**Experiment NO. 4**

**1.0 TITLE:**

To calibrate pressure gauge by using dead weight pressure gauge tester.

**APPARATUS:**

ii) A set of standardized weights for the test range.

iii) A priming pump-cum-oil reservoir for quick initial setting of the unit.

iv) A high pressure screw type pump for adjustment during the test at higher

pressures.

v) An isolating valve for the priming pump.

vi) Pressure gauge adaptor.

vii) A set of spare pressure gauge adaptors.

viii) Two open ended spanners and a nee-dle puller.

The apparatus is assembled on a sturdy base with leveling screws and is encased in a sheet

metal cover. This type of apparatus is avail-able for the following standard test ranges.

**2.0 General Concepts:**

Pressure, pressure measurement using bourdon tube, construction and working principle of bourdon

tube.

**3.0 NEW CONCEPTS:**

Proposition 1: Calibration

It is defined as the process of comparison of specific values of input and output of instrument with

the corresponding reference standards.

**Proposition 2:**

Calibration must be performed periodically to test the validity of performance of device or system.

**Theory:**

Pressure gauge, especially Bourdon’s gauge is calibrated by means of dead weight tester.

The essential components of such a tester is reservoir ‘R’, cylinder ‘C’, barrel ‘B’ and passage up to

‘C’ to hold up clean dry oil. A spindle ‘S’ with highly finished surface and precise cross-sectional

area slides vertically in the barrel ‘B’ through close fitting, highly polished bearing ‘b’ and carries thetable ‘T’ at its upper end. Its lower end rests on ‘HP’ piston.

Screws ‘Ls1 and ‘Ls2 lock the passage of oil when required. The tester is mounted on a stand ‘ST’.

It is provided with special precise weights marked in terms of pressure. A double piston ‘DP’ can be

moved forward and backward by rotating the handle ‘H’. The double acting piston works both ways

and does not allow the oil to leak. The gauge under calibration can be connected at ‘D’ such that the

connection is leak tight.

With ‘Ls1’ and ‘Ls2’ open, the handle is rotated such that the oil is just in level with the gauge

connecting points ‘D’, and ‘Ls2’ is now locked. The gauge ‘G’ is mounted carefully. ‘H’ is rotated until

the table ‘T’ is at raised position in line with the upper edge of colour band.

‘Ls1’ is then locked. ‘Ls2’is opened and the handle H is rotated such that the gauge needle just moves and reads some minimum pressure characteristics of the tester because of the weight of the unloaded table acting through the piston’ LP’. A weight is placed on the table increasing the pressure on the oil in the tester.

The gauge pressure reading should give a reading corresponding to the amount scribed on the

weight if it is operating correctly. If not, the dial is rotated so that the needle points to be correct

pressure. Another weight is added and another gauge reading is noted and so on.

A combination of weights can be used with thinner piston ‘HP’, with a multiplying factor given by the manufacturer, Say 20. Such a tester can give pressure values accurate up to + 0.05% of the

pressure being measured. The range of pressure is typically 0.5 to 10000 kg / cm2

 using dual spindles.

 The pressure range that dead weight tester can measure is limited by the area of cross –

section of the spindle S and the number of weights that can be safely placed on the table.

In order to increase the range, another spindle of smaller cross section can be provided increasing

the pressure range for the same weight placed on the table by a factor equal to the ratio of the cross

sectional area of the two spindles.

The weights are typically for 0.05,0.1,0.5,1,2,5,9,10 kg / cm2

 .With thinner spindle and factor of 20

these can give 1,2,10,20,40,100,130,200 kg / cm

% guage error = $\frac{absolute guage error}{pressure in the cylinder}$

**Observations**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S.no | Weight added to Piston |  Total weight  |  Prssure on cylinder  | Pressure Guage  |  Guage error | % error |
|  |  |  |  |  |  |  |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |

**Graph**