

EIPC  
NEE-403  
Unit-1  
TRANSDUCERS

# PASSIVE TRANSDUCERS

- **Resistive transducers :**

- Resistive transducers are those transducers in which the resistance change due to the change in some physical phenomenon.

- The resistance of a metal conductor is expressed by a simple equation.

- $R = \rho L/A$

- Where  $R =$  resistance of conductor in  $\Omega$

- $L =$  length of conductor in m

- $A =$  cross sectional area of conductor in  $m^2$

- $\rho =$  resistivity of conductor material in  $\Omega\text{-m}$ .

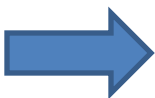
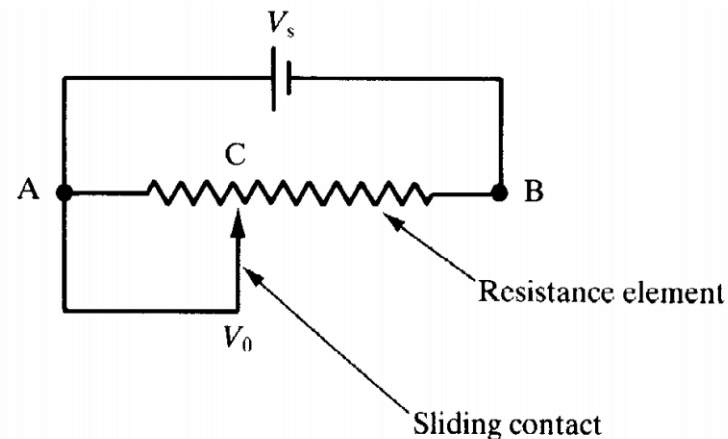
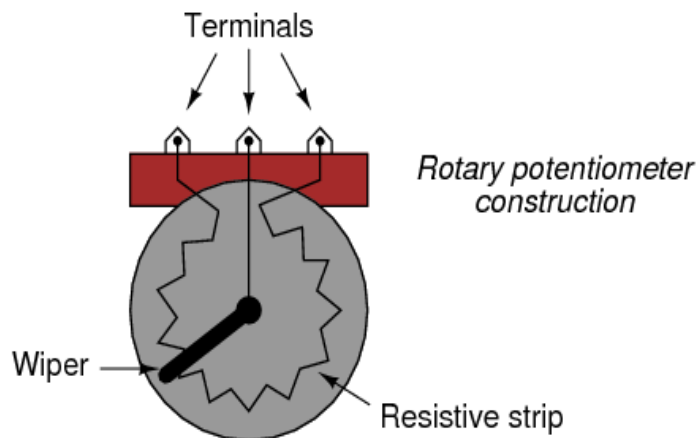
# **RESISTIVE TRANSDUCER**

**There are 4 type of resistive transducers.**

1. Potentiometers (POT)
2. Strain gauge
3. Thermistors
4. Resistance thermometer

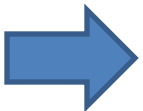
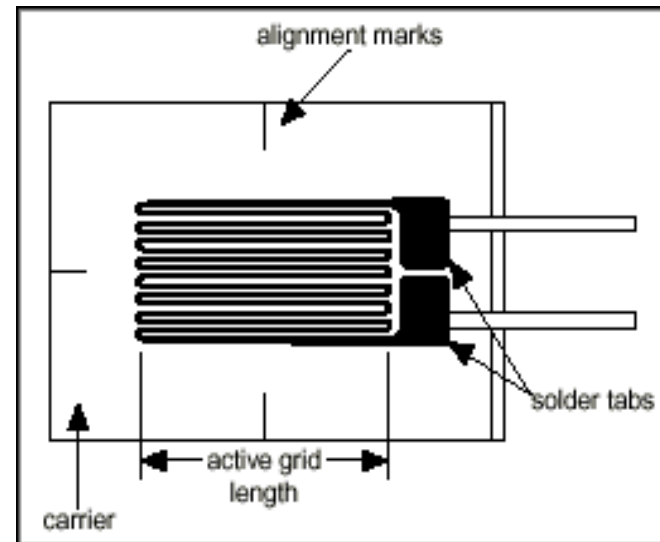
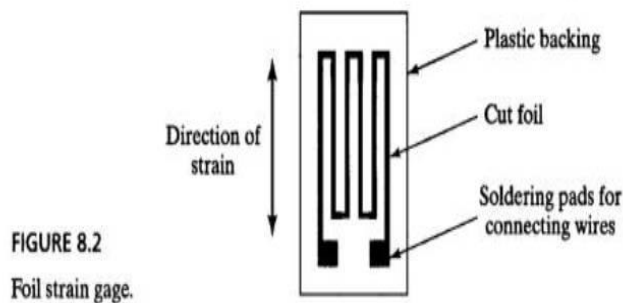
# POTENTIOMETER

- The potentiometer are used for voltage division. They consist of a resistive element provided with a sliding contact. The sliding contact is called as wiper.
- The contact motion may be linear or rotational or combination of the two. The combinational potentiometer have their resistive element in helix form and are called helipots.
- Fig shows a linear pot and a rotary pot.



# STRAIN GAUGE

- The strain gauge is a passive, resistive transducer which converts the mechanical elongation and compression into a resistance change.
- This change in resistance takes place due to variation in length and cross sectional area of the gauge wire, when an external force acts on it.



# TYPES OF STRAIN GAUGE

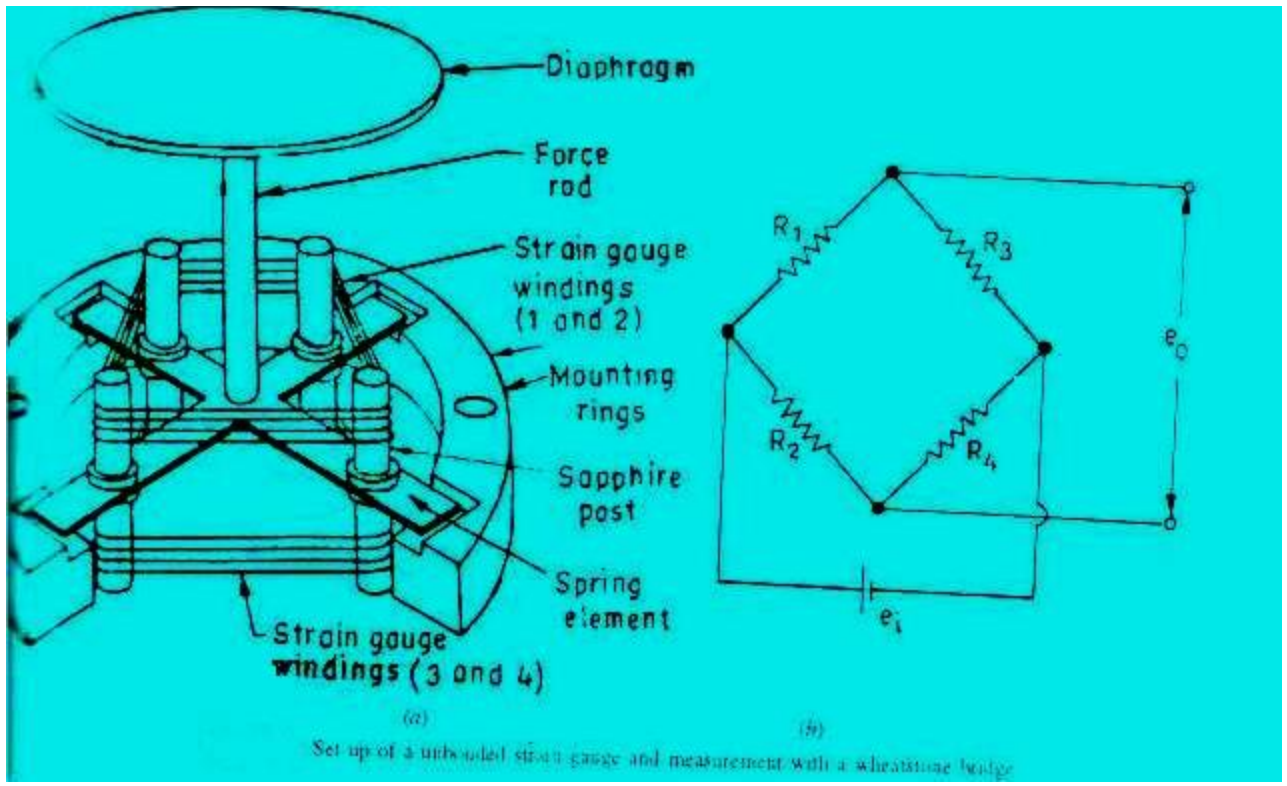
- The type of strain gauge are as
  1. gauge
    - a) Unbonded
    - b) Bonded
    - c) Foil type
  2. Semiconductor gauge

# UNBONDED STRAIN GAUGE

- An unbonded meter strain gauge is shown in fig
- This gauge consist of a wire stretched between two point in an insulating medium such as air. The wires may be made of various copper, nickel, crome nickle or nickle iron alloys.
- In fig the element is connected via a rod to diaphragm which is used for sensing the pressure. The wire are tensioned to avoid buckling when they experience the compressive force.
- The unbounded meter wire gauges used almost exclusively in transducer application employ preloaded resistance wire connected in Wheatstone bridge as shown in fig.

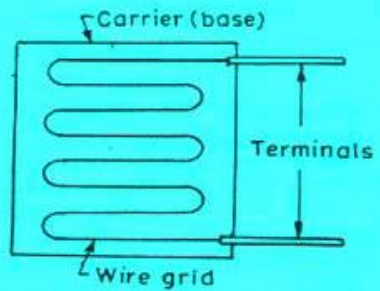
- At initial preload the strain and resistance of the four arms are nominally equal with the result the output voltage of the bridge is equal to zero.
- Application of pressure produces a small displacement, the displacement increases a tension in two wire and decreases it in the other two thereby increase the resistance of two wire which are in tension and decreasing the resistance of the remaining two wire .
- This causes an unbalance of the bridge producing an output voltage which is proportional to the input displacement and hence to the applied pressure .



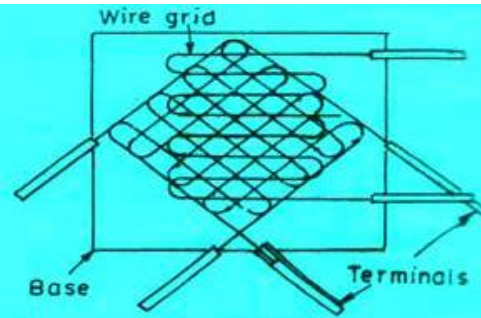


# BONDED STRAIN GAUGE

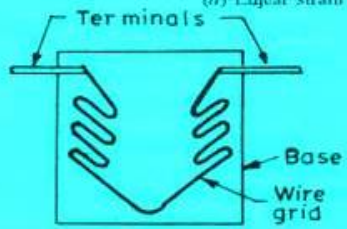
- The bonded metal wire strain gauge are used for both stress analysis and for construction of transducer.
- A resistance wire strain gauge consist of a grid of fine resistance wire. The grid is cemented to carrier which may be a thin sheet of paper bakelite or teflon.
- The wire is covered on top with a thin sheet of material so as to prevent it from any mechanical damage.
- The carrier is bonded with an adhesive material to the specimen which permit a good transfer of strain from carrier to grid of wires.



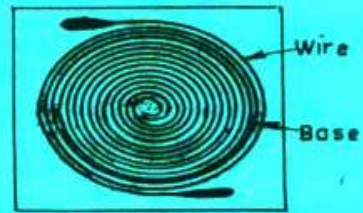
(a) Linear strain gauge.



(b) Rosette.



(c) Torque gauge.



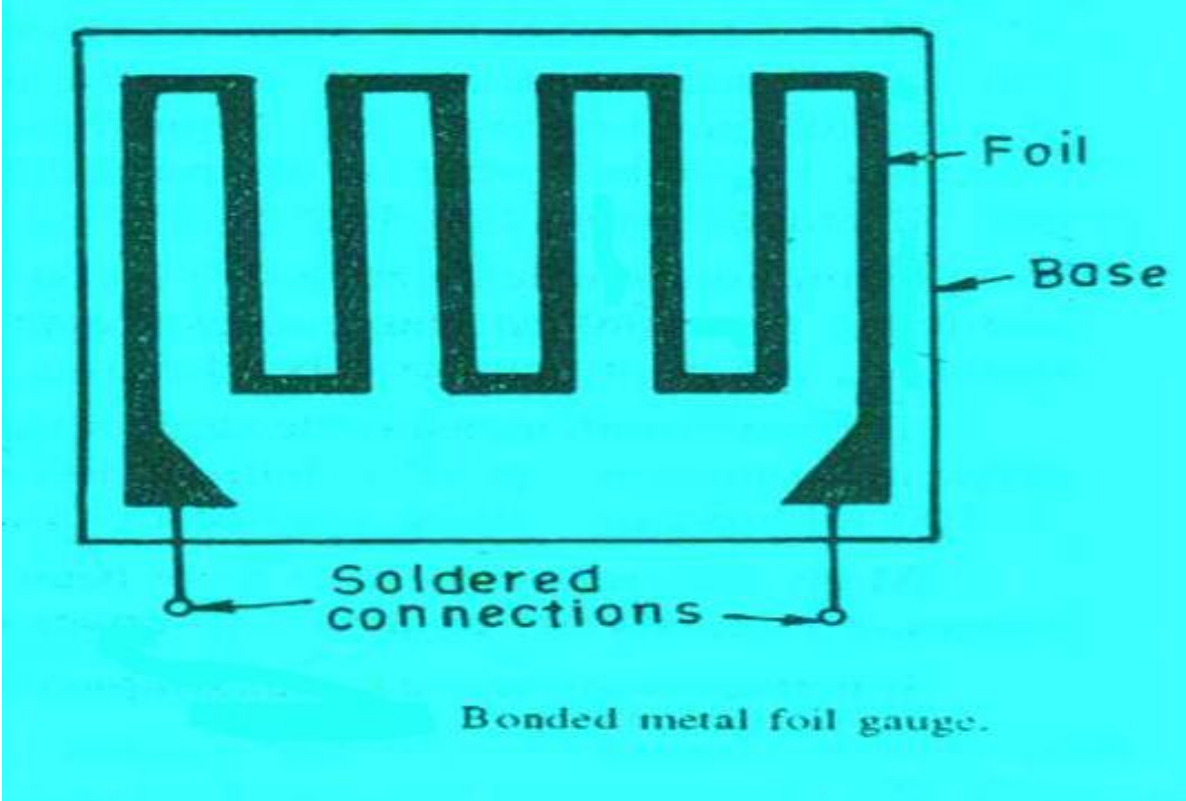
(d) Helical gauge.

Resistance wire strain gauge.

# BONDED METAL FOIL STRAIN GAUGE

- It consist of following parts:
  - 1. Base (carrier) Materials:** several types of base material are used to support the wires. Impregnated paper is used for room temp. applications.
  - 2. Adhesive:** The adhesive acts as bonding materials. Like other bonding operation, successful strain gauge bonding depends upon careful surface preparation and use of the correct bonding agent.

In order that the strain be faithfully transferred on to the strain gauge, the bond has to be formed between the surface to be strained and the plastic backing material on which the gauge is mounted .

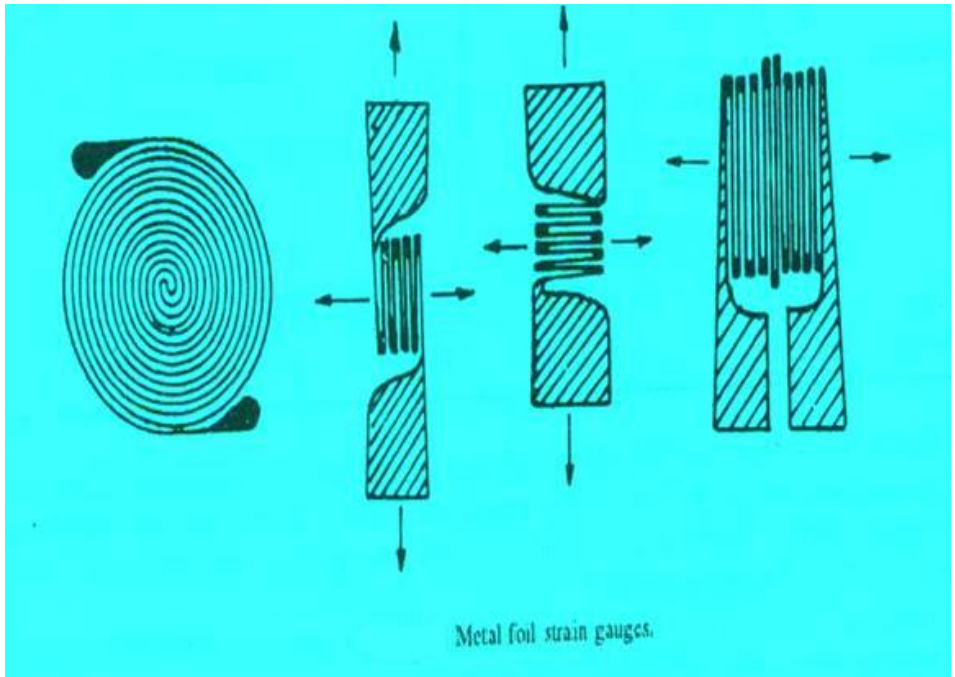


It is important that the adhesive should be suited to this backing and adhesive material should be quick drying type and also insensitive to moisture.

**3. Leads:** The leads should be of such materials which have low and stable resistivity and also a low resistance temperature coefficient

## Contd.

- This class of strain gauge is only an extension of the bonded metal wire strain gauges.
- The bonded metal wire strain gauge have been completely superseded by bonded metal foil strain gauges.
- Metal foil strain gauge use identical material to wire strain gauge and are used for most general purpose stress analysis application and for many transducers.





**Thank You**