E230 Aircraft Systems

Manifold Pressure Sucks

6th Presentation

School Of Engineering

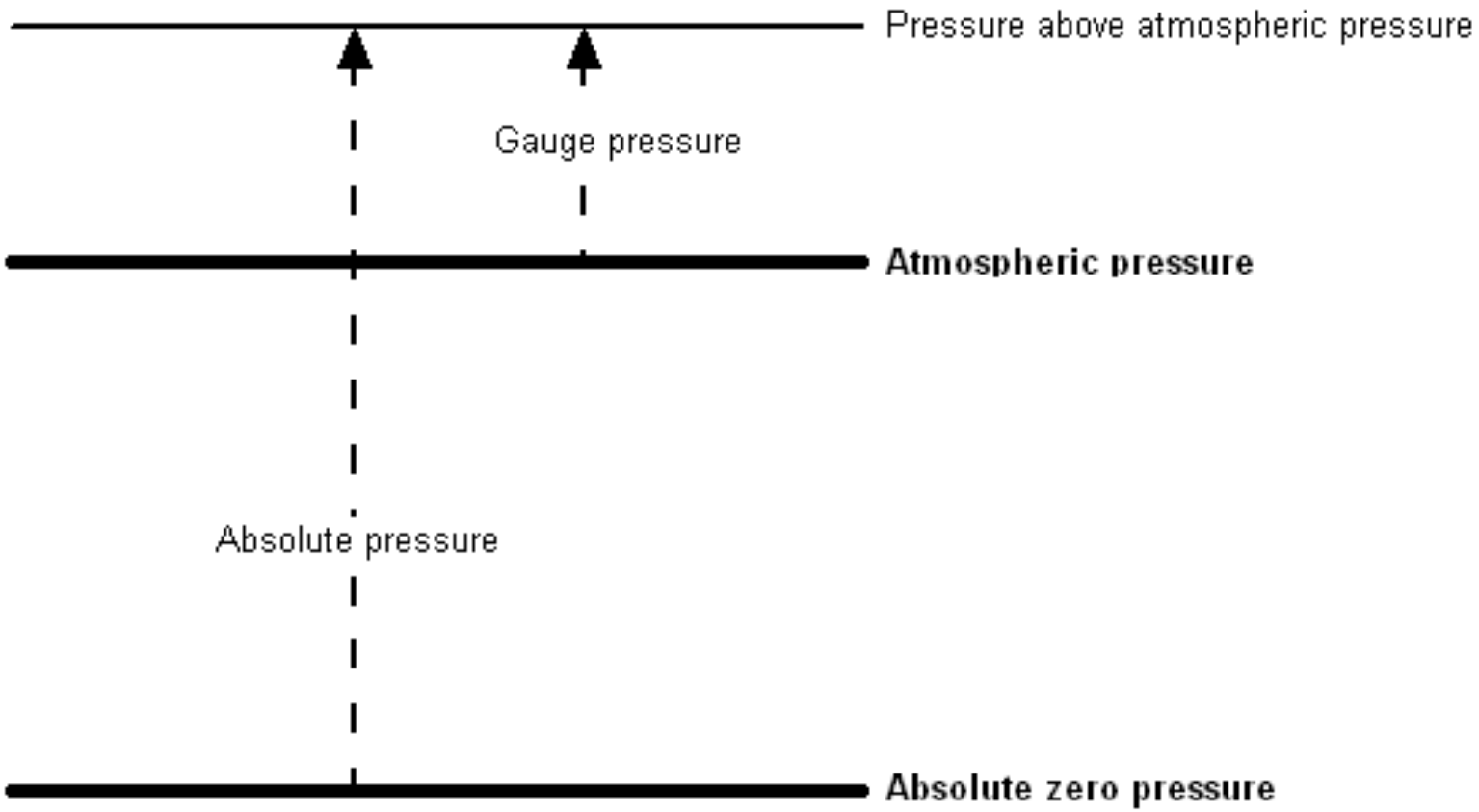
Aircraft Pressure Gauges

- Instruments used to measure pressure are called pressure gauges
- Examples of pressure gauges are:
  - Manifold pressure gauge
  - Suction gauge
  - Engine Pressure Ratio (EPR) indicator
  - Engine oil pressure gauge
  - Hydraulic pressure gauge
  - Oxygen pressure gauge
  - Cabin pressure gauge

Types of Pressure

- **Absolute pressure**
  - Pressure referenced against absolute zero or perfect vacuum.
  - Sum of gauge pressure and atmospheric pressure
- **Gauge pressure**
  - Pressure reference against atmospheric pressure
  - Difference of absolute pressure and atmospheric pressure
- **Differential pressure**
  - Difference in pressure between two points

Types of Pressure



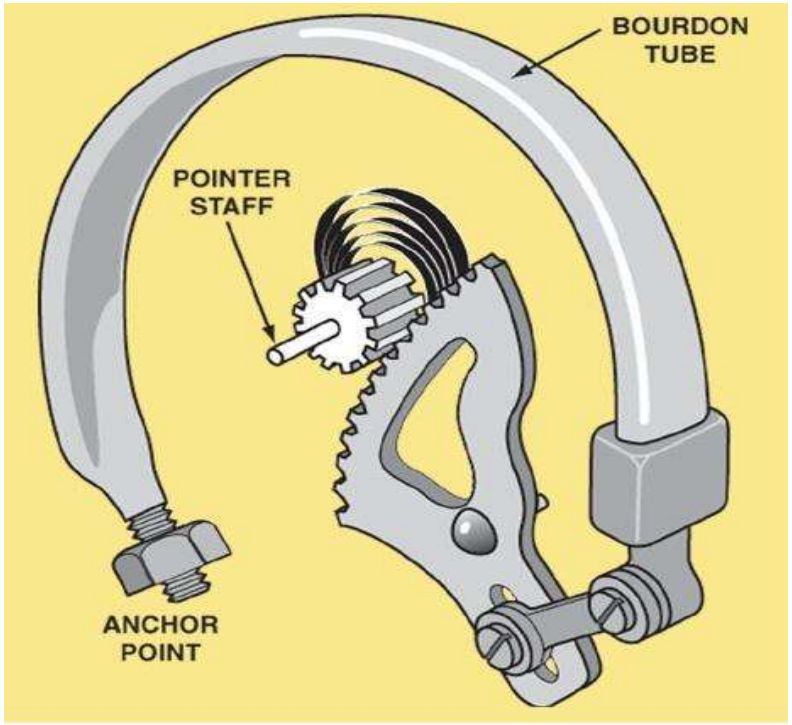
Examples of different pressure uses

- Absolute pressure
  - -Manifold pressure gauge
- Gauge pressure
  - -Engine oil pressure gauge
  - -Hydraulic pressure gauge
- Differential pressure
  - -EPR gauge
  - -Airspeed indicator

Pressure Sensing Elements

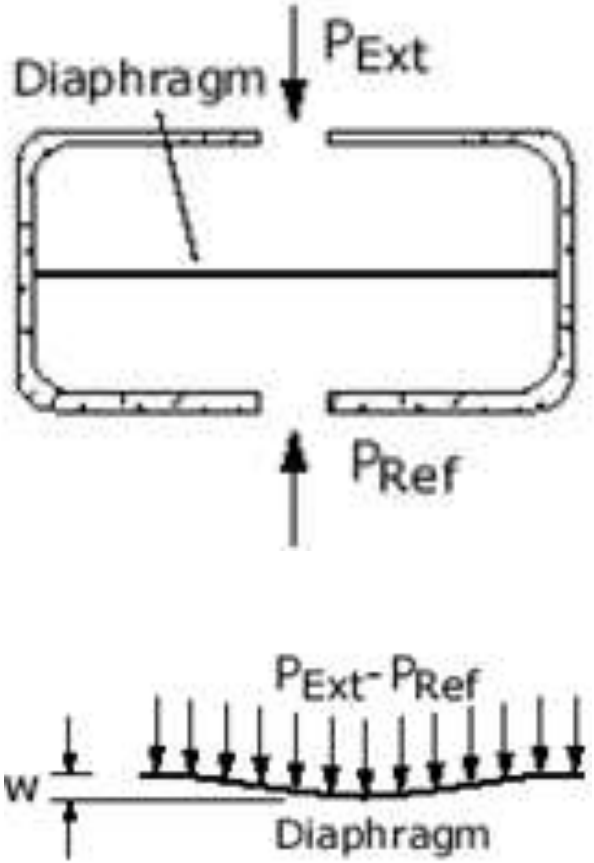
- Principle: Deflection/movement due to changes in pressure
- Common types
  - Bourdon tubes
  - Diaphragms
  - Capsules
  - Bellows

Bourdon Tubes



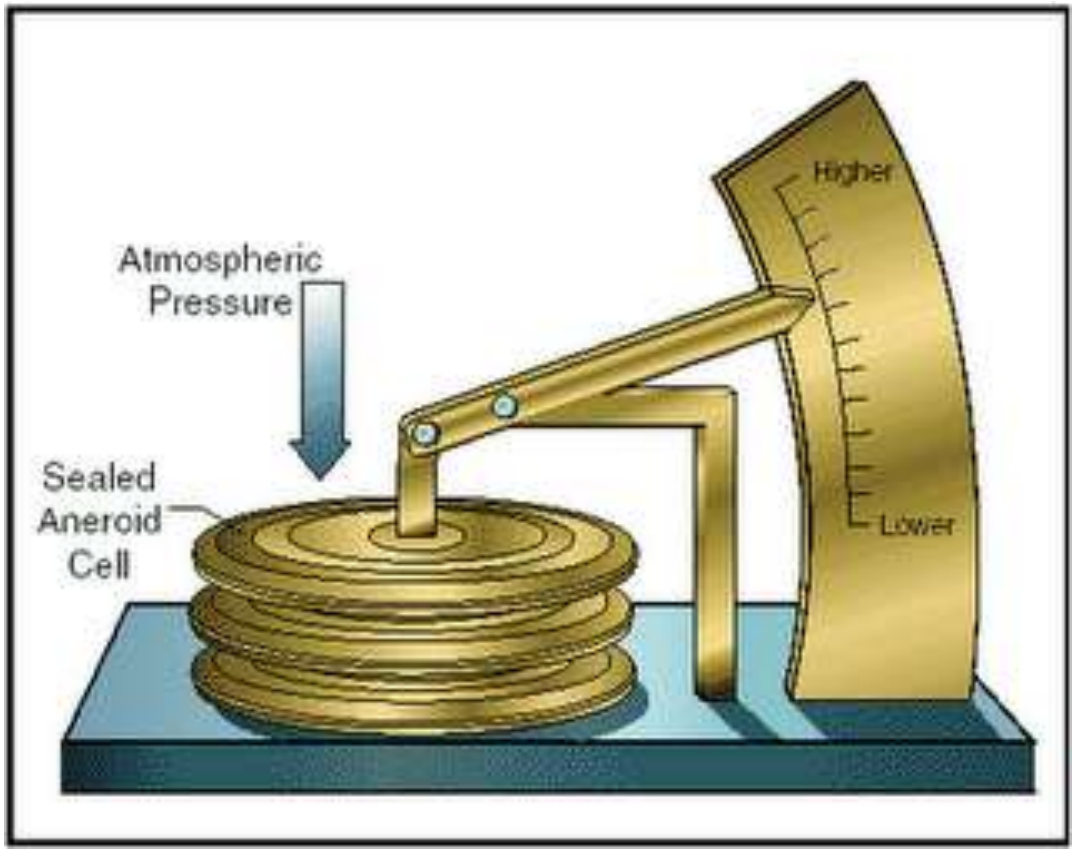
- Consist of a flatten tube anchored at one end
- When pressure increase, tube tends to straighten out.
- The movement is converted to the rotation of the pointer
- Measures gauge pressure

Diaphragms



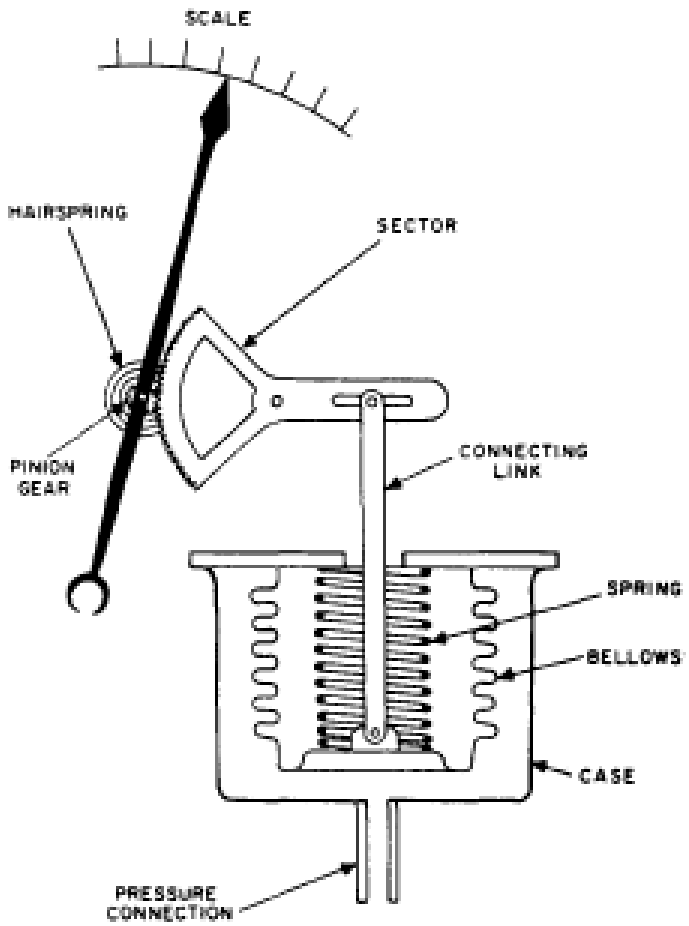
- The diaphragm has a flexible membrane with two sides
- One side is enclosed at fixed pressure and the other side exposed
- When there is pressure difference, the membrane will be deflected.
- Deflection is converted into dial movement

Capsules



- Enclosure made of flexible metal
- Pre-filled and sealed air chamber
- As pressure changes, capsules expands or contracts
- Movement will deflect the pointer.

Bellows



- Use the sealed chamber as a reference pressure and are driven by the external pressure
- As pressure increases, bellow shortens and vice versa.
- Movement will deflect the pointer.

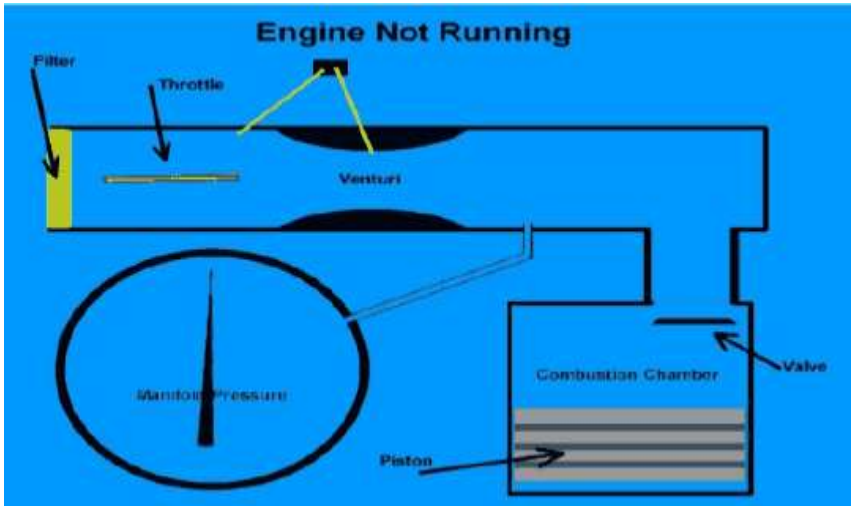
Direct Reading Vs Remote Indicating

- Direct reading
  - Source of pressure is directly connected
  - Mostly bourdon tube type
  - E.g. pitot-static
- Remote Indicating
  - Connected to pressure at a remote point
  - Eliminates pipelines → saves weight
  - Hazardous fluids not channeled to cockpit
  - E.g. oil pressure, hydraulic pressure gauge

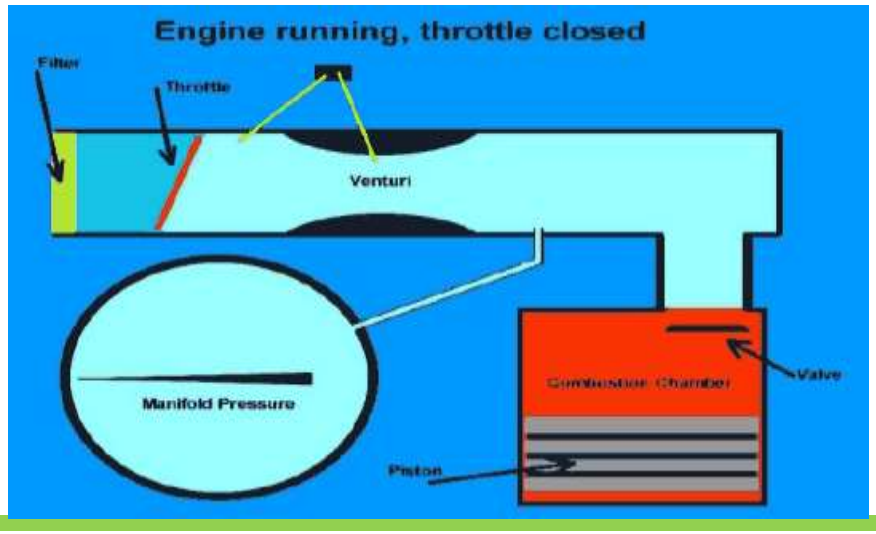
Manifold Pressure Gauge

- Measures the absolute pressure inside the engine intake manifold
- Provides an indication of engine power

Operation of Manifold Pressure Gauge

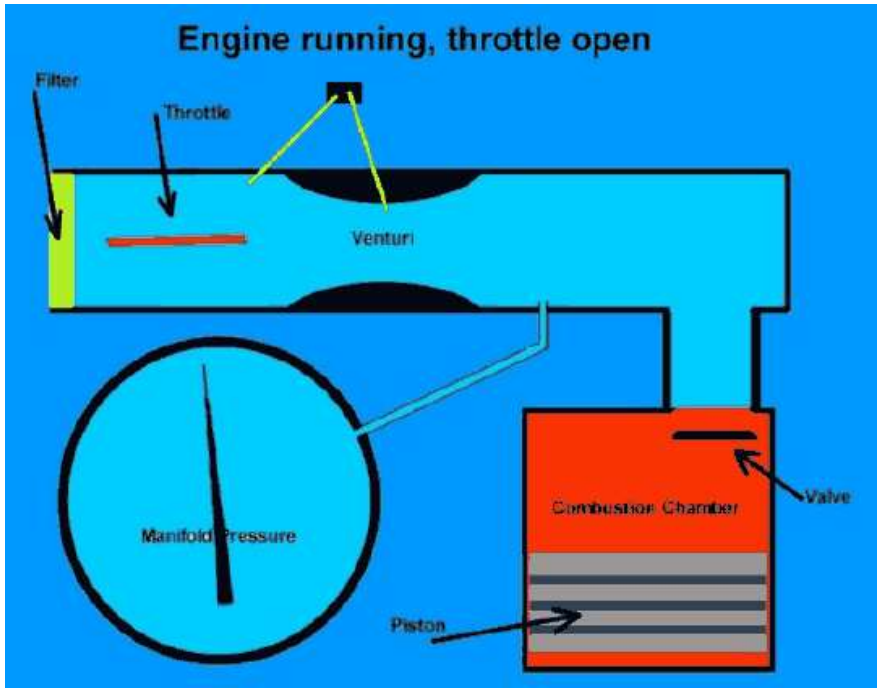


- Engine stationary
- Manifold pressure
  = Atmospheric pressure
  = 29.9 inHg



- Engine running, throttle closed
- Little air can enter manifold
- Suction effect by piston movement, creating a vacuum
- Manifold pressure
  < Atmospheric pressure

Operation of Manifold Pressure Gauge



- Engine running, throttle open
- More air can enter the manifold
- Manifold pressure increases

Learning Objectives

- Explain the different type of pressures
- Identify the various pressure gauges on aircraft
- Describe the principle of pressure sensing
- Explain the function of pressure sensing elements
- Compare direct reading and remote indicating gauges
- Relate manifold pressure gauge readings to engine power