

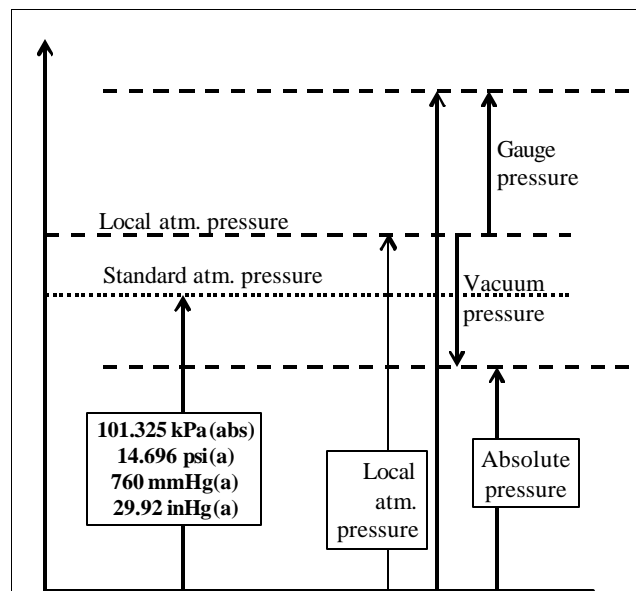
Ch.9: Pressure & Velocity Measurements

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- **Pressure Concept:**
 - ...it is an inward-normal force per unit (contact) area [N/m², psi, atm, inHg, ...]
- ...it is net-effect of change of momentum of a fluid's molecules collision with real (or imaginary) surface
- ...absolute lack of molecular activity is the zero absolute pressure
- ...it is a material property

Pressure Scales

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Reference pressure instruments

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FIGURE 9.3 McLeod gauge.

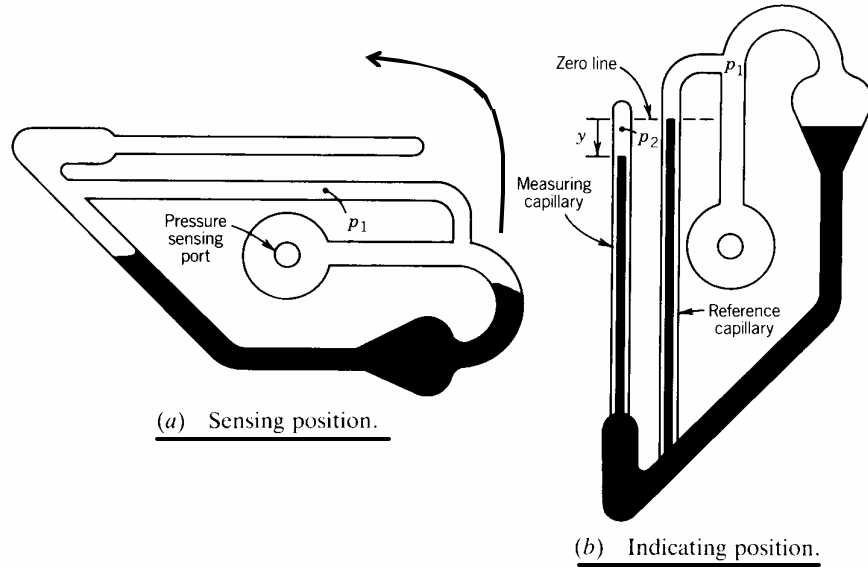
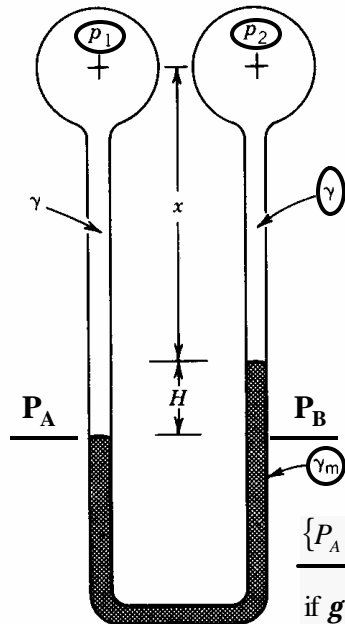


FIGURE 9.5 U-tube manometer.

U-tube Manometer

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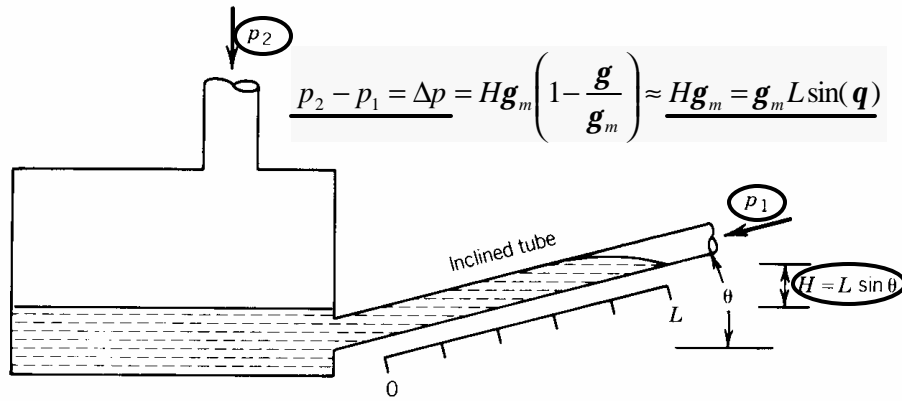


$$\{P_A = p_1 + (x+H)g_1\} = \{p_2 + (x)g_2 + Hg_m = P_B\}$$

$$\text{if } g_1 = g_2 = g \Rightarrow p_1 - p_2 = Hg_m \left(1 - \frac{g}{g_m}\right) \approx Hg_m$$

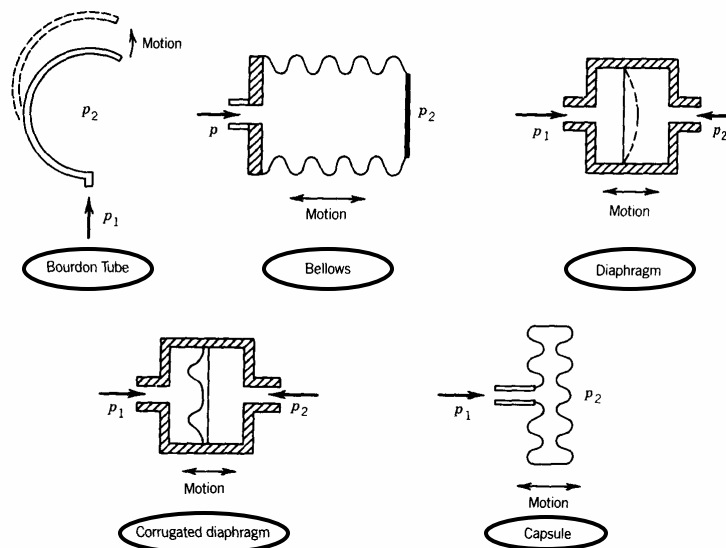
Inclined tube manometer

FIGURE 9.7 Inclined tube manometer.



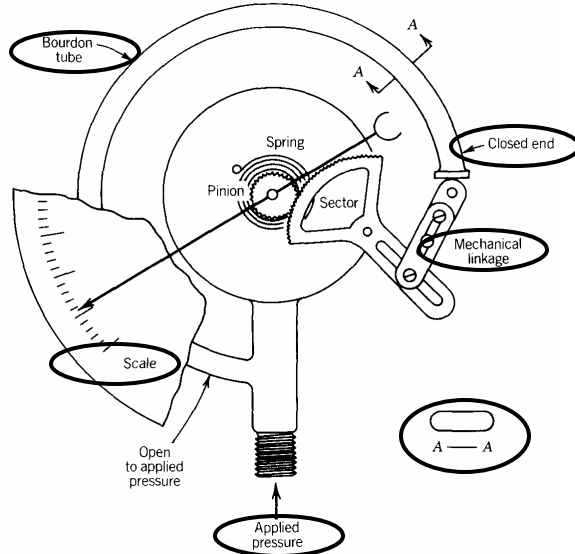
Elastic-element pressure sensors

FIGURE 9.9 Elastic elements used as pressure sensors.



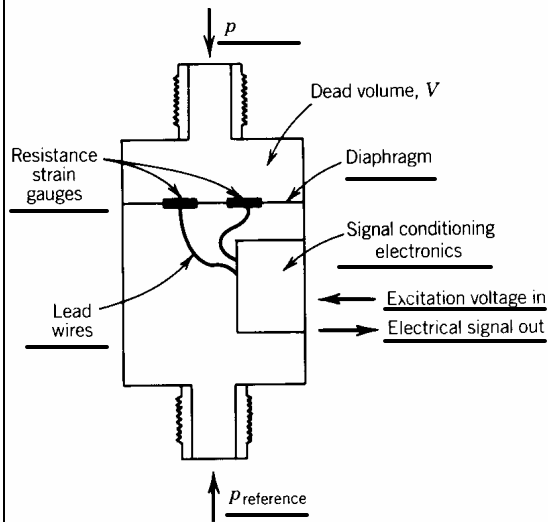
Bourdon tube pressure gauge

FIGURE 9.10 Bourdon tube pressure gauge.

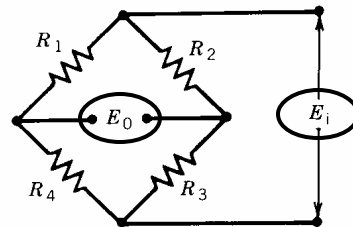


Diaphragm pressure transducer

FIGURE 9.13 Diaphragm pressure transducer.



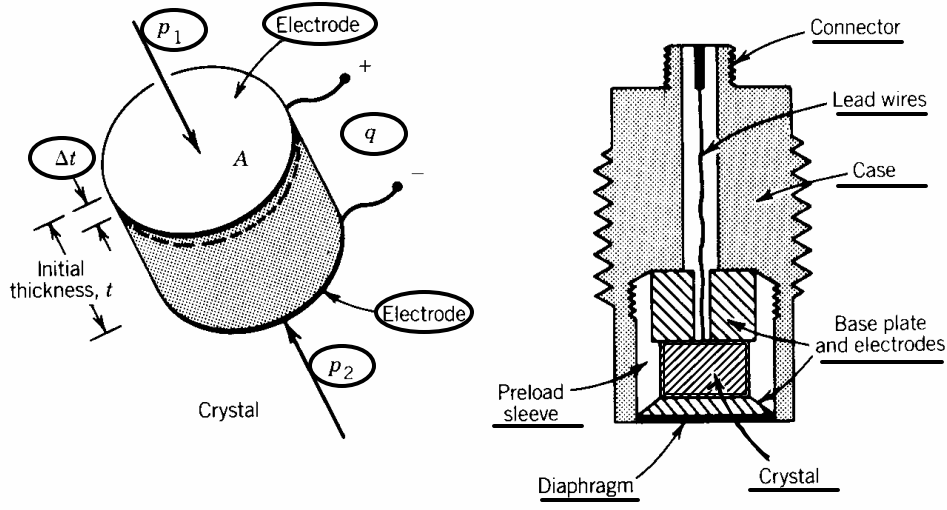
(a) Sensing scheme.



(b) Bridge—strain gauge circuit for pressure diaphragms.

Piezoelectric pressure transducer

FIGURE 9.15 Piezoelectric pressure transducer.



Design and errors of Pitot/Prandtl probe

FIGURE 9.20 Improved Prandtl tube for static pressure.

(a) Design. (b) Relative static error along tube length.

