Sub Module 2.10

Bourdon gage

Bourdon gages are available to cover a large range of pressures. Bourdon gages are purely mechanical devices utilising the **mechanical deformation** of a flattened but bent tube that winds or unwinds depending on the pressure difference between the inside and the outside. The motion is against a spring torque such that a needle attached to the shaft indicates directly the pressure difference. The working principle of the bourdon gage is explained with reference to Figure 68.

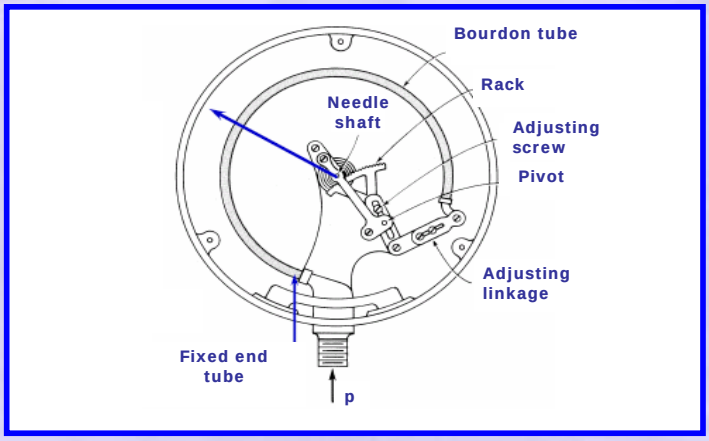

Figure 68 Schematic of a Bourdon pressure gage

Figure 69 Photograph of a Bourdon gage taken from the web
(Dr. Pravin Varma, Mount Allison University, Sackville, New Brunswick Canada)

The Bourdon tube is a metal tube of elliptic cross section having a bent shape as shown in Figure 68. The inside of the tube is exposed to the pressure to be measured. The outside of the Bourdon tube is exposed to a second pressure, usually the atmospheric. The Bourdon tube is held fixed at one end (the end connected to the pressure source) and the other end is connected by linkages to a spring restrained shaft. A pointer is mounted on the shaft, as indicated in the figure. The needle moves over a circular scale that indicates the pressure. The position of the needle is determined by a balance between the Bourdon tube developed torque acting on the shaft and the torque due to the shaft mounted spring that opposes its movement. The external appearance of a Bourdon gage is as shown in Figure 69. Bourdon gages are available for measuring pressures higher/lower than the atmospheric pressure. The pressure indicated is referred to as the gage pressure if it is with respect to the atmospheric pressure outside the Bourdon tube.

A Bourdon pressure gage may be calibrated by the use of a dead weight tester, a schematic of which is shown in Figure 70.

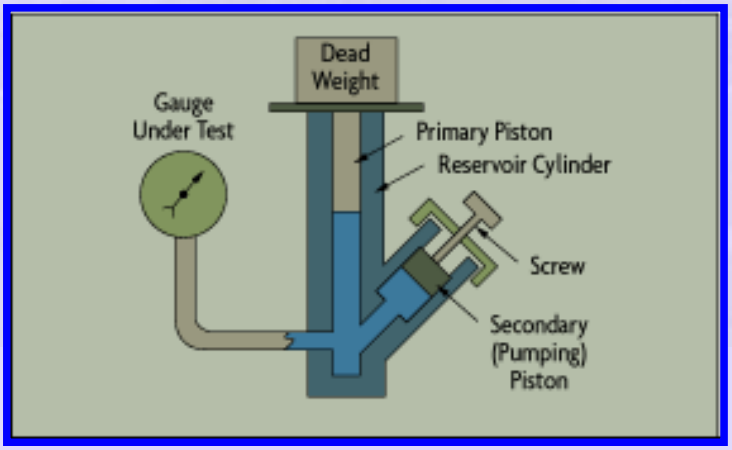

Figure 70 Schematic of a dead weight tester
(Visit: www.omega.com)

Figure 71 Typical dead weight tester supplied by WIKA, Australia

The dead weight tester consists of an arrangement by which a piston may be allowed to float over a liquid (usually oil) under internal pressure and a force in the opposite direction imposed on the piston by weights placed as indicated in the figure. The oil pressure is changed by the pumping piston. The pressure is calculated as the weight placed on the piston divided by the cross section area of the piston (the piston is to be oriented with its axis vertical). The gage under test experiences the same pressure by being connected to a side tube communicating with the oil. A dead weight tester is a precision device and is available from many manufacturers. A typical dead weight tester available from WIKA Australia is shown in Figure 71. Precision dead weight tester DWT1305 available from Omega USA has 0.1% accuracy, in the range of pressures from 1 atmosphere to 650 atmospheres (Visit: www.omega.com for details).