

GENERATING VOLTMETERS

Direct connection to high-voltage source is avoided in Generating Voltmeters. Generating voltmeter is a variable capacitor electrostatic voltage generator which generates current proportional to the applied external voltage.(driven by external synchronous or constant speed motor and does not absorb power or energy from the voltage measuring source).

Principle of operation

The charge stored in a capacitor of capacitance C is given by $q = CV$. If the capacitance of the capacitor varies with time when connected to a voltage source of voltage V , the current through the capacitor is given by $i = C \frac{dV}{dt}$. For a constant angular frequency ω , the current is proportional to the applied voltage V . The generated current is rectified and measured by a moving coil meter. Generating voltmeter can be used for a.c voltage measurements also provided that angular frequency ω is the same or equal to half that of the supply frequency.

Generating voltmeters employ rotating sectors for variation of capacitance. Figure gives the schematic diagram of a generating voltmeter. The high voltage source is connected to a disc electrode S_3 which is kept at a fixed distance on the axis of the other low voltage electrodes S_0, S_1 and S_2 . The rotor S_0 is driven at a constant speed by a synchronous motor at a suitable speed (1500, 1800, 3000, or 3600 rpm). The rotor vanes of S_0 cause periodic change in capacitance between the insulated disc S_2 and the hv electrode S_3 . The shape and number of the vanes of S_0 and S_1 are so designed that they produce sinusoidal variation in the capacitance.

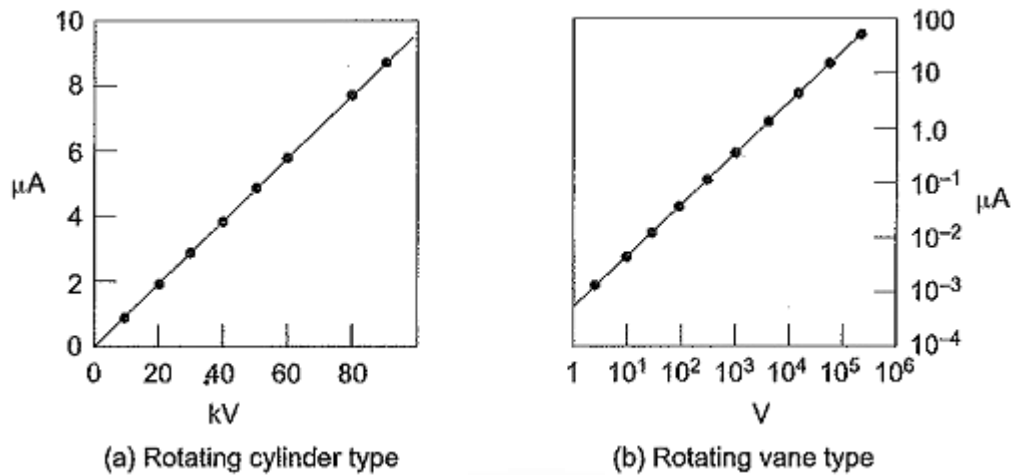


Figure 4.3.1 Calibration curve for generating voltmeter

[Source: "High Voltage Engineering" by C.L. Wadhwa, Page – 586]

- **Advantages**

- No source loading by the meter
- No direct connection to high voltage electrode
- Scale is linear and extension of range is easy
- a very convenient instrument for electrostatic devices such as Van de Graaff generator and particle accelerators.

- **Limitations**

- Require calibration
- Careful construction is needed and is a cumbersome instrument requiring an auxiliary drive.
- Disturbance in position and mounting of the electrodes make the calibration invalid.