" Compression Test"

Object: To determine the mechanical properties of metals under compression load.

Theory: Compression tests are the reverse of tensile tests since the specimen is being stretched under tensile load in the tensile test while in the compression test, the specimen is being compressed under compression load. Some materials are tested mainly in compression. Among these are brick, wood, cast Iron, and tile Standards specify that metal specimens should be cylindrical.

Three height-to-diameter ratios are suggested:

1. Short" height equals to (0.9) of the diameters. (used in testing bearing metals)
2. Medium" height equals to (3) diameters. (used for compressive properties elasticity "
3. (Long" height equal to (8) to (10) diameters. (used to determine the modulus of Compression.

Testing of Ductile Materials:

Ductile metals such as steel, aluminum, and copper have proportional limits in compression very close to those in tension; hence the initial regions of their compression stress-strain.

diagrams are very **similar** to the tension diagrams However; when yielding begins, the behavior is quite different. In a tension test, the specimen is stretched. Necking may occur, and ultimately fracture takes place. When a small specimen of ductile material is compressed, it begins to bulge outward on the sides and become barrel-shaped. With increasing load, the specimen is fluttered out, thus offering increased resistance to further shortening (which means the stress-strain curve goes upward).

Compression Testing of Brittle Materials:

Brittle materials in compression typically have an initial linear region followed by a region in which the shortening increases at a higher rate than the load. Thus, the compression stress-strain diagram has a shape that is similar to the shape of the tensile diagram. However, the materials usually reach much higher ultimate stresses in compression stress tension and fracture or break at the maximum load.

Factor Affecting Compression Test:

a. The dimension of the specimen used in the test and the ratio of its length to its diameter. are chosen to prevent buckling
b. The specimen should have a parallel and good finishing surface
c. A lubricant must used between the surface of a specimen and the compression dies to overcome friction.
d. In common with tension testing, the loading speed influences the test results.

The high rates of loading give higher ultimate strength and higher yield strength.

Apparatus used:

The testing machine used in this test is the same machine used in the tensile test and its specification is explained elsewhere as shown in Fig (3)

1. clamp
2. Specimen
3. elongation gauge
4. load gauge
5. sensor (elongation)
6. release(load)
7. power

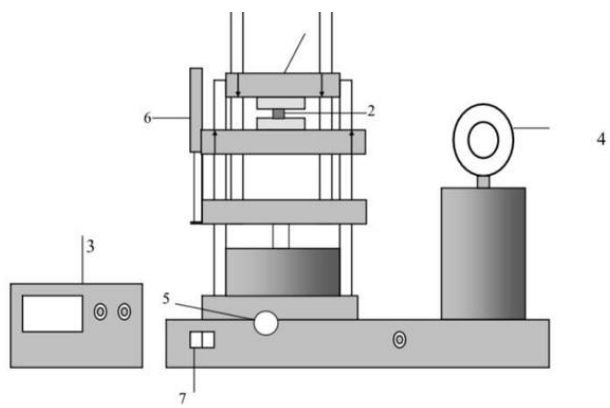

Fig. (3)

Experimental procedure:

1. Prepare the testing machine unit for use in compression tests.
2. Measure the dimensions of the specimen used. (its diameter, length, and the ratio of its length to its diameters).
3. Clean the surface of the specimen from any dirt and lubricant the faces of the specimen to decrease the effect of friction.
4. Put the specimen on the lower compression ram.
5. Check and set the upper compression ram and select the most suitable speeds for the chaste recorder.
6. Check adjustments of loading range
7. Note the loading range and chart speed
8. Start the loading of a specimen and record the load-displacement diagram
9. Measure the change in the values of the length of the specimen

Calculation:

a. Compression stress (σc)

$\sigma c = P/Ao$

Where P: compression load (KN)
Ao: Original area of the specimen. (mm2)
σc: Compression stress (KN/ mm2)

b. Compression strain (εc)

$\varepsilon c = Lo\_Lf / Lo$

Lo: Original length of the specimen (mm)
Lf: Final length of the specimen (mm)
εc: Compression strain . . .

c. Young's Modulus (E)

$E = \sigma c / \varepsilon c$

σc : Compression stress.
εc: Compression strain.
E: Young Modulus.

Main Difference – Tensile vs Compressive Stress

Tensile and compressive stresses are two types of stresses a material can undergo. The type of stress is determined by the force being applied to the material. If it is a tensile (stretching) force, the material experiences a tensile stress. If it is a compressive (squeezing) force, the material experiences compressive stress. The main difference between tensile and compressive stress is that tensile stress results in elongation whereas compressive stress results in shortening. Some materials are strong under tensile stresses but weak under compressive stresses. However, materials such as concrete are weak under tensile stresses but strong under compressive stresses. So, these two quantities are very important when choosing suitable materials for applications. The importance of the quantity depends on the application. Some applications require materials that are strong under tensile stresses. But some applications require materials that are strong under compressive stresses, especially in structural engineering.