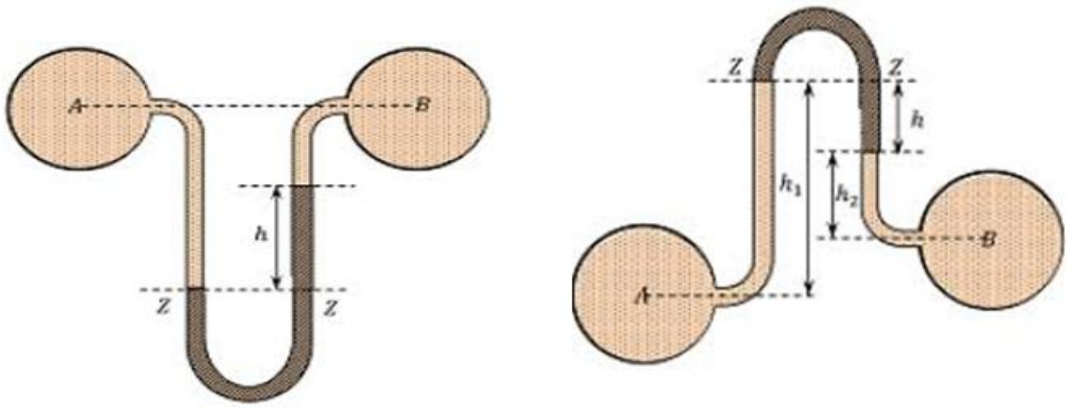
Unit – I

Pressure and Pressure Measurement

Session - VII

❑ Differential Manometers

- Differential manometers are the devices used for measuring the difference of pressure between two points in a pipe or in two different pipes.
- A differential manometer consists of a U-tube, containing heavy/lighter liquid, whose two ends are connected to the points, whose difference of pressure is to be measured.
- The common types of U- tube differential manometers are:
  - U- Tube differential manometer
  - Inverted U- tube differential manometer



Differential Manometers

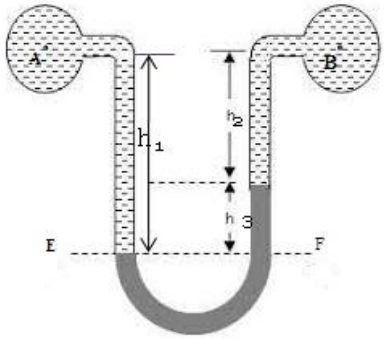
❑ U Tube Differential Manometer

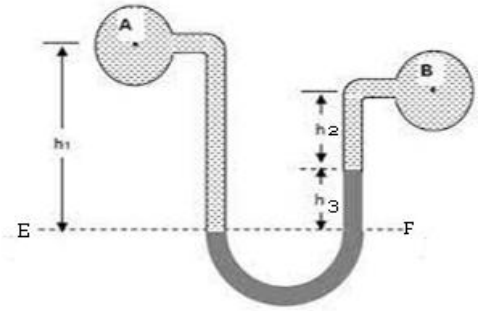
- It consists of glass tube bent in U-shape, the two ends of which are connected to the two gage points between which the pressure difference is required to be measured.
- Figure shows such an arrangement for measuring the pressure difference between any two points A and B.
- The lower part of the manometer contains a manometric liquid which is heavier than the liquid for which the pressure difference is to be measured.
- It is used to measure high pressure difference.

Pressure at E = Pressure at F

$$p_A + s_1 w h_1 = p_B + s_2 w h_2 + s_3 w h_3$$

$$(p_A - p_B) = s_2 w h_2 + s_3 w h_3 - s_1 w h_1 \qquad N/m^2$$





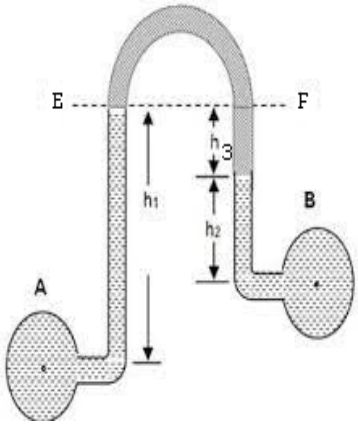
❑ Inverted U Tube Differential Manometer

- It consists of glass tube bent in inverted U-shape, the two ends of which are connected to the two gage points between which the pressure difference is required to be measured.
- Figure shows such an arrangement for measuring the pressure difference between any two points A and B.
- The lower part of the manometer contains a manometric liquid which is lighter than the liquid for which the pressure difference is to be measured
- It is used to measure low pressure difference.

Pressure at E = Pressure at F

$$p_A - s_1 w h_1 = p_B - s_2 w h_2 - s_3 w h_3$$

$$(p_A - p_B) = s_1 w h_1 - s_2 w h_2 - s_3 w h_3 \qquad N/m^2$$



Problems

1. Calculate the pressure difference between A and B in N/m²

Sol^n

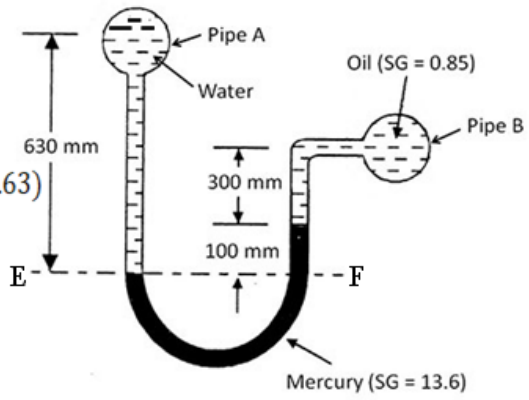
Pressure at E = Pressure at F

$$p_A + s_1 wh_1 = p_B + s_2 wh_2 + s_3 wh_3$$

$$(p_A - p_B) = s_2 wh_2 + s_3 wh_3 - s_1 wh_1$$

$$(p_A - p_B) = (0.85 \times 9810 \times 0.30) + (13.6 \times 9810 \times 0.10) - (1 \times 9810 \times 0.63)$$

$$(p_A - p_B) = 9.662 \times 10^3 \text{ N/m}^2$$



2. Determine the pressure at the center of water pipe

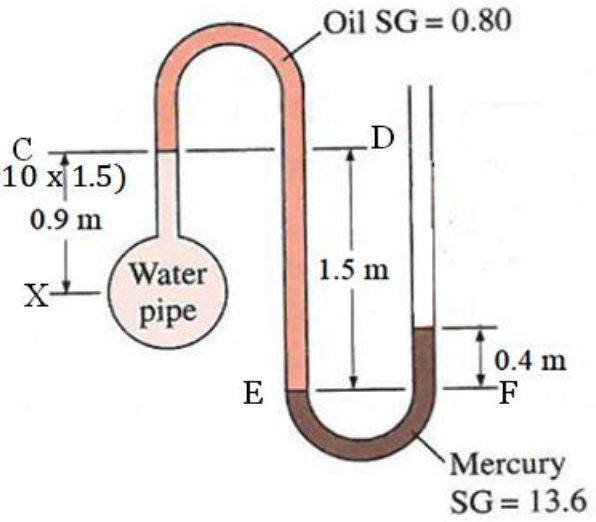
Pressure at E = Pressure at F

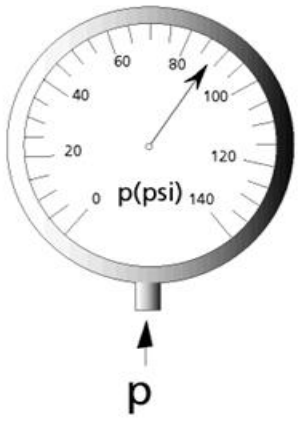
$$p_x - s_1 wh_1 + s_2 wh_2 = s_3 wh_3$$

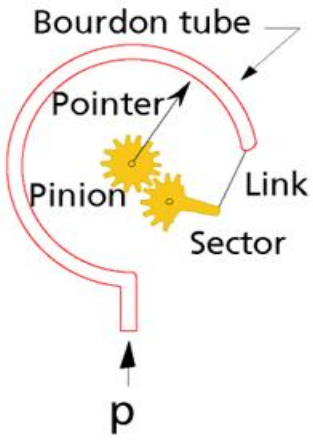
$$p_x = s_3 wh_3 + s_1 wh_1 - s_2 wh_2$$

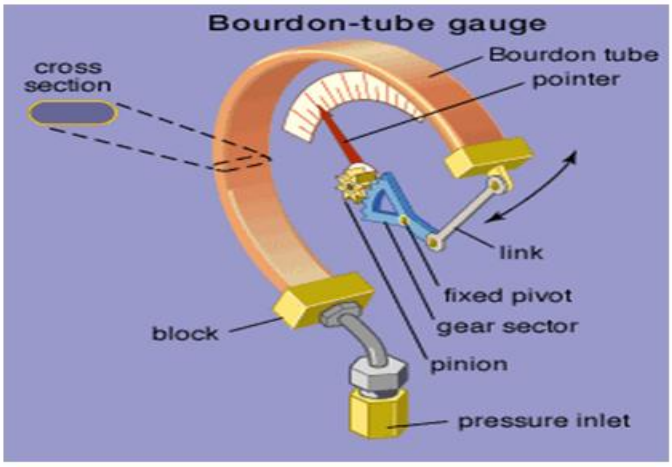
$$p_x = (13.6 \times 9810 \times 0.4) + (1 \times 9810 \times 0.9) - (0.85 \times 9810 \times 1.5)$$

$$p_x = 49.68 \times 10^3 \text{ N/m}^2$$





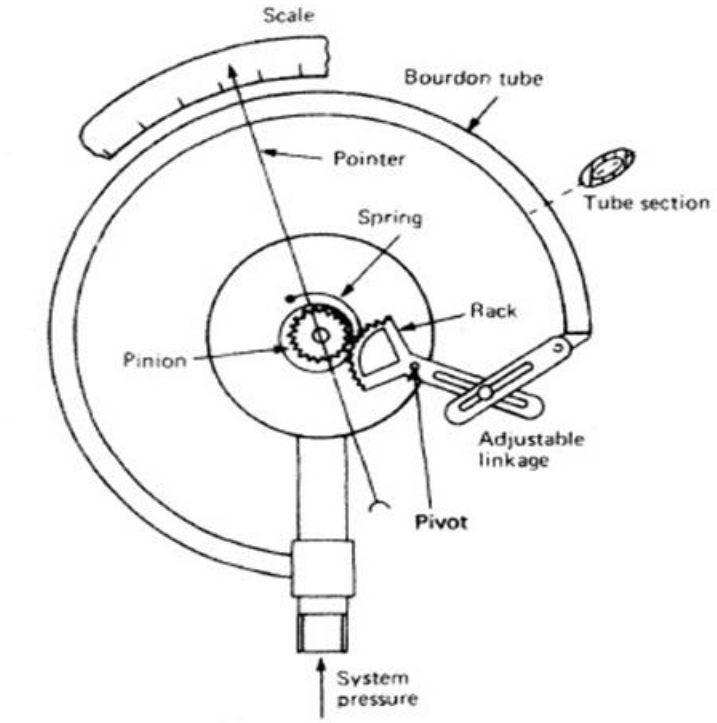




Bourdon's tube pressure gauge

❑ Bourdon's tube pressure gauge

- It consists of hollow, elliptical, metallic flexible tube. One end of the tube is sealed and connected pinion and sector arrangement while other end is connected to the point where pressure is to be measured. The tube is encased in a circular cover.
- When the tube is connected to the pipe, fluid flows under pressure through the tube and tries to straighten the tube. This causes the free end of the tube to move. This movement is amplified by a lever connected to the sector and pinion arrangement . Consequently the pointer rotates over the graduated scale. Thus the fluid pressure can be obtained.



Bourdon's tube pressure gauge