

Clamp-on Meter & Megger – Testing Tools in Electrical Engineering

Department: Electrical Engineering (EEE)

Course: Basic Electrical Measurement / Electrical Machines / Lab Instruments

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Document Overview: –

This document provides detailed notes on two important electrical testing tools, like Clamp-on Meter and the Megger. It includes:

- Working principles and internal construction
- Types of clamp meters (CT, Hall effect, flexible)
- Applications in industrial and field testing
- Insulation resistance testing using Megger
- Safety tips and practical conclusions
- Ideal for lab preparation, viva, and university exams

Use Case: GTU Practical Notebook | Viva Prep | Electrical Lab Record

Understanding of Clamp-on meters and Meggers

1. CLAMP ON METER: –

- It is an electrical test tool that combines a basic digital multimeter with a current sensor. Clamps measure current, while probes measure voltage. A hinged jaw integrated into an electrical meter allows technicians to clamp the jaws around a wire, cable, or other conductor at any point in an electrical system and measure current in that circuit without disconnecting or de-energizing it.
- Inside the plastic moldings, the hard jaws are made of ferrite iron and designed to detect, concentrate, and measure the magnetic field generated by current flowing through a conductor.
- Clamp meters are ideal for measuring high current levels. DMMs cannot measure 10 A of current for more than 30 seconds without risking damage to the meter.
- Consider summarizing as: “Most clamp meters can measure from 0 A to 600 A, while advanced models and iFlex® accessories can handle up to 2500 A.



- Clamp meters are used on industrial equipment, industrial controls, residential/commercial/industrial electrical systems, and commercial/industrial HVAC.

➤ There are three types of clamp meters:

1. Current transformer clamp meters: measure only alternating current (AC).

2. Hall Effect clamp meters measure both alternating current (AC) and direct current (DC).

3. Flexible clamp meters employ a Rogowski coil, measure AC only, and are suitable for use in tight spaces.

➤ Advantages: -

- Non-invasive measurement
- Safe and quick for live circuits
- Compact and portable

➤ Limitations: -

- Less accurate at very low currents
- Limited use for measuring voltage or resistance



➤ **Industrial applications of clamp-on meter:** –

- Clamp-on ultrasonic flow meter can be used in any industrial application where a regular ultrasonic flow meter would be. However, they are especially suited for the following materials:

1. Gas
2. Oil
3. Water and other clear liquids
4. Sewage and wastewater
5. Slurry
6. Process water
7. Air or Oxygen

➤ **Conclusion:** –

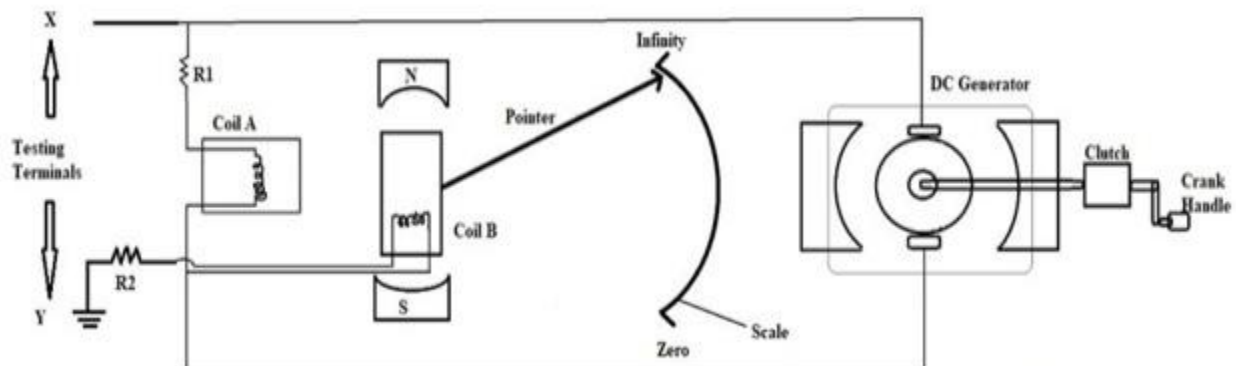
- In this practical, we understand that a clamp-on meter is a convenient, safe, and efficient way to measure current without test leads. As we all know that when current flows through a conductor, a magnetic field is produced. So, a clamp-on-meter senses this magnetic field and gives a corresponding current reading [Amp].

2. MEGGER: -

- A megger is a high-resistance measuring instrument used primarily to test the insulation resistance of electrical equipment.
- If the resistance of the insulation is high, the pointer of the moving coil deflects towards infinity, and if it is low, then the pointer indicates zero resistance. The accuracy of the Megger is high compared to other instruments.

➤ Construction of Megger: -

- Megger is used to measure high values of resistance. Megger consists of the following parts.
 1. DC generator
 2. 2 Coils (Coil A, Coil B)
 3. Clutch
 4. Crank handle
 5. terminal X & Y



- The crank handle present here is rotated manually, and the clutch is used to vary the speed. This arrangement is placed between magnets, where the entire setup is called a DC generator.
- A Resistance scale is present towards the left of the DC generator, which provides the value of resistance ranging from 0 to infinity.
- There are two coils in the circuit, Coil-A and Coil-B, which are connected to the DC generator.

- ❖ The two testing terminals X and Y, which can be connected in the following manner: –
 - To calculate the resistance of the winding of the transformer, the transformer is connected between the two testing terminals X and Y.
 - If we want to measure the insulation of the cable, then the cable is connected between the two testing terminals, A and B.

➤ Working of Megger: –



- Megger is used here to measure
 1. Insulation resistance
 2. Machine windings
 - According to the principle of the DC generator, whenever a current-carrying conductor is placed between the magnet fields, it induces a certain amount of voltage. The magnetic field generated between the two poles of the permanent magnet is used to rotate the rotor of the DC generator using the crank handle.
 - Whenever we rotate this DC rotor, some voltage and current are generated. This current flows through Coil A and Coil B in an anti-clockwise direction.
- Where coil A carries current = I_A and
- Coil B carries current = I_B .
- These two current produces fluxes ϕ_A and ϕ_B in two coils A and B.

- On one side motor requires two fluxes to interact and produce a reflecting torque, then the motor runs.
- Whereas on the other side, the two fluxes φ_A and φ_B , which interact with each other, and then the pointer, which is presented, will experience some force by the production of deflecting torque " T_d ", where the pointer shows the resistance value on the scale.

➤ **Industrial applications of Megger:** –

1. Used for the insulation of windings.
2. Used to test electronic devices.
3. Used to measure the resistance of an insulator.

➤ **Safety Tip:** –

- Meggers should never be used on live circuits — they generate high voltage during testing.

➤ **Typical Voltage Output:** –

- Ranges from 250V to 5kV depending on the application (low-voltage systems vs. HV insulation tests).

➤ **Conclusion:** –

- Clamp-on meters are safe, efficient tools for measuring high currents without physical contact.
 - Meggers are essential instruments for evaluating insulation health, especially in motors, transformers, and cables.
- Both instruments are indispensable for modern electrical testing and maintenance.