18ECO133T

Sensors and Transducers

UNIT V

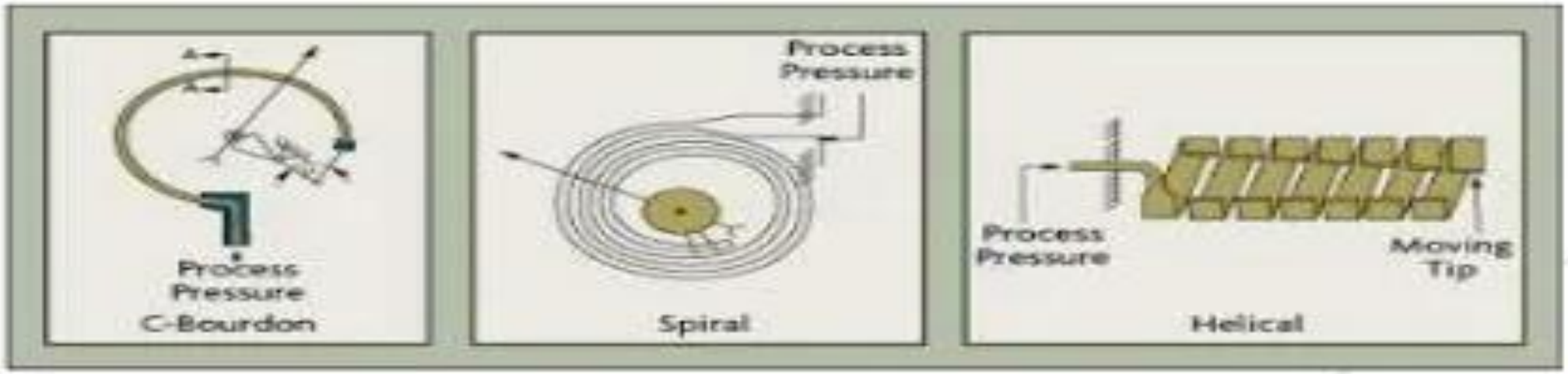
Session 7: SLO – 2

Elastic Pressure Transducers

- The elastic pressure transducers are the mechanical elements that are used for converting one form of energy into the other form of energy that can be measured easily.
- There are number of mechanical transducers, some of the commonly used ones are described below:
    1) Bourdon tube pressure transducers
    2) Diaphragm pressure transducers
    3) Bellows pressure transducers

➢ Bourdon tube pressure transducers

- A Bourdon gauge uses a coiled tube, which, as it expands due to pressure increase causes a rotation of an arm connected to the tube. In 1849 the Bourdon tube pressure gauge was patented in France by Eugene Bourdon



Advantages:

- Low cost
- Simple construction
- Time-tested in applications
- Availability in a wide variety of ranges, including very high ranges
- Adaptability to transducer designs for electronic instruments
- High accuracy, especially in relation to cos

Disadvantages:

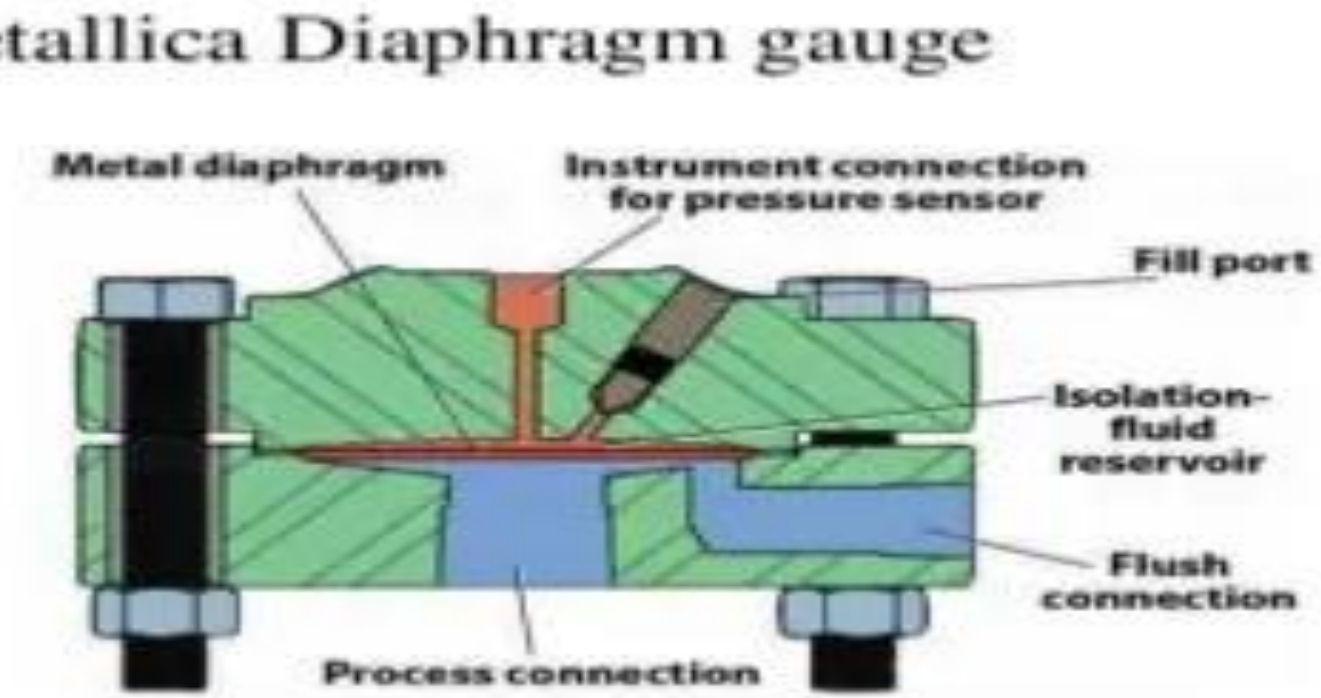
- Low spring gradient (i.e. below 50 psig)
- Susceptibility to shock and vibrations
  Susceptibility to hysteresis

Diaphragm pressure transducers

- A second type of aneroid gauge uses the deflection of a flexible membrane that separates regions of different pressure.
- The amount of deflection is repeatable for known pressures so the pressure can be determined by using calibration.
- The deformation of a thin diaphragm is dependent on the difference in pressure between its two faces.
- The reference face can be open to atmosphere to measure gauge pressure, open to a second port to measure differential pressure, or can be sealed against a vacuum or other fixed reference pressure to measure absolute pressure. The deformation can be measured using mechanical, optical or capacitive techniques.
- Ceramic and metallic diaphragms are used.

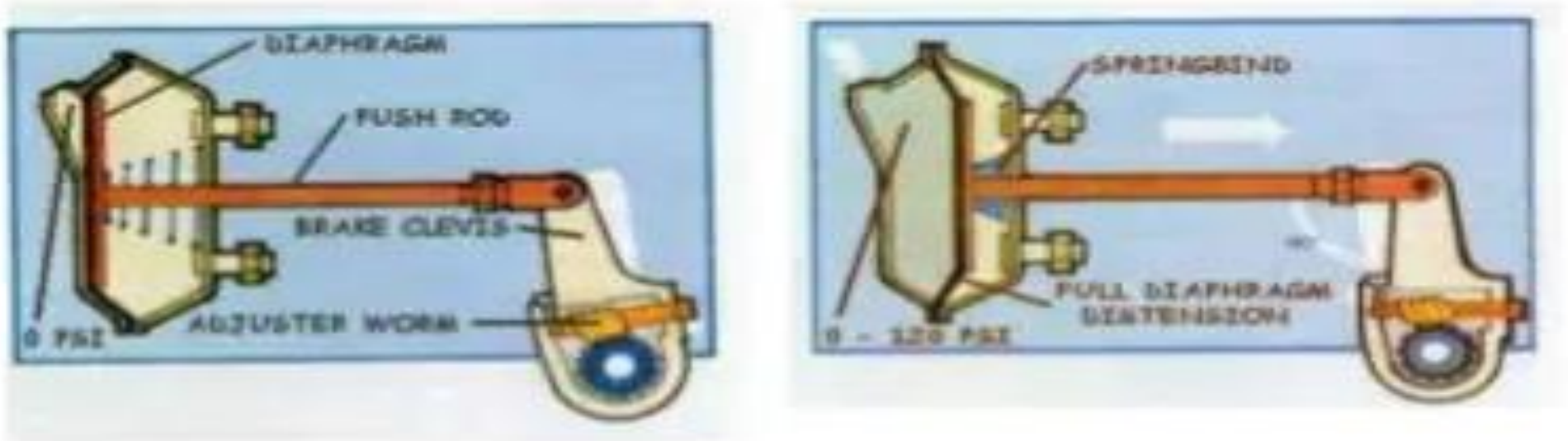
- Diaphragm are widely used for pressure (gauge pressure), particularly in very low ranges. They can detect a pressure differential even in the range of 0 to 4mm.
- The diaphragm can be in the form of Flat, Corrugated and Capsules the choice depends on the strength and amount of deflection required.
    - Two types of diaphragm are generally used:
        1) Metallic diaphragm gauge
        2) Slack diaphragm gauge

❖ Metallic diaphragm gauge



❖ Slack diaphragm gauge

Slack Diaphragm gauge



Advantages:

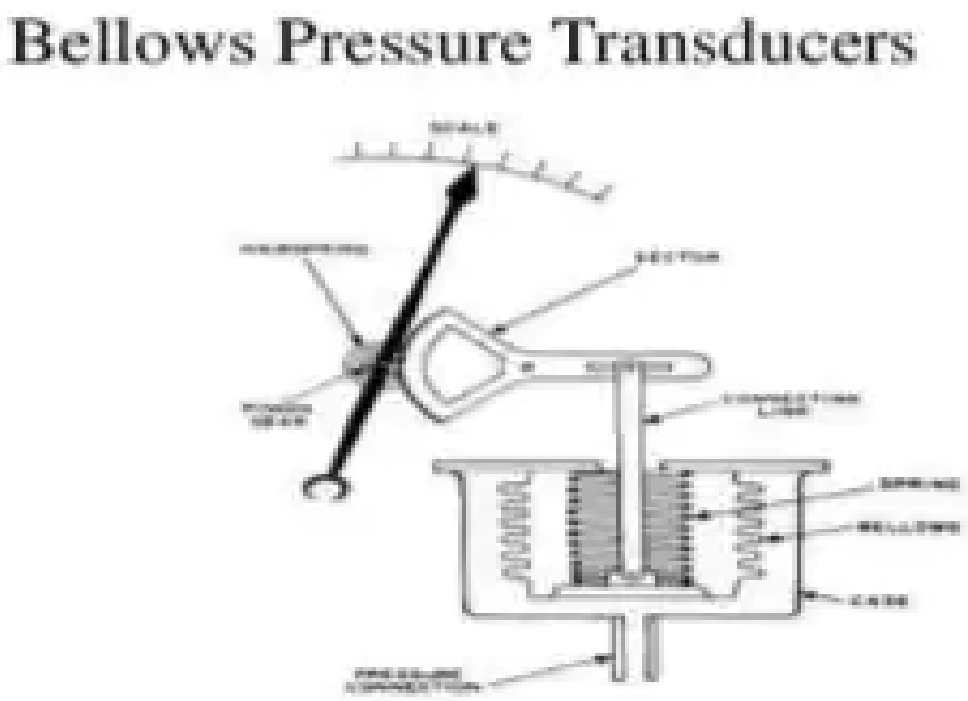
- Diaphragm Pressure Transducer cost is moderate.
- Diaphragm Pressure Transducer possesses high over range characteristics.
- Diaphragm Pressure Transducers are adaptable to absolute and differential pressure measurement.
- Diaphragm Pressure Transducer has good linearity.
- Diaphragm Pressure Transducer is small in size.

Disadvantages:

- Diaphragm Pressure Transducer lack good vibration and shock resistance
- Diaphragm Pressure Transducers are difficult to repair.
- Diaphragm Pressure Transducer is limited to relatively low pressures

Bellows pressure transducers

- A bellows gauge contains an elastic element that is a convoluted unit that expands and contracts axially with change in pressure.
- The pressure to be measured can be applied to the outside or inside of the bellows however, in practice, most bellows measuring devices have the pressure applied to the outside of the bellows.



Advantages:

- Moderate cost
- Delivery of high force
- Adaptability for absolute and differential pressure
- Good in the low to moderate pressure range

Disadvantages:

- Ambient temperature compensation neede
- Unsuitable for high pressure
- Limited availability of metals and work hardening of some of them
- Unsuitability of its zero and the stiffness (therefore it is used in conjunction with (in parallel with) a reliable spring of appreciably higher stiffness for accurate characterization