

## **Understanding the Impact Test**

*The “Understanding the Product Safety Tests” Series*

*Impact Testing*, more appropriately titled “Enclosure” Impact Testing, involves striking the product’s enclosure with a defined object at a specified impact energy. Impact Testing requirements take into account a number of variables that affect the likelihood, location, and level of impact that a product may be subjected to in normal use. These variables include whether a product is hand-held, table-top, or floor standing, the weight of the product, and the enclosure material. In all cases, the impact itself is only the pre-cursor to an engineering review of the results.

### **The Purpose of the Test:**

- To verify that the product’s enclosure has adequate strength to withstand the typical impact forces associated with normal use over the life of the product.

**Test Method:** The impact test involves striking the product with a defined impact force delivered with a defined impact device. Impact material/hardness and impactor size/shape/weight, can affect how much of the energy is absorbed on impact. For many standards, the impact force is 5 ft-lb delivered by either a 2 inch or 50 mm diameter steel impact ball that has a mass of 500 g.

**Test Locations:** The test involves striking the product’s enclosure in areas that, if the enclosure failed, could allow access to a “hazard”. This means that if an impact causes an opening in the enclosure, the opening is checked for “access” to hazards using the accessibility probes.

- a) Plastic enclosures are more susceptible to the type of failures that would allow access. However, that does not mean we do not test metal enclosures.
- b) Seams in the enclosure are important to test.
- c) Enclosure vents in areas involving shock and injury hazards must be tested.

**Test Configurations:** All operator accessible sides of the product are to be tested – which means that even the bottom of the product is tested for some product types.

- 1) Impact Ball – Drop vs. Pendulum: To test the sides of the product requires either turning the product on its side for testing or, attaching the impact ball to a string so that the impact ball can be swung as a pendulum. In either case, the impact force applied is to be the same. Both methods are acceptable, however products that do not have flat surfaces usually need to be pendulum tested since they will not sit firmly on their sides.
  - For this reason, it is best to purchase an impact ball that has a removable eyelet so it can be used either for drop or pendulum impact testing.
- 2) Impact Ball vs. Impact Hammer: Some standards specify or allow as an alternative the use of an Impact Hammer instead of an Impact Ball for delivering the impact force. The benefit of using an impact hammer is the ability for pinpoint accuracy in the location where the impact force is applied.
  - a) To help insure that a dropped impact ball hits the intended impact point, many users drop the ball down a PVC pipe.
  - b) The impact ball has a tendency to bounce after the initial impact. You should avoid allowing this and insure that it does not have an effect on the test results. Note that an impact hammer also prevents impact bounce.



#### Test Configurations: (Continued)

- 4) Cold Impact Tests: Plastic enclosures are especially susceptible to cracking in freezing temperatures. Products with plastic enclosures that are rated for use in freezing temperatures must be cold impact tested = the product is conditioned at its low ambient rating and then impact tested in the freezer.
- 5) Impact Test Exceptions:
  - a) In most standards, clear viewing windows for gauges and meters are not to be impact tested.
  - b) If the product is considered stationary or fixed equipment, any sides that are protected by the building after mounting are not tested.
- 6) Alternative Testing – the Drop Test: Hand-held products, transportable products, and very light weight desk top products are usually subjected to drop impact tests rather than the ball impact test.

#### The Test Objectives: The objectives are to find weakness in the product enclosure which includes:

- a) Identifying enclosure materials that are too thin,
- b) Identifying enclosure materials that are too brittle,
- c) Identifying enclosure materials that are too flexible,
- d) Identifying enclosure vent patterns which have inadequate strength for the material used and,
- e) Identifying seams and enclosure securement methods which are inadequate

Additional Pass/Fail Criteria: As mentioned above, the primary pass/fail criteria is to determine if there is “accessibility” to any hazards through any openings created in the enclosure as a result of the impact force. However, there are also secondary pass/fail criteria mentioned in many safety standards. Some of these additional pass/fail criteria include:

- 1) No damage to the strain relief system for cord connected products – when in doubt, the product must continue to comply with the strain relief test after the impact test.
- 2) No reduction to creepage & clearance distances below the distances specified in the standard – the product must continue to comply with the creepage & clearance distance requirements after the impact tests.
- 3) No damage to the protective earthing system – the product must continue to comply with the P.E. requirements.

Conclusion: As you can see, we don’t simply perform the tests because they are in the standard. Each test in the standard has a set of objectives that relate to the 6 Hazards of Product Safety. The Impact Tests are performed as part of the accessibility review for Shock, Energy, & Injury hazards. Verifying the physical integrity of the product’s enclosure is crucial to insuring the product continues to provide protection from a Risk of Shock, a potentially serious hazard that could lead to death by electrocution. It is also critical to insuring that no opening develops in the enclosure that could allow access to hazardous moving parts. It is therefore an extremely important test – another test that directly saves lives.

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