superb technologies

DEAD WEIGHT PRESSURE GAUGE TESTER

LAB MANUAL

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FOREWORD

Welcome to value-conscious company. We are proud of the advanced engineering and quality construction of each equipment we manufacture.

This manual explains the working of equipment. Please read it thoroughly and have all the occupants follow the instructions carefully. Doing so will help you enjoy many years of safe and trouble free operation.

When it comes to service remember that Superb Technologies knows your equipment best and is interested in your complete satisfaction. We will provide the quality maintenance and any other assistance you may require.

All the information and specifications in this manual are current at the time of printing. However, Because of Superb Technologies policy of continual product improvement we reserve the right to make changes at any time without notice.

Please note that this manual explains all about the equipment including options. Therefore you may find some explanations for options not installed on your equipment.

You must follow the instructions and maintenance instructions given in the manual carefully to avoid possible injury or damage. Proper maintenance will help ensure maximum performance, greater reliability and longer life for the product.

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CONTENTS

Dead Weight Pressure Gauge Tester

1. Objective:

To study about dead weight pressure gauge.

2. Aim:

To compare the actual value of pressure with calculated value.

3. Introduction:

Dead weight pressure gauge is the direct method of pressure measurement. The instrument consists of a piston and a cylinder of known area connected to a fluid space by a tube. The fluid exerts a force on the piston equal to the pressure times the piston area. This force can be balanced by weights fitted on the top of the vertical piston. This is the most accurate device and it is used for calibrating other pressure gauges.

4. Theory:

A dead weight pressure gauge consists of a piston and a cylinder of known area, which is connected to a fluid through a tube. The pressure on the fluid, in the pipe, is calculated from the relation, $P = \frac{\text{Weight}}{\text{Areaof the piston}}$

5. Description:

The main components of the tester are fixed on a rigid steel base plate. A sheet metal cover is provided for protecting the interconnecting piping against damages.

Screw Pump:

This is basically a plunger, which moves into a cylinder when the screw pump handle is turned clockwise, and pushes oil into the circuit to generate pressure. Anticlockwise turning of the handle serves to reduce pressure and also to draw in oil into the circuit at the start of the test.

The screw pump is provided with a floating piston which has two 'O' rings for leak tightness. A thrust bearing takes the axial thrust for easy operation. A stopper provided on the screw of the pump limits the maximum travel and the torque pin provided on the stopper and moving in guide strips provides the axial movement.

Piston block: This is solid steel block with drilled interconnections at the rear of the tester. The Screw Pump is fitted to it on the front side and the Free Piston Assembly is fitted on its top. A tube leads out from the Piston Block to the Gauge Block.

Gauge Block:

This is mounted on the front side of the base plate and is connected by piping to the Piston Block and to the Reservoir Block. A Gauge Valve is provided to isolate the gauge. The Valve is provided with nylon seat to provide leak proof closing.

A Union Connector of ½" BSW is fitted to the top face for mounting the pressure gauge to be tested. The Connector is provided with a soft seating washer and the pressure gauge to be tested must tighten on it. Hand tightening of the pressure gauge is sufficient. Use of Teflon (PTFE) tape is not required and will not provide leak tightness

Reservoir Block:

This is provided with 3/8" BSW threads on the top side for mounting the Oil Reservoir. Oil from the reservoir flows into this block through the Release Valve into the piping connecting to the Gauge Block.

Free Piston Assembly:

This is fitted directly to the top face of the Piston Block and is in communication with the oil in the system. A Weight Carrier is fixed on to the Free Piston, which serves as a table for loading more weights. The pressure equivalent of the weight of the carrier and piston is marked on the carrier. This is the minimum pressure, which can be tested by the instrument.

6. Utilities Required:

1. Bench Area Required: 1 m x 1 m.
2. Oil SAE 20W40 (250 ml)

7. Experimental Procedure:

Priming:

1. Pour a clean mineral oil to approximately 2/3rd of the capacity of the reservoir.
2. [SAE 20 Heavy Duty Engine Oil is suitable] Open Release Valve.

3. Turn Screw Pump Handle Clockwise fully. This will release some air from the system, which will bubble out in the oil cup.
4. Turn the handle anticlockwise fully to draw in oil into the instrument.
5. Open Gauge Valve.
6. Turn Screw Pump clockwise slowly until oil shows at the union connector. Install the gauge to be tested at the Union Connector using adapter if necessary. Please ensure that the gauge and adapters are seating properly, are tightened well and the assembly is rigid.
7. Draw in oil fully and close the Release Valve.

TESTING:

1. Place the necessary weight on the Carrier so that the sum of the pressure values of the carrier and weights loaded is equal to the first reading to be taken.
2. Slowly turn Screw Pump clockwise. This will build up pressure in the circuit and after a few turns will show on the pressure gauge.
3. Continue to increase the pressure until the piston with weights starts rising up.

CLOSING UP:

1. After the work is over, please ensure that the tester is left in the following condition:

a) Release Valve – Open.
b) Reservoir Cover – in position
c) Union Connector – plugged
d) Screw Pump – Fully anticlockwise
e) Weights – Removed from the carrier, properly cleaned and stacked elsewhere.

This will ensure that there is no accidental pressure build up and prevent damages to the Free Piston.

8. OBSERVATIONS & CALCULATIONS:

DATA:

D = 0.8 cm

W_p = ~~0.275~~ 0.283 kg

OBSERVATION TABLE:

S. No.	W, kg	P_{act}, kg/cm^2

CALCULATIONS:

$W_t = W + W_p$, kg = ---------- kg

$A = \frac{\pi}{4} D^2$, m^2 = ---------- m^2

$P_{cal} = \frac{W_t}{A}$, kg/cm^2 = ---------- kg/cm^2

$E = \frac{P_{cal} - P_{act}}{P_{act}} \cdot 100$ = ---------- %

9. NOMENCLATURE:

A = Area of Piston, m^2

D = Diameter of Piston, m

E = % Error.

P_{act} = Actual pressure, kg/cm^2

P_{cal} = Calculated pressure, kg/cm^2

W = Applied Weight, kg

W_P = Weight of Platform, kg

W_t = Total Weight, kg

10. PRECAUTIONS & MAINTENANCE INSTRUCTIONS:

1. Cleanliness and lubrication: The Instrument and weights should be kept scrupulously clean. The screw Pump requires periodic lubrication, which may be done every 3 to 6 months depending on the conditions.

2. Care of free piston assembly: If the piston is moved up and down by hand and it is found that it is giving a feel of rough or sluggish movement as distinguished from the normal smooth movement; this will be due to dust or dirty oil. It is now necessary that the piston be cleaned as follows:

   (a) Remove the weight carrier. Unscrew the Free Piston Assembly from the instrument, Extract the retaining lock. Take out the piston from its cylinder. Wash the piston and cylinder bore with a proper solvent and wipe carefully with a soft cloth. Dip the piston in oil and reassemble.

   (b) Valves: If leakage is noticed from the valve stem, tighten the gland nut slightly. If leakage is still not stopped, the 'O' ring packing needs replacement.

   (c) Changing the hydraulic fluid: Turn screw pump fully clockwise so that most of the oil is transferred to the Reservoir. Remove the Reservoir and discard the oil in it. Clean the Reservoir and install it in position.

11. References:

1. Dr. P.N.Modi & S.M.Sethi, "Hydraulics & Fluid Mechanics", 15th ed., Standard Book House, ND, 2005, Page 60-61.