San Jose State University
Department of Mechanical and Aerospace Engineering
ME 120 Experimental Methods

Pressure Measurement

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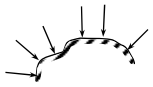
Pressure

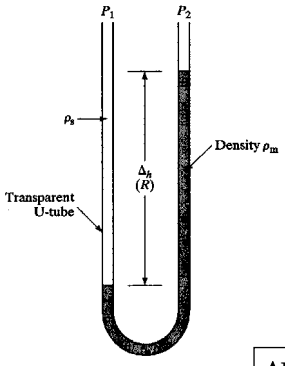
- Force over area
  - Not a fundamental quantity
    - Derived from force and area
      - Force and area are derivable from mass, length, and time
  - Acts normally to interfacial surface

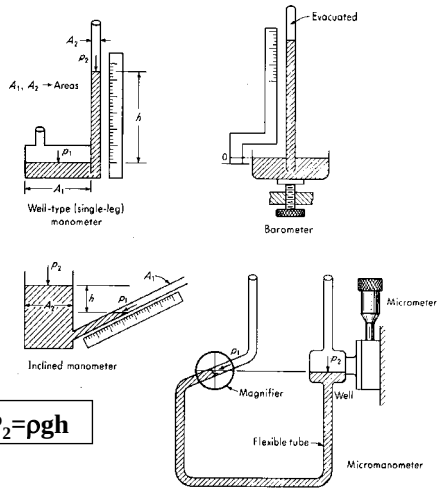


  - Three forms
    - Absolute → measured with respect to _____
    - Gage → measured relative to _____
    - Differential → is the _____ between two pressures
  - Units
    - English: lb/in^2 (psi) [psia, psig, psid]
      - in. Hg or in. H_20
    - SI: N/m^2 (Pa) [abs, gage, differential]
      - mm Hg (torr) or mm H_20

Pressure Measurement

- Manometer





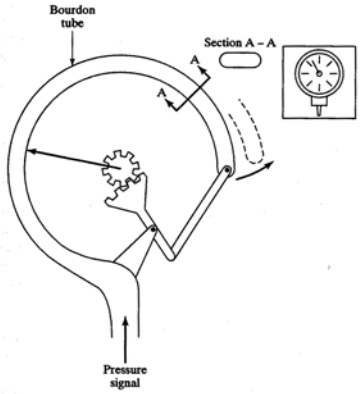
EmfE, p. 262

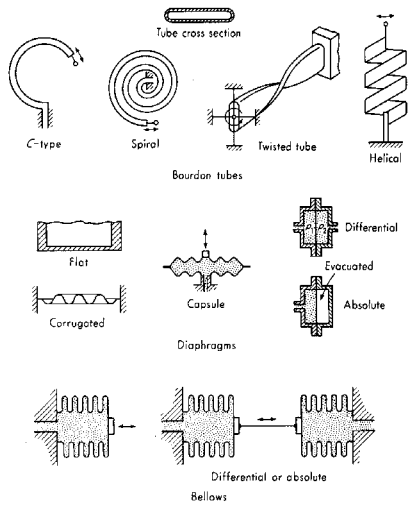
$$\Delta P = P_1 - P_2 = \rho g h$$

Doeblin, E. O., Measurement Systems: Applications and Design, McGraw-Hill, NY, rev. ed., 1975

Pressure Measurement, cont.

- Elastic transducers
  - Bourdon tube



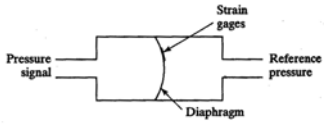


EmfE, p. 267

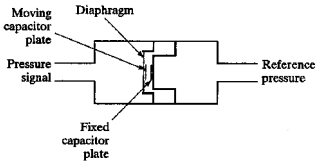
Doeblin, E. O., Measurement Systems: Applications and Design, McGraw-Hill, NY, rev. ed., 1975

Pressure Measurement, cont.

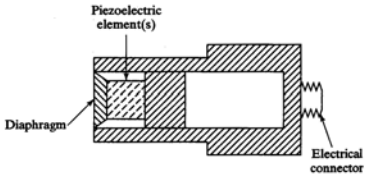
- Strain Gage types



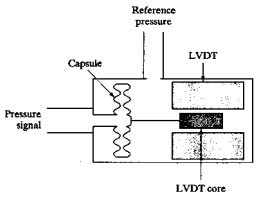
- Capacitive



- Piezoelectric



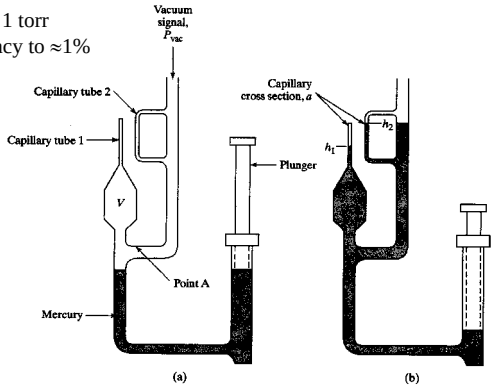
- LVDT



EmfE, p. 268-270

Pressure Measurement, cont.

- Low pressure measurement
  - McLeod gage 10^{-6} to 1 torr
    Accuracy to ≈1%



EmfE, p. 268-270

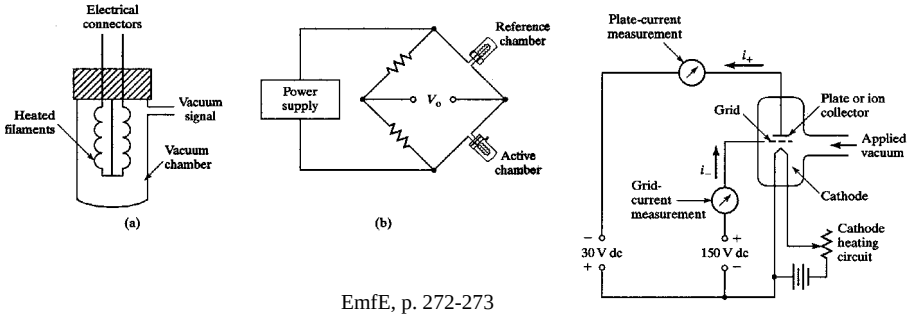
http://www.torontosurplus.com/redirect.php?middleframe=http://www.torontosurplus.com/tes/tes69.htm

$250

Pressure Measurement, cont.

- Vacuum

Low	760 – 25 torr
Medium	25 – 10^{-3} torr
High	10^{-3} – 10^{-6} torr
Very high	10^{-6} – 10^{-9} torr
Ultra high	Less than 10^{-9} torr



EmfE, p. 272-273

References

- Experimental Methods for Engineers, custom ed., Prentice-Hall, 2004.
- Doeblin, E. O., Measurement Systems: Applications and Design, McGraw-Hill, NY, rev. ed., 1975.
- Figliola, R. S., Beasley, D. E., Theory and Design for Mechanical Measurements, 3rd ed., J. Wiley & Sons, New York, 2000.