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.

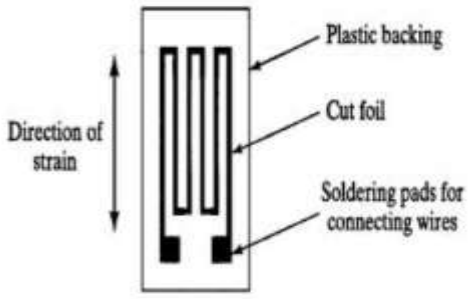
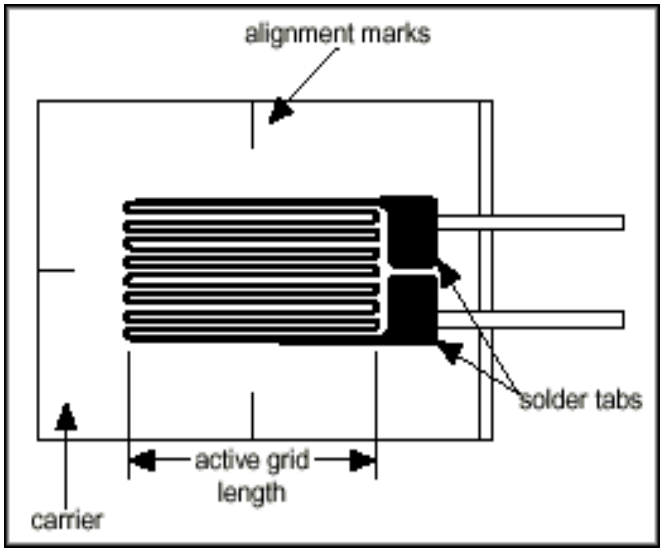


FIGURE 8.2
Foil strain gage.



TYPES OF STRAIN GAUGE

- The type of strain gauge are as

1. Wire gauge

a) Unbonded

b) Bonded

c) Foil type

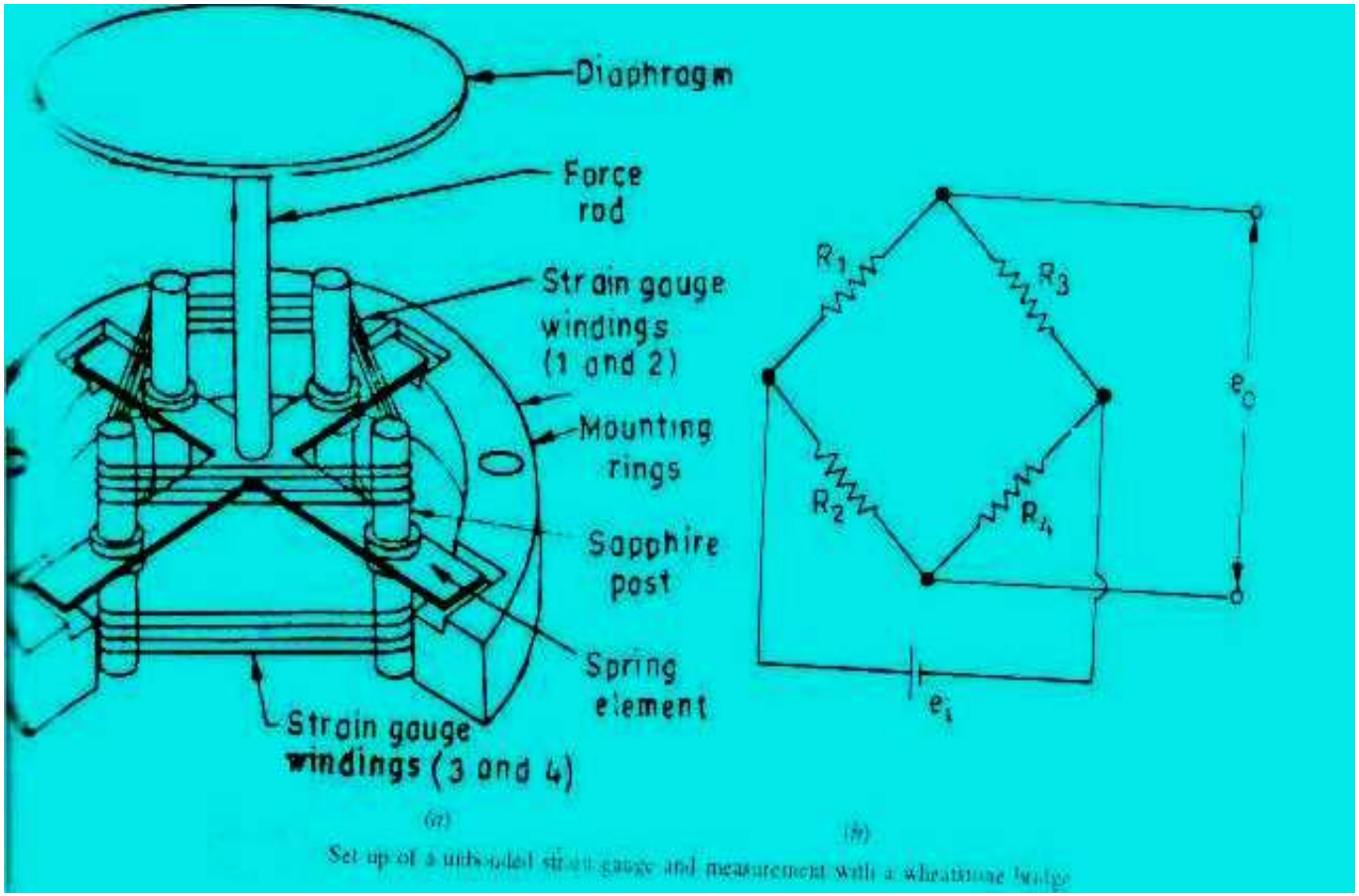
2. Semiconductor gauge

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 .

UNBONDED STRAIN GAUGE



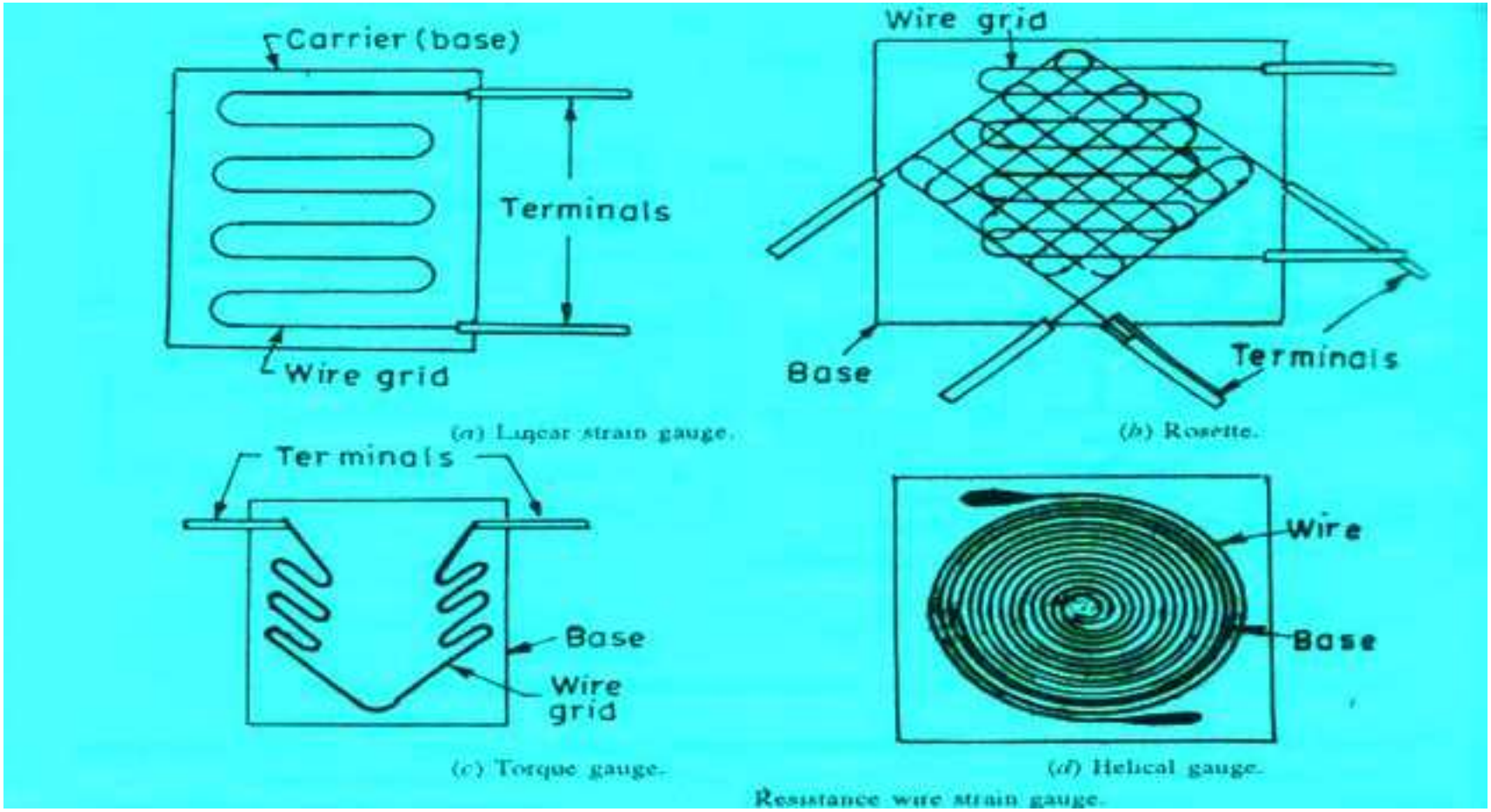
(a) (b)

Set-up of a unbonded strain gauge and measurement with a wheatstone bridge

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 demage.
- The carrier is bonded with an adhesive material to the specimen which permit a good transfer of strain from carrier to grid of wires.

RESISTANCE WIRE STRAIN GUAGE



BONDED METAL FOIL STRAIN GAUGE

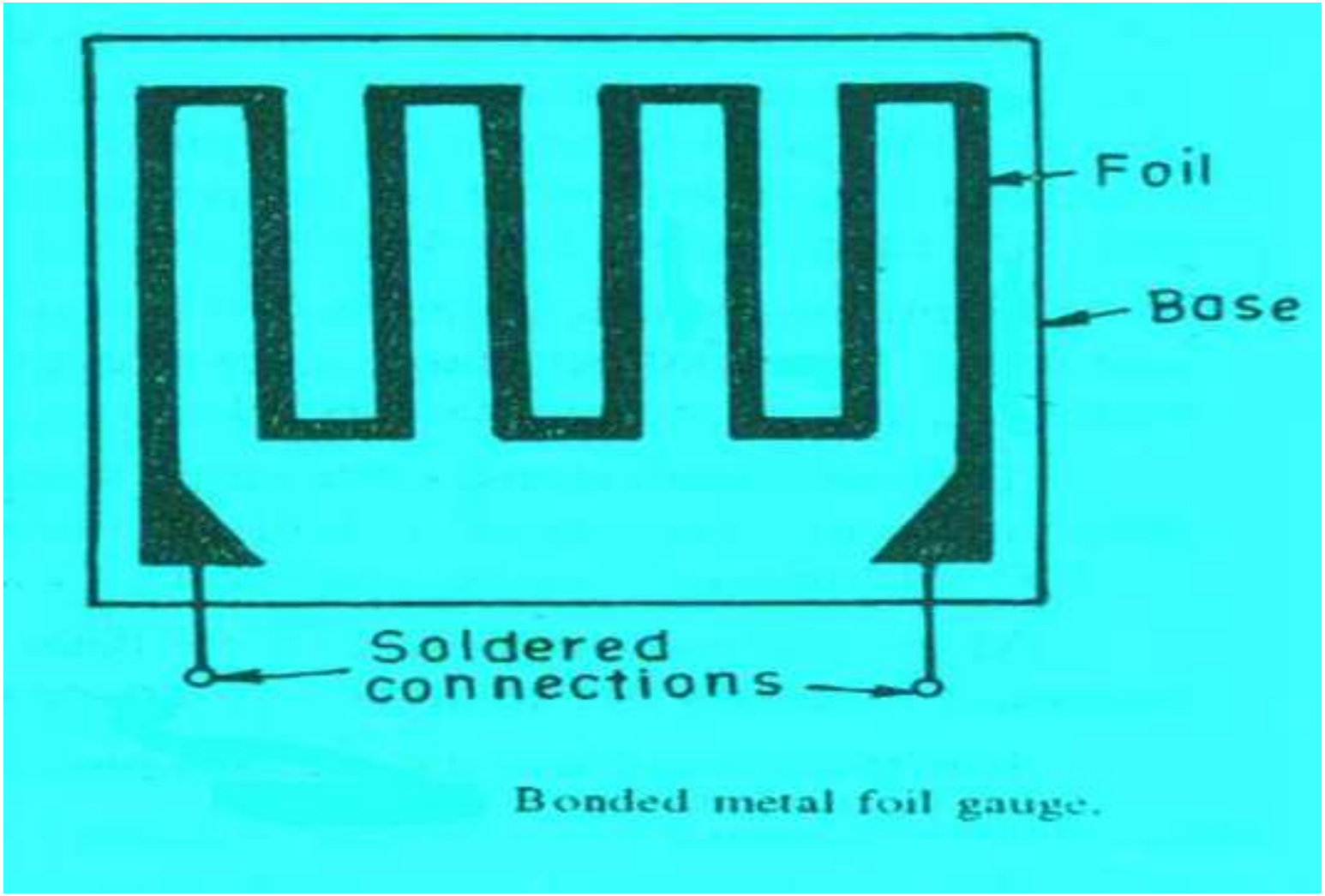
- It consist of following parts:

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 starain 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.

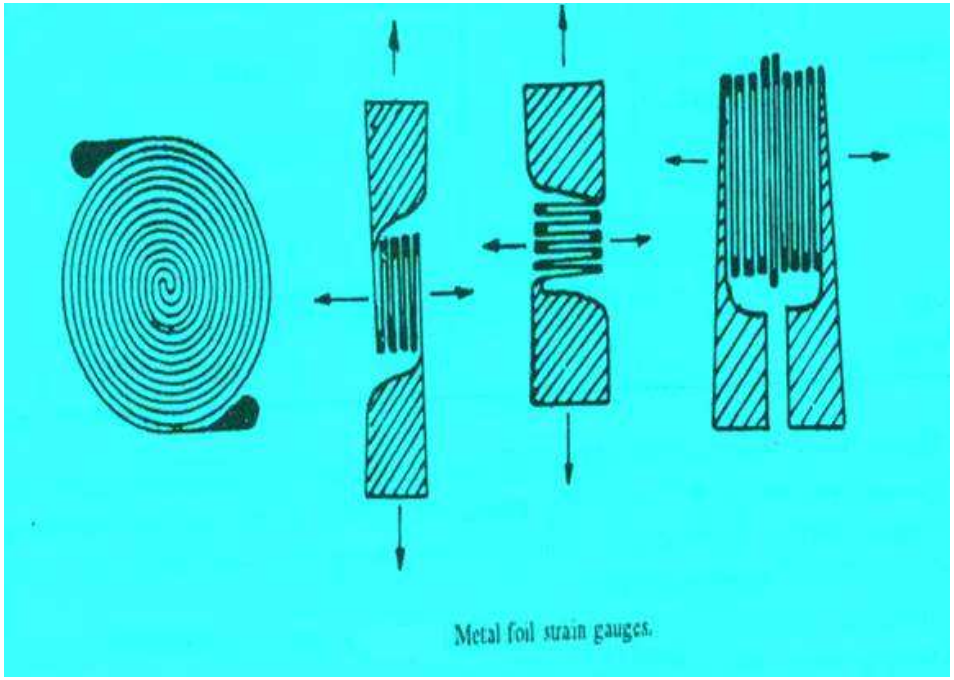
BONDED METAL FOIL STRAIN GAUGE



Bonded metal foil gauge.

- **3. Leads:** The leads should be of such materials which have low and stable resistivity and also a low resistance temperature coefficent
- This class of strain gauge is only an extension of the bonded metal wire strain gauges.
- The bonded metal wire starin 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.

METAL FOIL STRAIN GUAGE

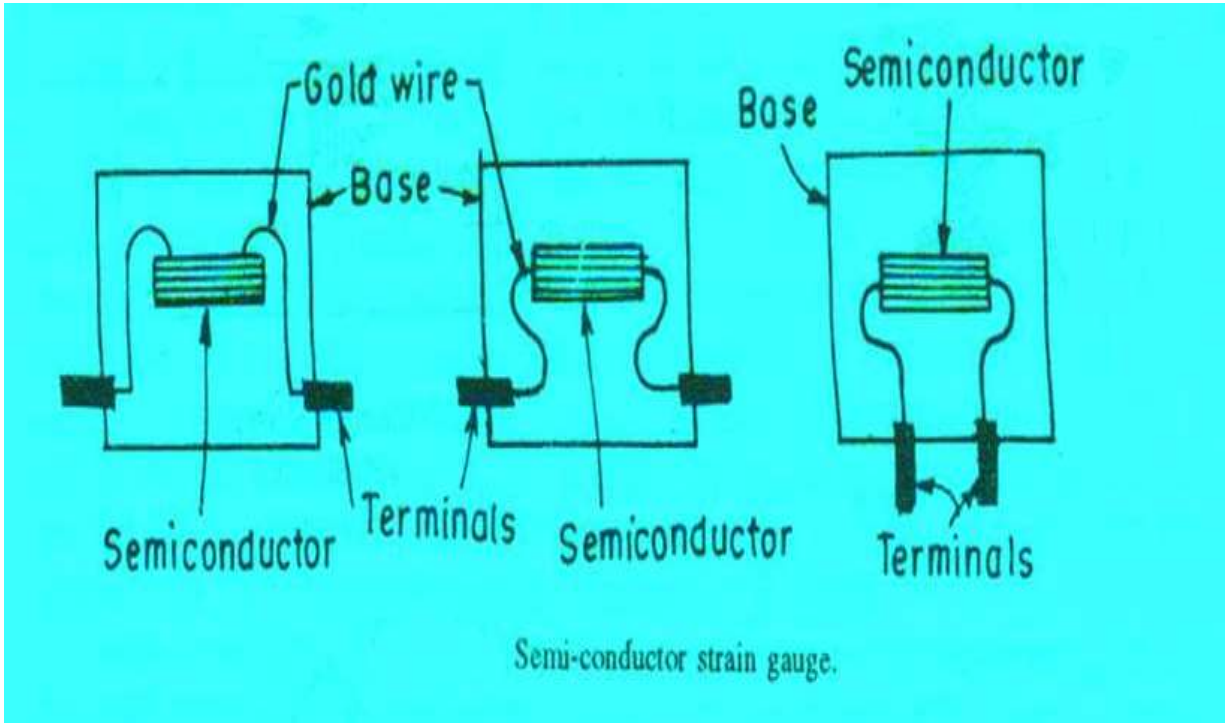


Metal foil strain gauges.

SEMICONDUCTOR STRAIN GAUGE

- Semiconductor gauge are used in application where a high gauge factor is desired. A high gauge factor means relatively higher change in resistance that can be measured with good accuracy.
- The resistance of the semiconductor gauge change as strain is applied to it. The semiconductor gauge depends for their action upon the piezo-resistive effect i.e. change in value of resistance due to change in resistivity.
- Silicon and germanium are used as resistive material for semiconductor gauges.

SEMICONDUCTOR STRAIN GAUGE



Semi-conductor strain gauge.