kg (1 lb) to a maximum drop weight of 50 kg (110 lb).

6.1.3 *Impactor*—The loading nose to be used with Type A specimens is shown in Fig. 3; with Type B specimens as shown in Fig. 4. The impactor surface shall be free of nicks or other surface irregularities. The impactor geometry for Type B specimens corresponds to Test Method D 790.

6.1.4 *Impact Location*—The center of mass of the falling weight shall be guided by a two cable system or other suitable means to repeatedly strike within 2.54 mm (0.10 in.) of the center of the specimen support fixture as measured in the plane of the specimen, in order to assure uniform, reproducible drops. Friction retarding the falling weight should be minimal so that the impact velocity approaches

$$\sqrt{2gh}$$

where:

g = acceleration of gravity, and
h = drop height.

6.1.5 *Supports*—Clamp and support rings as shown in Fig. 5 and Table 1 will be used to accommodate Type A plate specimens. Adjustable D 790–Test Method 1 supports will be used to accommodate the Type B simply supported beam specimens of 6 + 1 span-to-depth ratio. Specimens shall be supported so that the surface to be impacted is horizontal and at an angle of 90 (± 1)° (π/2 radians) with respect to the falling weight guides.

TABLE 1 Plate Support Ring Geometry

NOTE 1—Reference Fig. 5 for definition of "A" and "C."

Ring Size	"*A*"	"*C*"	Span
	mm (in.)	mm (in.)	mm (in.)
1	88.9 (3.50)	127.0 (5.00)	101.6 (4.00)
2	114.3 (4.50)	157.5 (6.20)	127.0 (5.00)
3	190.5 (7.50)	254.0 (10.00)	203.2 (8.00)
4	292.1 (11.50)	381.0 (15.00)	304.8 (12.00)

6.1.6 *Release*—An electromagnetic or mechanical releasing mechanism, capable of supporting the maximum falling weight, will be provided to assure uniform and reproducible drops.

6.1.7 *Rebound Catcher*—Means must be provided to catch the weight if it rebounds to prevent restriking the specimen and causing further damage.

6.1.8 *Energy Absorber*—An energy absorbent material must be provided beneath the specimen to prevent damage to the fixture when the impactor penetrates the specimen.

7. Hazards

7.1 To reduce a hazard to the test operator or witness, or both, a protective enclosure shall be placed around the test specimen impact area to contain any flying particles which may be generated during the test. No further adjustments to the specimen shall be made after positioning the falling weight at the selected drop height.