

IMPACT TEST

An impact test is a dynamic test in which a selected specimen which is usually notched, is struck and broken by a single blow in a specially designed machine. Using an impact machine, the energy absorbed while breaking the specimen is measured.



(a)



(b)

Figure 1. Pendulum type impact testing machines. (a) for metals (b) for plastics

The energy quantities determined are qualitative comparisons on a selected specimen and cannot be converted to energy figures that would serve for engineering design calculations.

In our laboratory, impact testing is done on the Tinius Olsen Impact testing machine, and consists of two tests:

1. Charpy Test
2. Izod Test

The purpose of the impact test is to measure the toughness, or energy absorption capacity of the materials. The principal difference between two tests is the manner in which the specimen is supported. In the Charpy test the specimen is supported as a simple beam with a notch in the center. The specimen is supported so that the notch is on the vertical face away from the point of impact. Figure 2 and 3 show the dimensions of the Charpy test specimen and the positions of the striking edge of the pendulum and the specimen in the anvil.

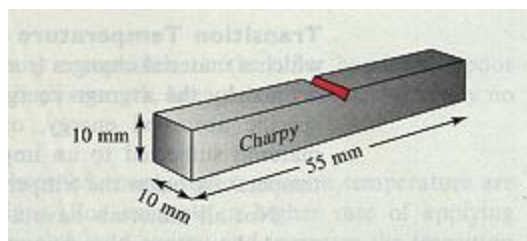


Figure 2. Charpy specimen

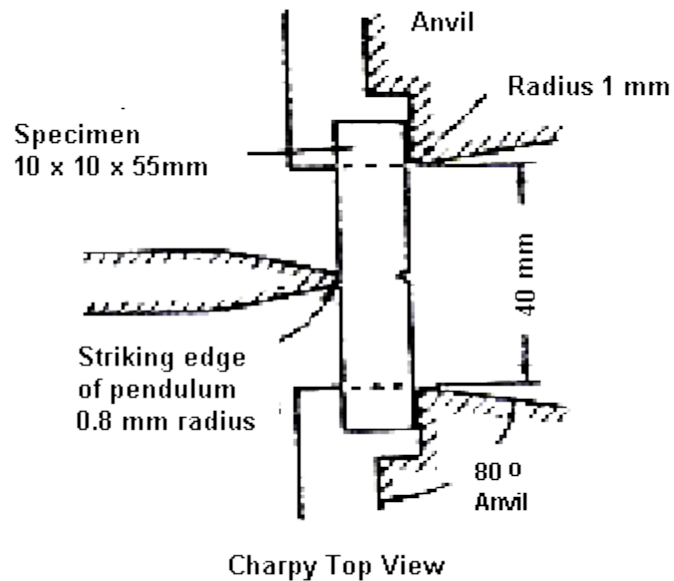


Figure 3. Position of the Charpy test specimen on the impact test machine

In the Izod test, the specimen is held on one end and is free on the other end. This way it forms a cantilever beam. Figures 4 and 5 show the dimensions of the Izod test specimen and the positions of the striking edge of the pendulum and the specimen in the anvil. In this case the notch is just at the edge of the supporting vise and facing into the direction of impact. As with the Charpy, this position places the notch at the location of the maximum tension.

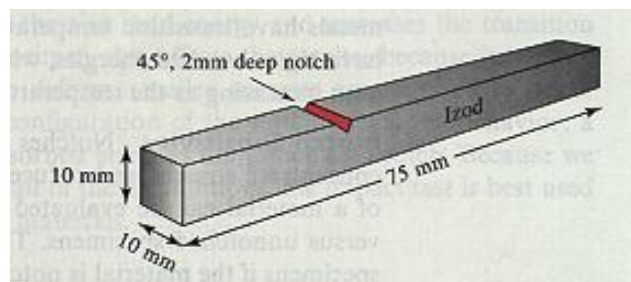


Figure 4. Izod test specimen

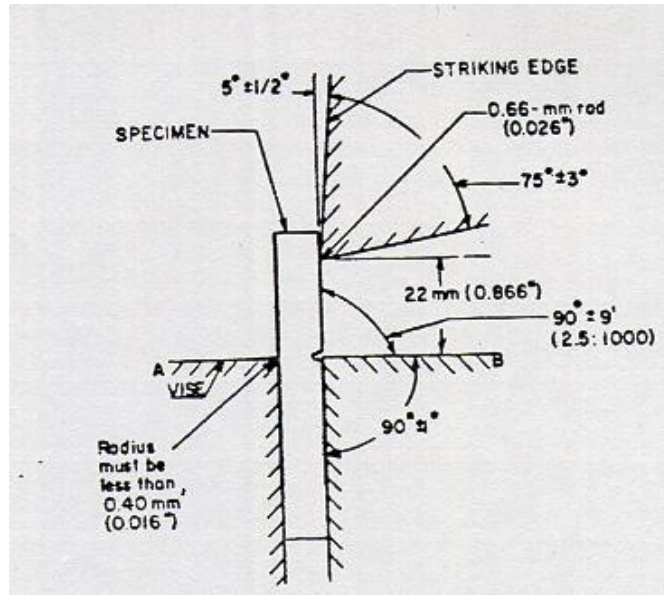


Figure 5. Izod test specimen and its position in the anvil.

The results of the impact test of metals made with various machines differ, owing to the following:

1. Variation in amounts of energy transformed at impact into vibrations of parts of the machines,
2. Variations in striking velocity of the pendulum (striking hammer)
3. Size and form of the specimen.

The major factors that affect the results of an Impact Test are:

1. Velocity
2. Specimen
3. Temperature

Velocity:

The velocity at impact does not appear to appreciably affect the results. However, experiments conducted with machines that develop velocities above certain critical values, impact resistance appears to decrease markedly. In general, the critical velocities are much less for annealed steels than for the same steels in the hardened condition.

Specimen:

In some cases it is not possible to obtain a specimen of standard width from the stock that is available. Decreasing either the width or the depth of these specimen decreases the volume of metal subject to distortion, and thereby tends to decrease the energy absorption when breaking the specimen.

The effect of the notch is to concentrate stresses at the root of the notch, embrittle the material in the vicinity of the notch and , at the same time, raise the elastic limit of the material in this area. When a crack forms at the root of the notch the stress is greatly intensified and the crack quickly progresses across the section. Without the notch, many compositions would simply bend without fracture, and their total capacity to absorb energy could not be detected.

The sharper the notch (i.e. the smaller the included angle) the more pronounced are the effects noted above. The specimen sizes have been standardized so that results can be compared with reasonable confidence.

Theoretical Explanation Of Pendulum Test:

In a typical Pendulum Machine, the mass of the hammer (striking edge) mass (m) is raised to a height (a). Before the mass (m) is released, the potential energy will be :

$$E_p = m g a$$

After being released, the potential energy will decrease and the kinetic energy will increase. At the time of impact, the kinetic energy of the pendulum:

$$E_k = 1/2 m v^2$$

And the potential energy:

$$E_p = m g a$$

Will be equal. $E_k = E_p$

$$m g a = 1/2 m v^2$$

$$v^2 = 2 g a$$

and the impact velocity will be :

$$v = (2 g a)^{1/2}$$

α = Angle of fall

β = Angle of rise

R = Pendulum arm

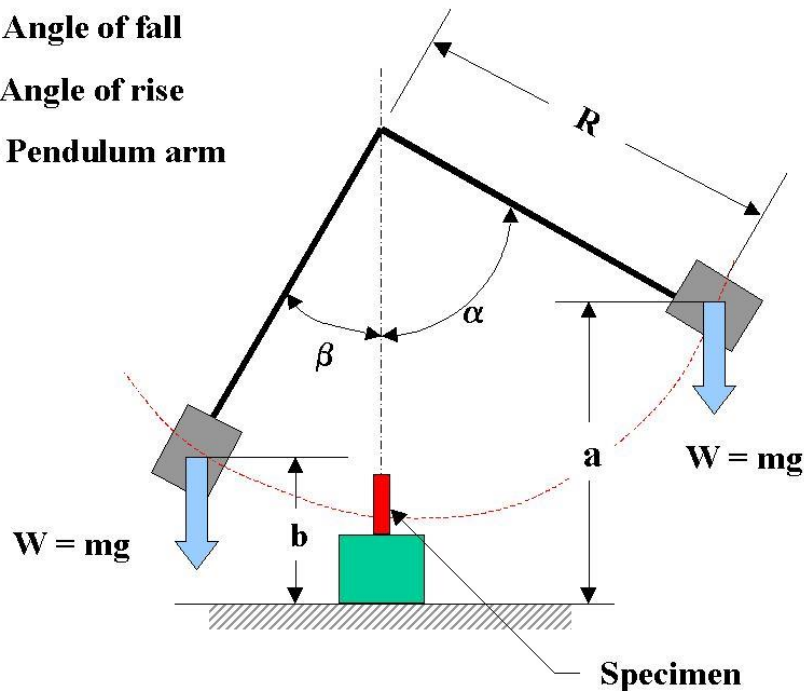


Figure 6

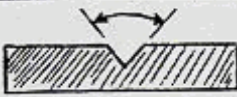


Experimental Procedure:

To conduct the impact test:

1. Obtain and measure the specimens.
2. Learn how to position the specimen in the anvil. Find out the proper position of the impact head (striking edge) and the height the pendulum should be set.
3. Secure the specimen.
4. Set pendulum in raised position.
5. Set pointer on upper limit of the scale.
6. Make sure that the machine is connected to an electrical outlet. Otherwise, the break system that stops the pendulum from swinging can not be used.
7. **WARNING: DO NOT ATTEMPT TO STOP THE PENDULUM MANUALLY.**
8. Release pendulum.
9. Record all results.
10. Examine fracture surfaces and include a description of these surfaces and explanation of their meaning in your report.

Assignment

An impact testing machine has a hammer weighing 60 lbs. At striking edge and a drop height of $a = 40$ inches. The length of the striking arm is $R = 35$ inches. (See Figure 6). Three different specimens that are made of same material but having different angle of notch were tested to observe the effect of the notch angle on the amount of energy absorbed at the time of impact. The following data were obtained:

(Specimen) Angle of Notch	Sketch of the Specimen	(Pendulum) Angle of Rise
30 °		87 °
120 °		79 °
150 °		73 °

Calculate:

1. Velocity of the hammer
2. Initial energy of the hammer
3. Energy of the hammer after the rupture
4. Energy absorbed by the specimen
5. Discuss the relationship between the energy absorbed during impact and the angle of notch of the specimen.

Work Sheet

Length of striking arm = R = _____ (mm)

Velocity of the hammer = V = _____ (m/sec)

Drop Height = a = _____ (mm)

	C/S area of the specimen(A), mm ²	Energy after rupture (joules),I	Impact energy I/A
Case 1			