Standard Procedure SP 0012-2:2005

Methods of testing strengths of materials - Part 2: Comparing the impact resistance of materials

1 Scope

This procedure is adapted from BS EN ISO 6603-1:1996 Plastics – Determination of multi-axial impact behaviour of rigid plastics – Part 1: Falling dart method.

The procedure allows comparison of the impact resistance of sheets of various materials such as plastics, wood, cardboard, ceramic tiles and composites.

2 Definitions

impact resistance
Not defined. British Standards use the term ‘impact-failure energy’. This is the impact energy required to break the specimen, or cause specified damage such as cracking or denting.

impact-failure energy
calculated as the mass dropped on the specimen x acceleration due to gravity x height dropped. A high value means that the material has good impact resistance.

3 Principle

An impact force is applied by dropping a mass onto a sample of a material. A steel ball resting on the test specimen concentrates the force onto a small area of contact.* This enormously increases the stress on the material. The energy of the impact is gradually increased, by increasing the mass or distance dropped, until the specimen breaks. Noting the mass and height required to break the test specimen allows comparisons with other materials tested in the same way.
* In BS EN ISO 6603-1 the steel ball is attached to a weighted ‘dart’ dropped onto the test specimen.

3 Apparatus

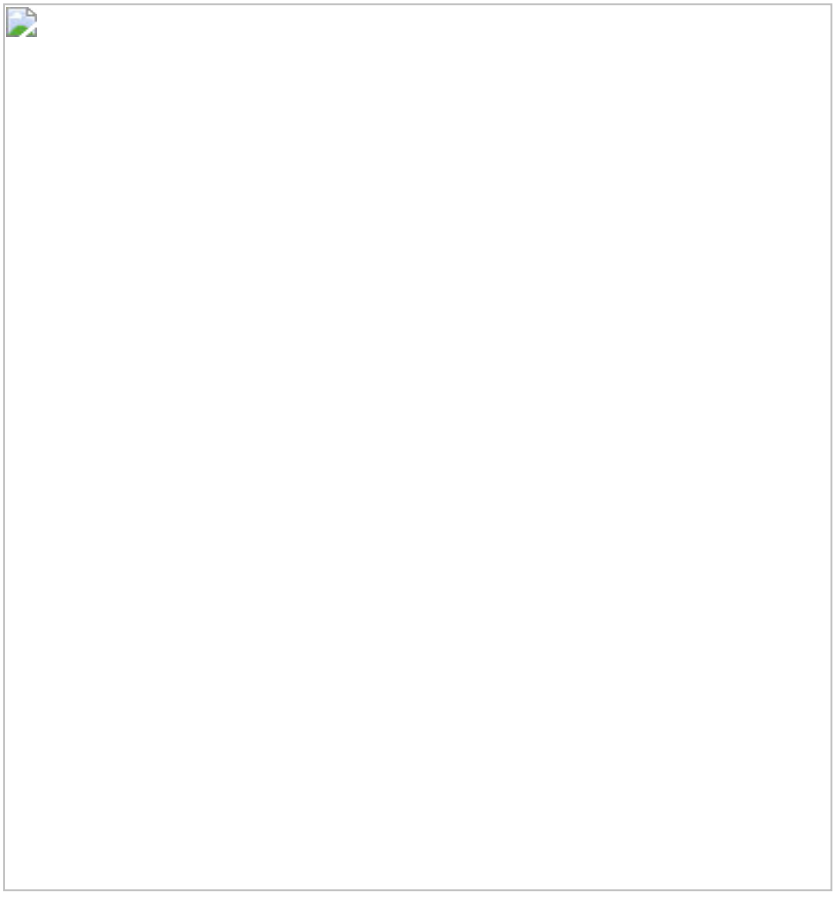
- steel ball bearing, approximately 20 mm diameter
- sticky tack
- two wooden blocks, approximately 40 x 40 x 40 mm
- two wooden blocks, approximately 40 x 40 x 8 mm
- mass hanger with 100 g and 10g masses
- tube, 500 mm long, with an inside diameter slightly larger than the diameter of the mass hanger.
    - tube can be made of any suitable material, provided the inside edge is smooth.
    - tube may need to be longer if the drop height is increased. (See NOTE in procedure.)
- clamp and stand
- thread
- metre rule
- 2 x G-clamp

4 Test Specimens

Test specimens should be 200 x 40 mm and less than 5 mm thick. For comparisons between different materials, specimens should be of the same thickness, or as close as possible. At least three specimens of each material should be tested.

5 Procedure

- Measure and record the thickness of the test specimen, in millimetres.
- Set up a testing rig as shown in figure 1.
- Lift the mass hanger by the thread, and drop it from a height of 300 mm onto the ball bearing.
- Remove the ball bearing and record changes, if any, to the test specimen (for example, cracks or dents).
- Put the ball bearing back into position.
- Add a 100 g mass to the hanger and drop it onto the ball bearing again from a height of 300 mm.
- Record any changes.
- Continue repeating this procedure, adding 100 g masses until the test specimen breaks. Record the mass, in kilograms, and height dropped, in metres. (NOTE: 1 kg = 1000 g; 1 m = 1000 mm)
- If the test specimen breaks too easily to obtain a meaningful result, repeat the procedure using 10 g masses; if it still breaks too easily, decrease the drop height. If the test specimen doesn’t break, try increasing the drop height to give more impact energy.



6 Expression of Results

Calculate the impact energy E required to break the test specimen (the impact-failure energy) using the equation:

E = M x H x 9.8

where

E is the impact energy, in joules

M is the dropped mass required, in kilograms

H is the drop height, in metres

9.8 is the acceleration due to gravity

NOTE: The mass alone can be used to compare the impact resistance of different materials, provided the drop height is the same for each.

7 Test Report

Your test report should include:

(a) reference to this Standard Procedure;

(b) the identity and thickness of each test specimen;

(c) the impact energy required to break each test specimen;

(d) the average value for test specimens of the same material.

(Calculate this by adding the values for all test specimens of this material, and dividing the total by the number of specimens tested.)

Note: Values determined by this method can only be used to compare the impact resistance of different materials if the test specimens have the same thickness.