5.3 Rockwell Hardness Test

Principle:

The **principle of the Rockwell hardness test** is based on measuring the **depth of penetration** of an indenter into the material under a **major load**, following the application of a **minor load**

Indenter:

This test employs a ball and a cone as indenters. B-scale employs a ball of 1/16 inch (1.58 mm) diameter. A cone indenter is used in C-scale with an angle of 120° and point of radius 0.2mm.

Test procedure:

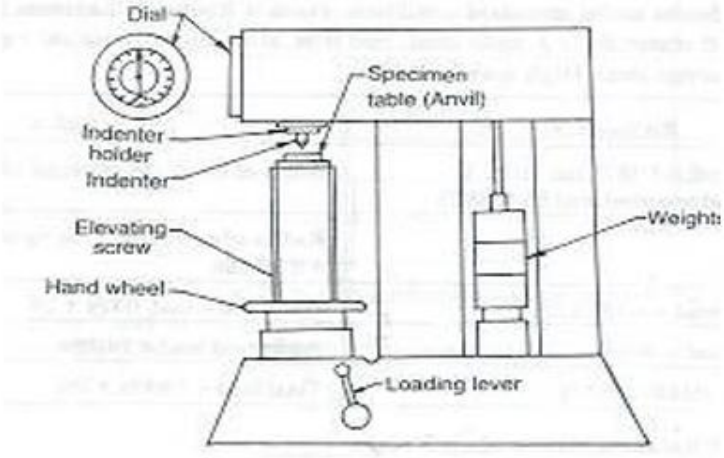
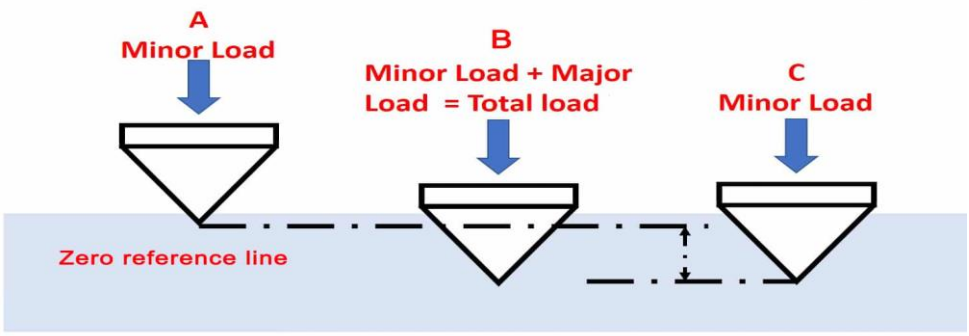


Fig. 1 Schematic diagram of Rockwell hardness test equipment



1. The specimen is placed on the anvil.
2. It is raised with the elevating screw until it touches the indenter
3. Then it is subjected to a minor load of 10kgs until the small pointer shows red mark.

4. Release the operating valve to apply additional load.
5. Immediately after the additional load applied, bring back operating valve to its position
6. Read the position of the pointer on the C scale, which gives the hardness number. These scales are named as A, B, C, D, E, F, M, R, etc. Of these B-scale and C-scale are commonly employed.
7. B-scale is preferred for soft steels and aluminium alloys, while C-scale is chosen for titanium and hard steel.

Precautions:

•Successive impressions should not be superimposed on one another, nor made too close.

•Thin specimen or edge should not be selected.

•Care should be taken for surface preparations, because small size impressions are made.

•The surface of specimen should be flat and free from spring action.

Advantages

•It is more flexible than Brinell test. Large combinations of indenters and loads are available.

•Rockwell testers are fitted with number of fixtures for testing different size and shapes.

•The measurement can be made quickly.

•Since, impressions made are small, it is considered as non-destructive.

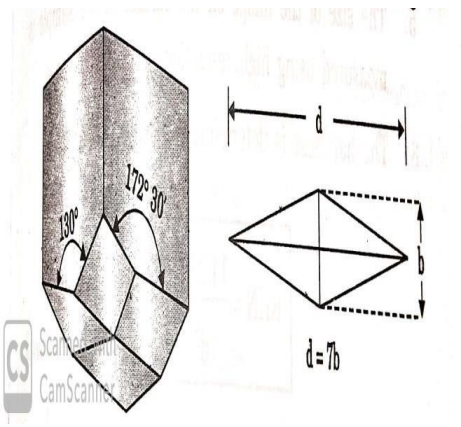
Limitations:

•Requires great care for sample preparation.

Knoop Hardness test

Principle:

A diamond pyramidal shape with transverse angle of 1300 and longitudinal angle 1720 30’ is used as an indenter.



Test procedure:

1. A test specimen is placed on the anvil. It is raised with the elevating screw until it touches the indenter
2. The indenter is pressed into the surface of the specimen by a gradually applied load.
3. The load is applied for 15-30 secs.
4. The indenter makes an impression on the specimen.
5. Using the built-in **optical microscope**, measure the **length of the long diagonal** of the indentation
6. Then we can find the harness number by using formula.

$$KHN = \frac{14.299P}{d^2}$$

P-load applied

d-diameter of the indentation

Precautions:

1.Micro hardness require extra care in all stages of testing.

2.Good polishing of the surface is required.

Advantages:

1.The diagonals of the square indentation can be measured more accurately.

2.This method is suitable for hard materials as well as for soft materials.

3. There is only one type of indenter, which can be used for all Knoop methods.

4. The test is non-destructive, and there is only very minor damage to the specimen surface

Disadvantages and Limitations:

1.The accurate measurement of indenting size is very difficult and it requires high polished surface.

2.It consumes time for measurement.

3.The long diagonal of Knoop indentation is affected by elastic recovery for loads less than300g

4.The process is rather slow (compared with the Rockwell method).