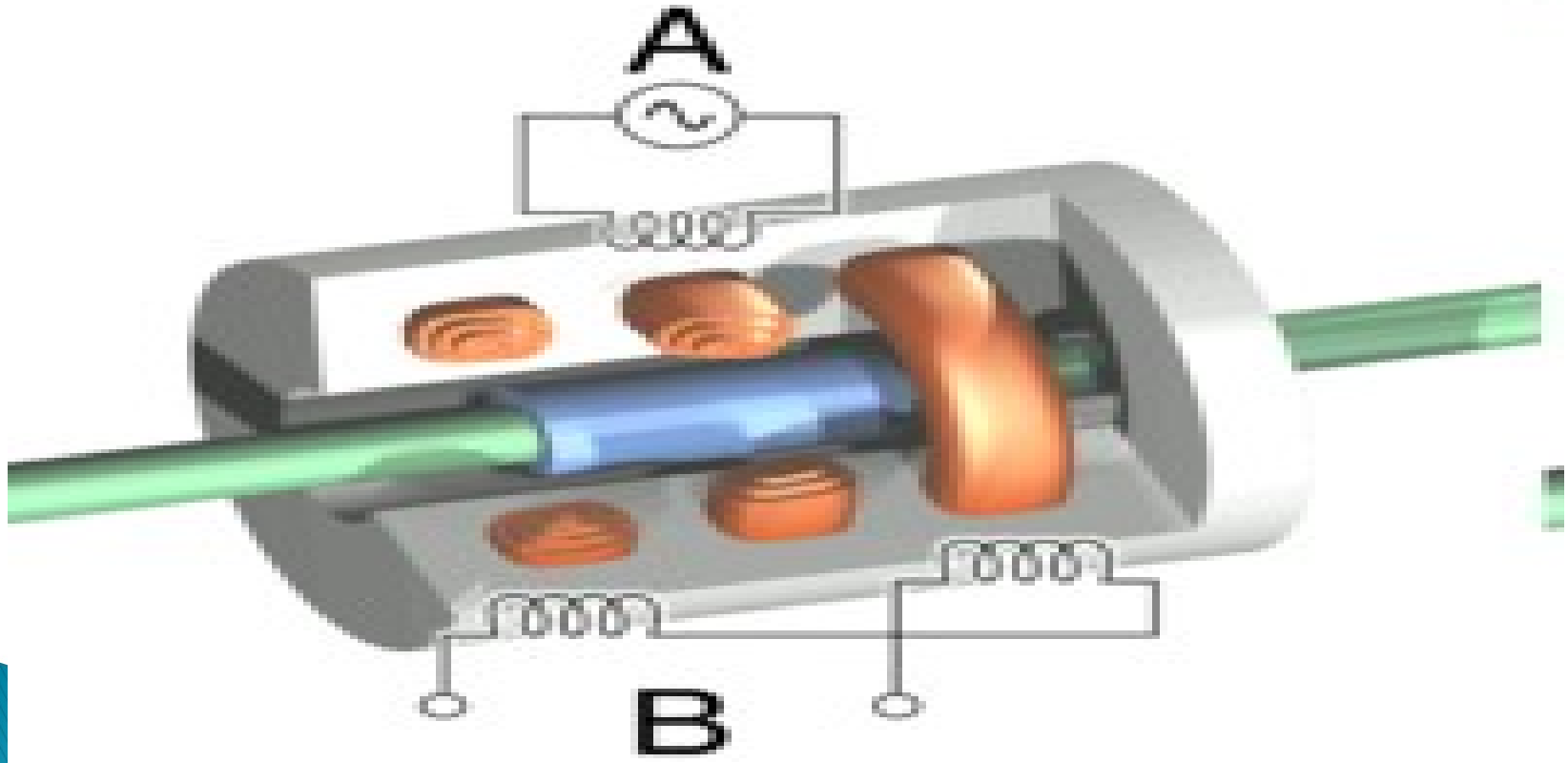
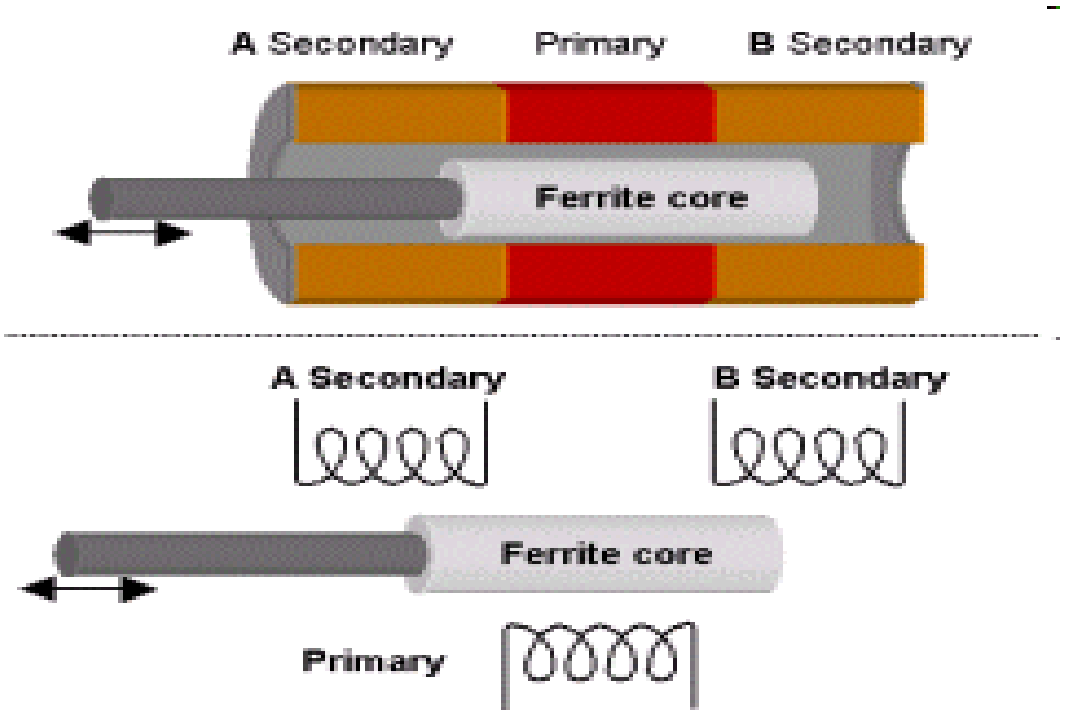
LVDT(Linear Variable Differential Transformer)

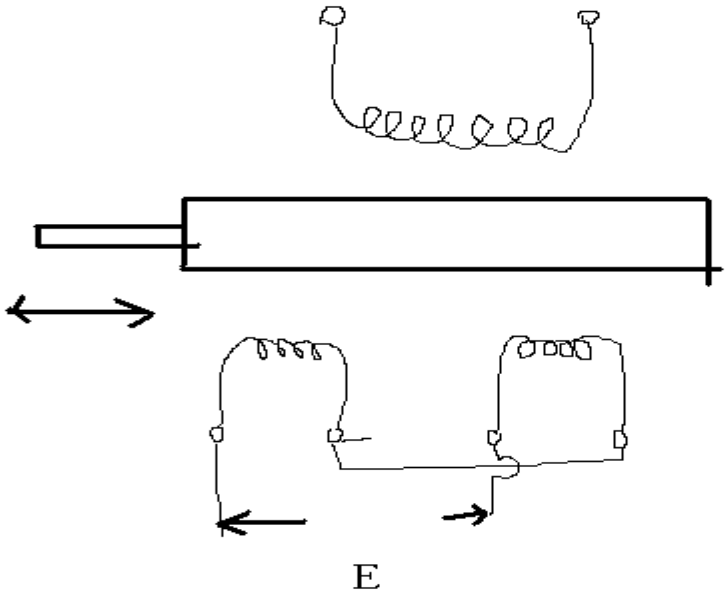
Construction



LVDT Working



LVDT Working



Linear Variable Differential Transducer (LVDT)

- The most widely used inductive transducer to translate the linear motion into electrical signals is the Linear variable differential transducer(LVDT).
- The assembly is placed in stainless steel housing & the end lids provide electrostatic & electromagnetic shielding.
- The frequency of a.c.applied to primary winding is b/w 50Hz to 20KHz.
- The o/p voltage of secondary, S_1 is E_{S1} and that of secondary, S_2 is E_{S2} .
- In order to convert the o/p from S_1 and S_2 into a single voltage signal, the two secondaries S_1 and S_2 are connected in series. Thus the o/p voltage of the transducer is the difference of two voltages .

Differential o/p voltage ,

$$E_o = E_{S1} - E_{S2}$$

When the core is at its normal position the flux linking with both the secondary windings is given as:

$$E_{S1} = E_{S2}$$

Linear Variable Differential Transducer(LVDT) contd.....

- Now if the core is moved to the Left of the Null position the magnitude of the o/p voltage is given by:

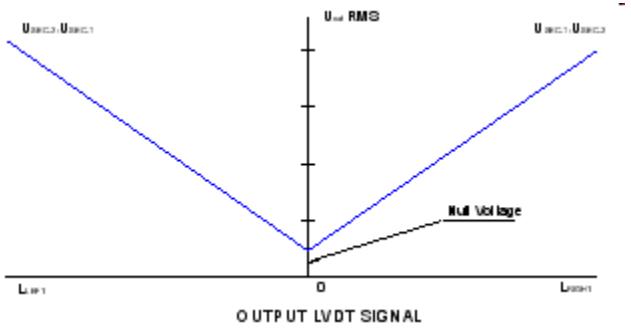
$$E_o = E_{S1} - E_{S2}$$

- Now if the core is moved to the Right of the Null position the magnitude of the o/p voltage is given by:

$$E_o = E_{S2} - E_{S1}$$

& it is 180° out of phase & negative with the primary voltage.

Displacement Vs O/p V



Characteristics of LVDT Contd……..

- The o/p voltage of an L.V.D.T is a linear function of core displacement within a limited range of motion, say 5mm from the null position.
- Beyond this range of displacement ,the curve starts to deviate from a straight line.
- Ideally the o/p voltage at the null position should be equal to zero. However,in actual practice their exists a small voltage at the null position.

Reasons of residual voltage:-

- This may be on account of I/P supply voltage and also due to harmonics produced in the o/p voltage on account of use iron core.
- An incomplete magnetic or electrical unbalance or both which result in a finite O/P voltage at the null position .This finite residual voltage is generally less than 1% of the max.o/p voltage in the linear range
- Other causes of residual voltage is stray magnetic fields and temperature effects.

Advantages of LVDT

1. ***High Range:***

- For measurement of displacement ranging from 1.25 mm to 250 mm.
- .025 % of linearity.

2. ***Friction and Electrical Isolation:***

- There is no physical contact b/w the movable core & coil structure which means that the L.V.D.T is a frictionless device
- The absence of friction b/w coil & core of an L.V.D.T means that there is no wear out. This gives an L.V.D.T essentially infinite mechanical life.
- The infinite mechanical life is also important for high reliability mechanisms and systems.
- System found applications in space vehicles, aircrafts, missiles & critical industrial equipment.
- The frictionless operation combined with induction principle can respond to even minute motion of the core & produce an output.

Advantages of LVDT

3.High input & high sensitivity:

- The L.VD.T gives a high o/p and many times there is no need for amplification
- The transducer has high sensitivity which is typically about 40v/mm.

4.Ruggedness:

- These transducer can usually tolerate high degree of shock and vibrations especially when the core is spring loaded without any adverse effects.
- They are simple in construction and by virtue of their being small and light in weight, they are easy to align and maintain.

5.Low Hysteresis:L.V.D.T show a low hence hysteresis & repeatability is excellent under all conditions.

6.Low Power Consumption: Most of L.V.D.T consume which is less than 1W.

Disadvantages of LVDT

1. Relatively large displacements are required for appreciable differential o/p.
2. They are sensitive to stray magnetic fields but shielding is possible. This is done by providing magnetic shields with longitudinal slots.
3. Many times ,the transducer performance is affected by vibrations
4. Temp.affects the performance of the transducer.

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