

LAMINATED GLASS RESISTANCE TO LEADING SIMULATED STONE IMPACT TESTING

Application

This test procedure assesses the resistance of a laminate (typically a windshield or windscreen) to develop long cracks resulting from flaws caused by stone impact. Stone impact is simulated using steel ball bearings (BBs) discharged at typical highway speed from a device here called a "BB Impact Tester".

Chemicals, materials, parts, and equipment referenced in this document must be used and handled properly conforming to regional firearms legislation and health and safety requirements.

Apparatus and Materials Required

Test Stand

- The laminate shall be mounted vertically and the BB Impact Tester oriented so that the BB strikes the surface at 45°. The laminate shall be supported at its bottom quarter points and leaning back 10 ±2°, as illustrated in Figure 1.



Figure 1 - Stone impact test support at the quarter points.

- The surface of the laminate must not be loaded with a force that would create tension on the surface.

Regulated air source

The BB Impact Tester requires a regulated 0 to 90 PSI (0 to 0.6 MPa) maximum dry air source with 4 CFM (100 l/m) minimum flow. The air pressure determines the speed the BB is discharged at. A digital air pressure regulator provides the best speed repeatability.

BB Impact Tester

- The direction of impact shall be at a 45° angle to the surface of the laminate.
- Chronograph or equivalent for measuring speed of impact.
- See Figure 2 for the Ford BB Impact Tester with a 45° impact angle and built-in chronograph.

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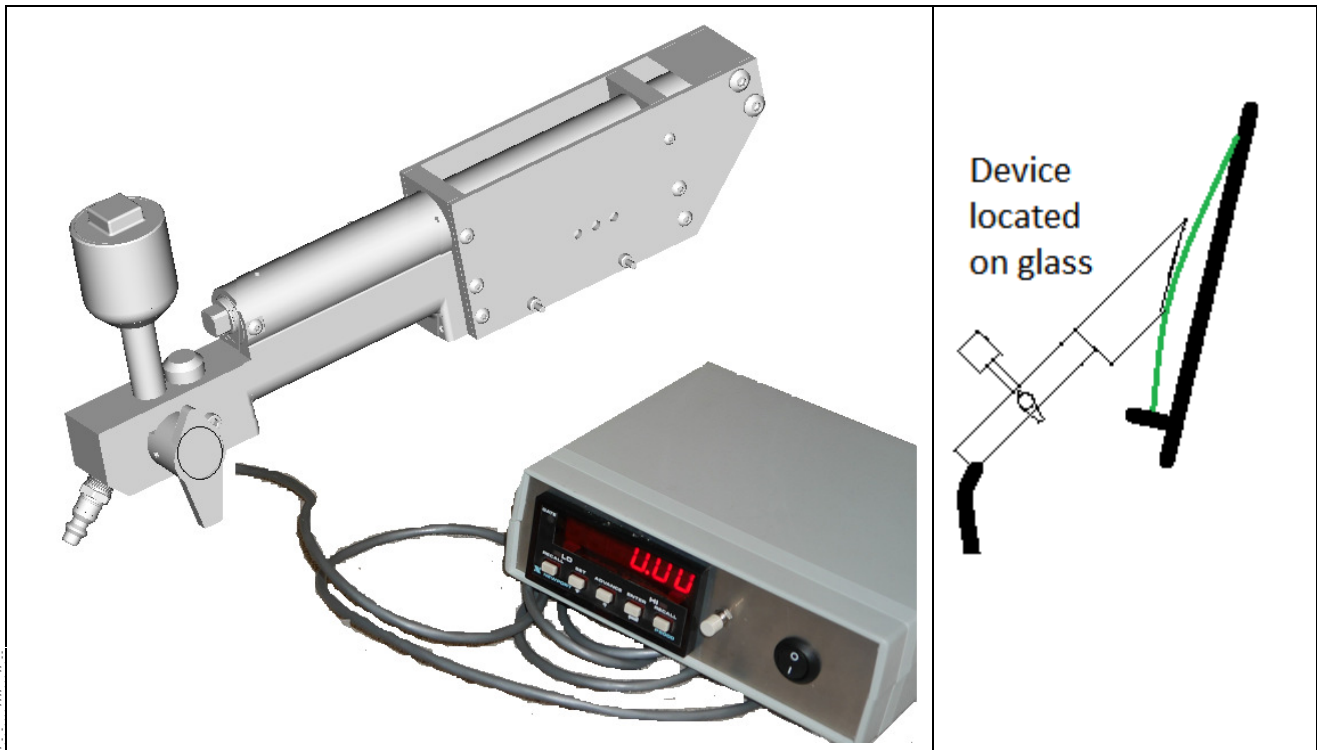


Figure 2 - Ford BB Impact Tester with built-in chronometer, CAD assembly number 976-529-0

BB

- 0.25 ± 0.0001 inch, (6.35 ± 0.0025 mm) BBs, approximately 1.0 gram mass. E52100 Alloy Steel, ball hardness within a range of HRC 60 – 67. It is essential that the BBs be free of surface particles of any kind or size. The BBs shall be washed with isopropyl alcohol and dried between paper wipes prior to each use. BBs with glass chips adhered to its surface will cause a high damage rate. Use an appropriate solvent to remove any oils, grease, or other contaminants on the BB's surface.
- The BB can be reused as often one desires provided there are no flat spots or obvious surface flaws.

Ruler or circle template, millimeters

Conditioning and Test Conditions

All test values indicated herein are based on material conditioned in a controlled atmosphere of 23 ± 2 °C and 50 ± 5 % relative humidity for not less than 4 h prior to testing and tested under the same conditions, unless otherwise specified.

Clean the laminate outer surface. It is essential that the glass surface is free of dust and particles of any kind. Glass chips will cause a high damage rate.

Procedure

Two test procedures are described. Each procedure has its advantages. The Variable Velocity procedure provides the best statistics, can be applied to any glass construction, but takes twice as long to perform. The Fixed Velocity procedure is quicker to perform but is only valid if impact damage occurs. Without impact damage one can't tell if long leads will form. Typically, the Fixed Velocity procedure would be used as a quick method to verify a laminate design and to meet a minimum requirement.