

Pressure Measurement

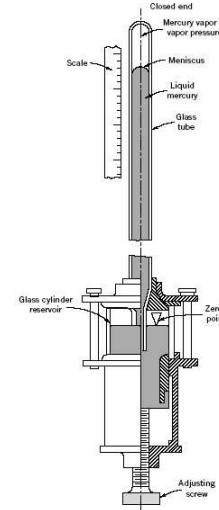
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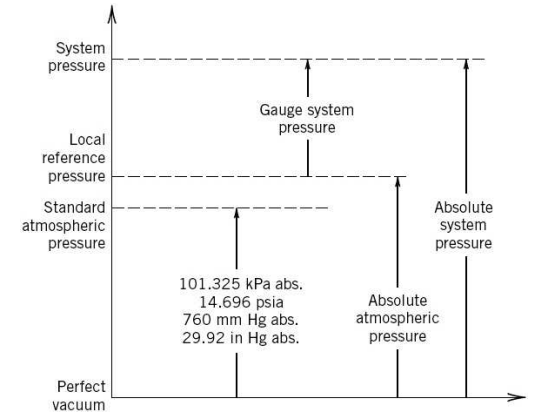
ME 361: Instrumentation & Measurement



Barometer & Relative Pressure Scales

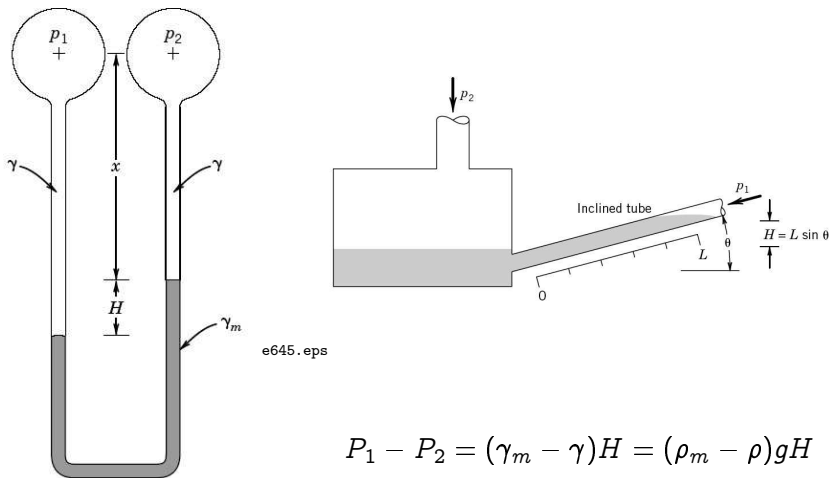


e640. eps



e641. eps

Manometer



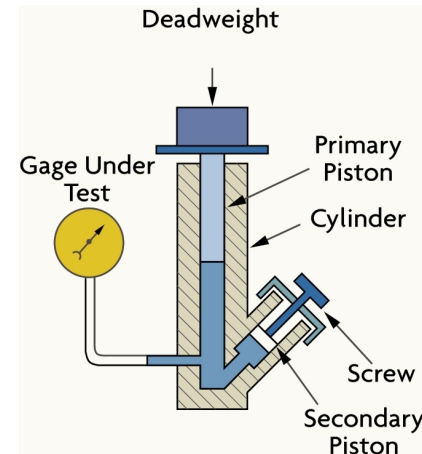
e645. eps

$$P_1 - P_2 = (\gamma_m - \gamma)H = (\rho_m - \rho)gH$$

e643. eps



Dead-Weight Tester for Static Calibration



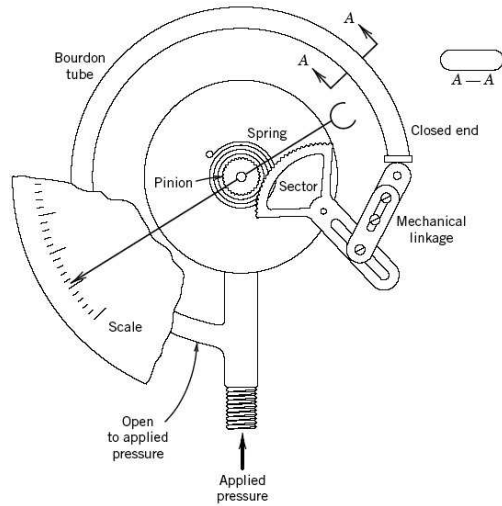
e639. eps

Sources of errors:

- Friction between the piston and the cylinder.
- Uncertainty of area of the piston.



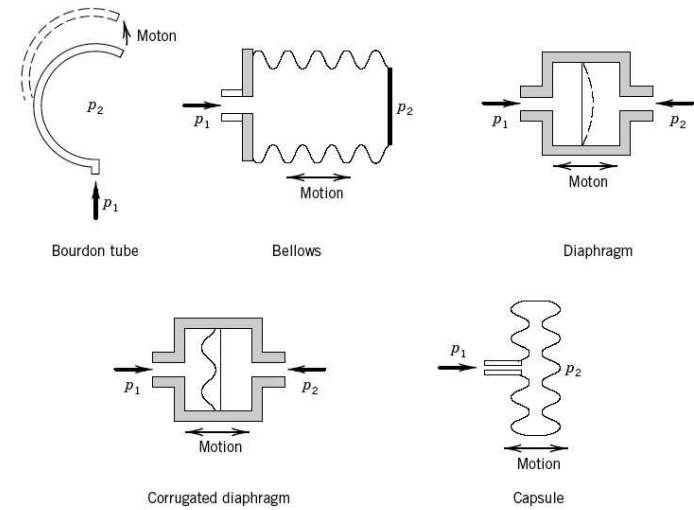
Bourdon Tube Pressure Gauge



e646.eps



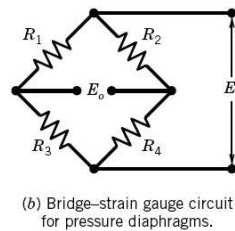
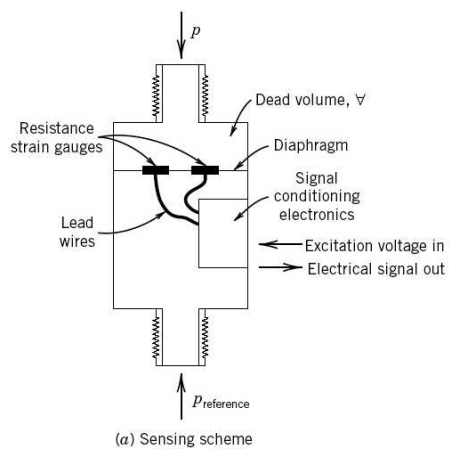
Elastic Elements Used as Pressure Sensors



e642.eps



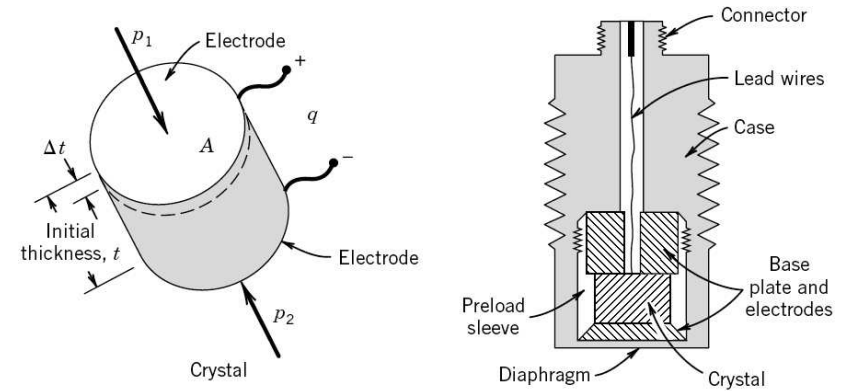
Diaphragm Pressure Transducer



e647.eps



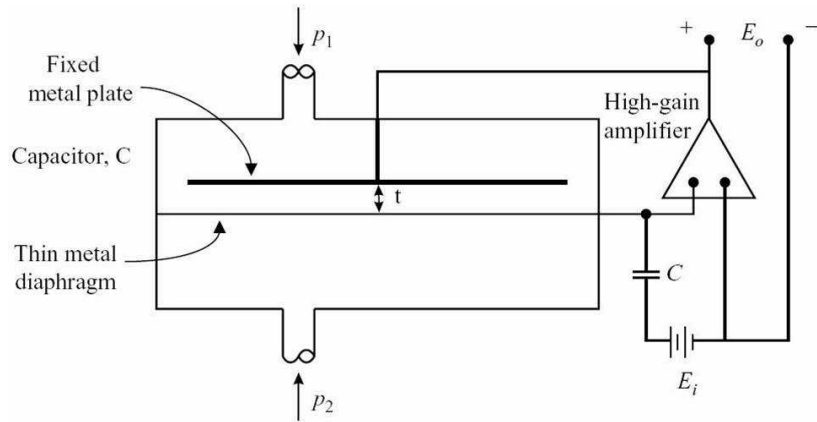
Piezoelectric Pressure Transducer



e648.eps



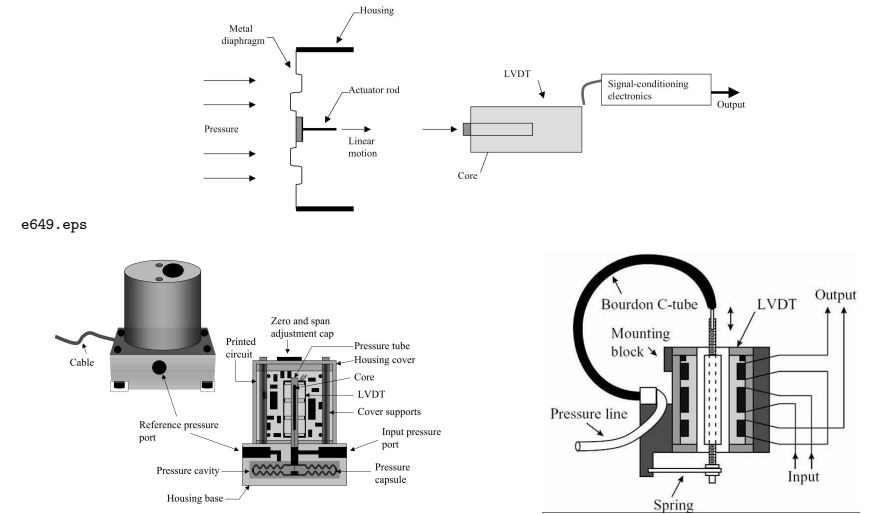
Capacitance Pressure Transducer



e474 . eps



LVDT Pressure Transducer



e649 . eps

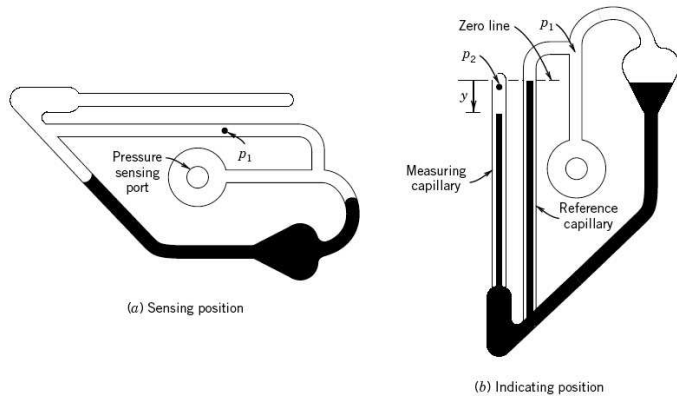
e650 . eps

e666 . eps



Measurement of Low Pressure

McLeod Gauge (0.1 → 1.0 torr)



e644 . eps

$$P = \frac{Ay^2}{V_b - Ay}$$

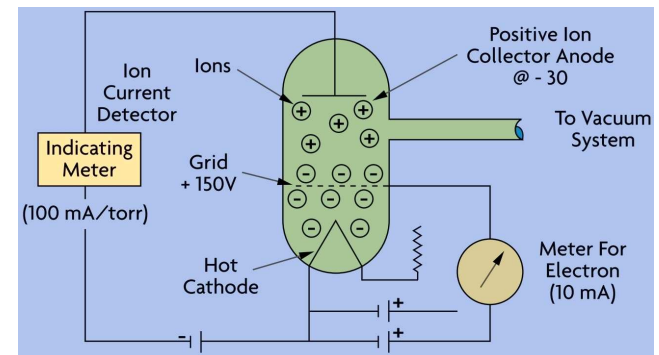
$V_B \equiv$ volume of capillary, bulb & tube down to the opening.

$A \equiv$ cross-section area of the capillary.



Measurement of Low Pressure

Ionization Gauge ($10^{-10} \rightarrow 10^{-2}$ torr)

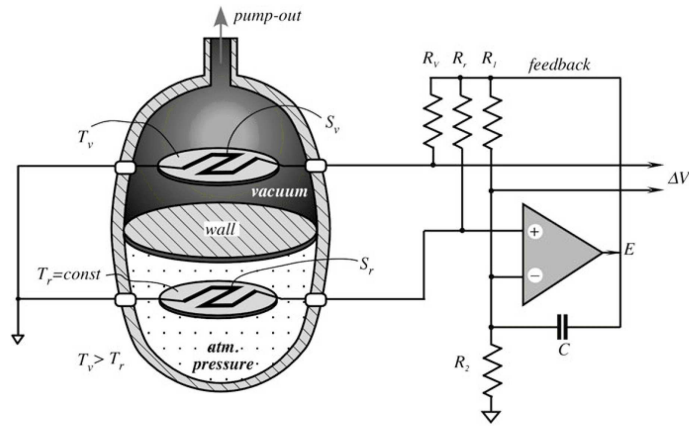


e669 . eps

Heated cathode emits electrons into the vacuum, where they collide with gas molecules to create ions. These positively charged ions are accelerated toward a collector where they create a current in a conventional ion gauge detector circuit. The amount of current formed is proportional to the gas density or pressure.



Pirani Thermal-conductivity Gauge ($10^{-2} \rightarrow 1$ torr)



e670 . eps

At low pressures the effective thermal conductivity of gases decreases with pressure. The Pirani gauge is a device that measures the pressure through the change in thermal conductance of the gas.