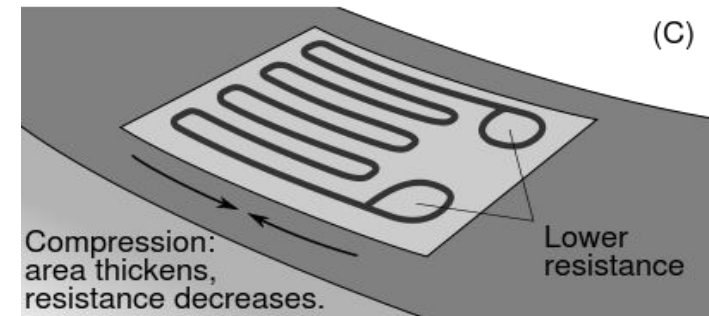
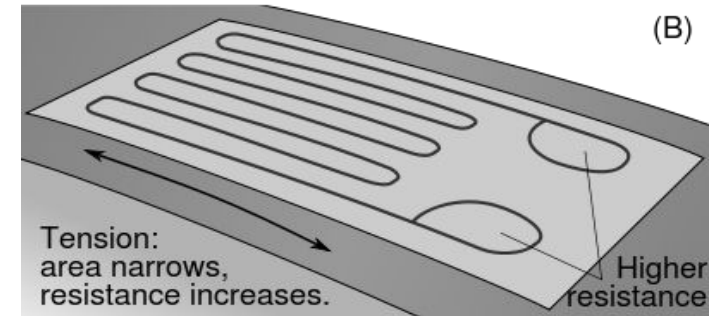
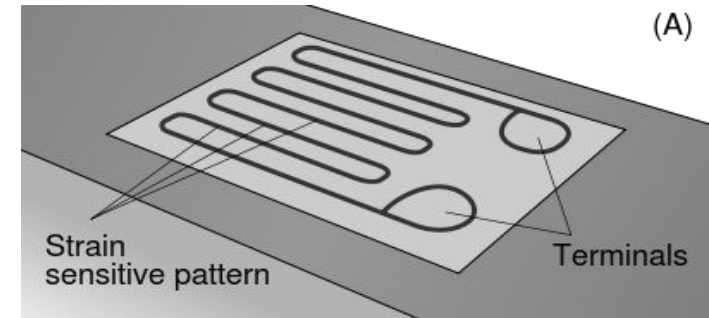
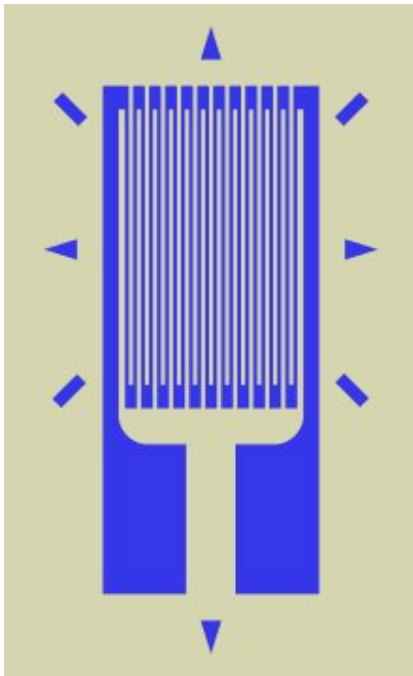
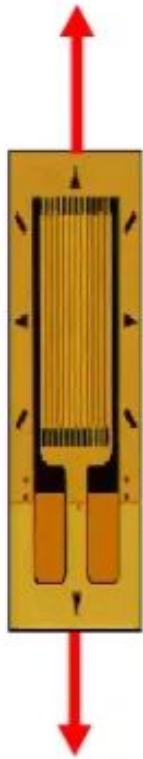


STRAIN GAUGE

- It works on Piezoresistive effect.
- These are used for measurement of stress and strain
- If an elastic material is subjected to tension then its resistance changes.



Tension



$l \uparrow$

$R \uparrow$

Strain Gauge



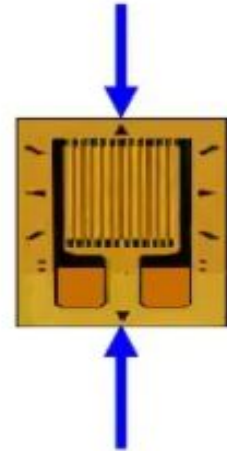
$$R = \rho \frac{l}{A} \Rightarrow R \propto l$$

R = Resistance

ρ = Property of material

l = Length of wire

Compression



$l \downarrow$

$R \downarrow$

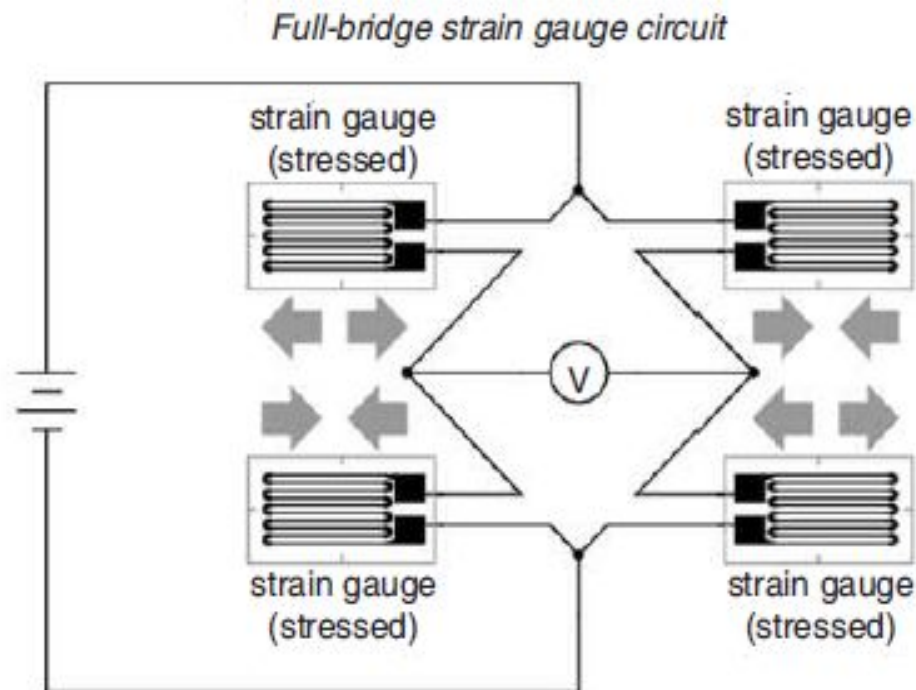
- When an electrical conductor is stretched within the limits of its elasticity such that it does not break or permanently deform, it will become narrower and longer, this leads to increase in electrical resistance end-to-end.
- Conversely, when a conductor is compressed such that it does not buckle, it will broaden and shorten, changes lead to decrease in electrical resistance end-to-end.
- A typical strain gauge arranges a long, thin conductive strip in a zig-zag pattern of parallel lines such that a small amount of stress in the direction of the orientation of the parallel lines results in a multiplicatively larger strain measurement .

- In an electrical resistance strain gauge the device consists of a thin wire placed on a flexible paper tissue and is attached to a variety of materials to measure the strain of the material.
- The gauge position will be in such a manner that the gauge wires are aligned across the direction of the strain to be measured.
- When a force is applied on the wire, there occurs a strain that increases the length and decreases its area. Thus, the resistance of the wire changes.
- This change in resistance is proportional to the strain and is measured using a Wheatstone bridge.

Three ways of connecting strain gauge in bridge circuit

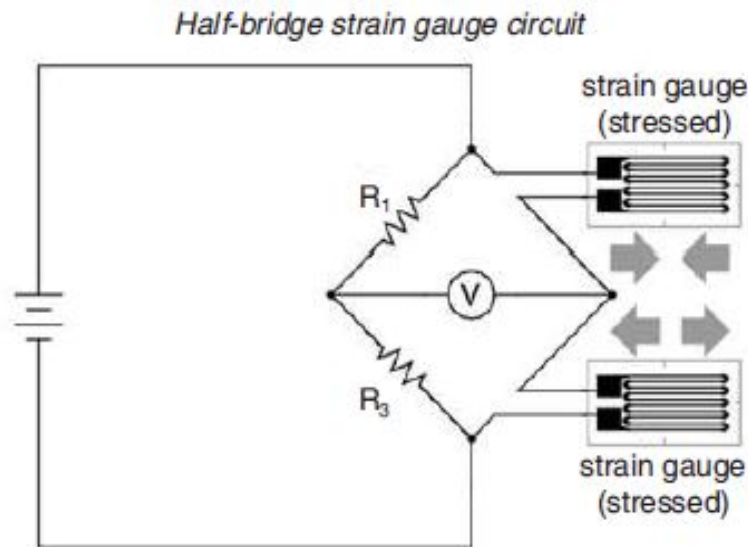
1. Full Bridge

- It has all four of its gauges active.
- A full bridge circuit is used in applications where complimentary pair of strain gauges is to be bounded to the test specimen.
- A full bridge circuit is said to be more linear than other circuits.



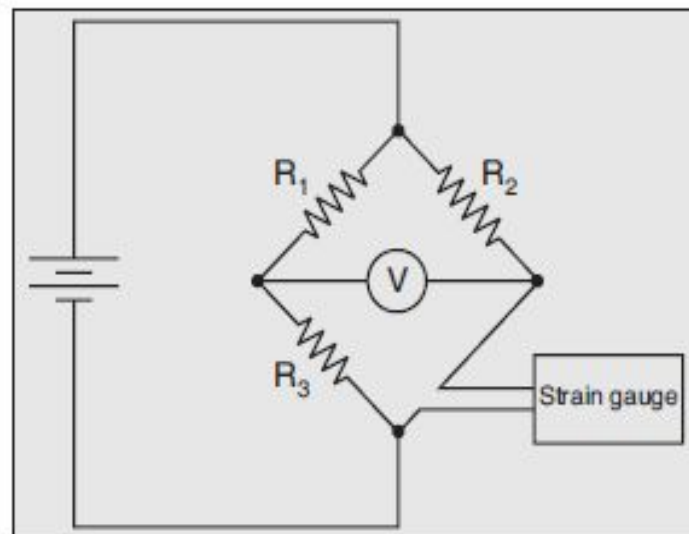
2. Half Bridge

- It has two of its gauges active and thus uses two precise value resistors.
- Two strain gauges are mounted on opposite surface of the test specimen with one in stretched strain and the other as compressed strain.
- The other two are dummy resistance that experience no strain and are temperature insensitive



3. Quarter Bridge

- R_2 is set at a value equal to the strain gauge resistance with no force applied.
- The two ratio arms of the bridge (R_1 and R_3) are set equal to each other.
- Thus, with no force applied to the strain gauge, the bridge will be symmetrically balanced and the voltmeter will indicate zero volts, representing zero force on the strain gauge.
- This arrangement, with a single element of the bridge changing resistance in response to the measured variable (mechanical force), is known as a quarter-bridge circuit.



Applications of Strain Gauge

- Measurement of pressure
- Measurement of force
- Measurement of small displacement
- Measurement of Torque
- Measurement of Load etc.

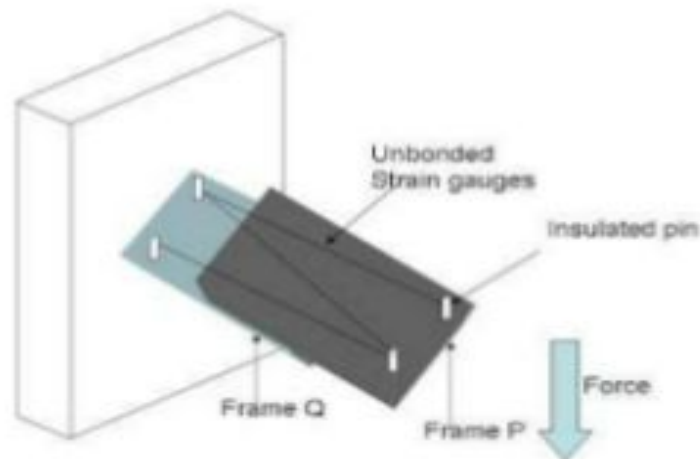
Types of Wire Strain Gauge

- (i) unbonded metal strain gauge and***
- (ii) bonded strain gauge.***

UNBONDED STRAIN GAUGE

- The unbonded strain gage consists of a wire stretched between two points in an insulating medium such as air. One end of the wire is fixed and the other end is attached to a movable element.

Unbonded Strain Gauge



Bonded Strain Gauge

- Bonded strain gauge is connected to a paper or a thick plastic film support.
- The measuring leads are soldered or welded to the gauge wire.
- The bonded strain gauge with the paper backing is connected to the elastic member whose strain is to be measured.

