

2.5 Earth Leakage Circuit Breaker

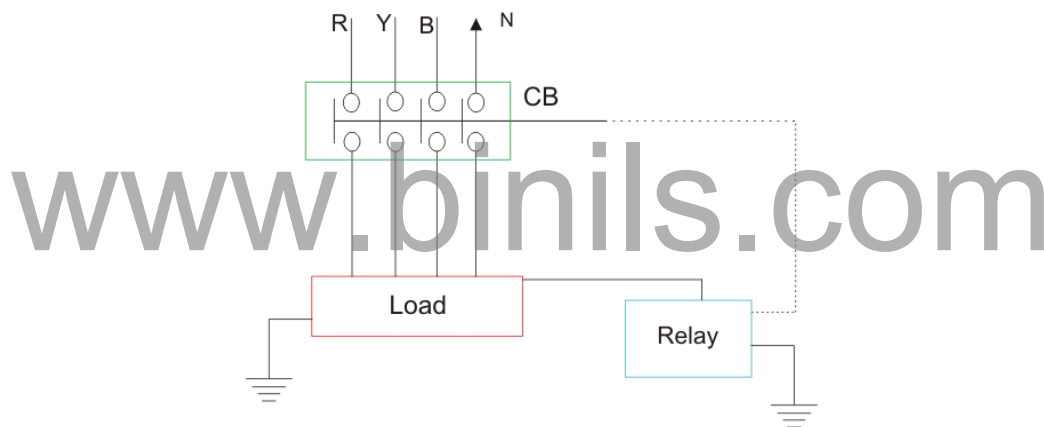
An Earth-leakage circuit breaker (ELCB) is a safety device used in electrical installations (both residential and commercial) with high Earth impedance to prevent electric shocks. It detects small stray voltages on the metal enclosures of electrical equipment, and interrupts the circuit if a dangerous voltage is detected.

ELCBs help detect current leaks and insulation failures in the electrical circuits that would cause electrical shocks to anyone coming into contact with the circuit.

Voltage Earth Leakage Circuit Breaker

The working principle of voltage ELCB is quite simple. One terminal of the relay coil is connected to the metal body of the equipment to be protected against earth leakage and other terminal is connected to the earth directly.

If any insulation failure occurs or live phase wire touches the metal body, of the equipment, there must be a voltage difference appears across the terminal of the coil connected to the equipment body and earth. This voltage difference produces a current to flow the relay coil.



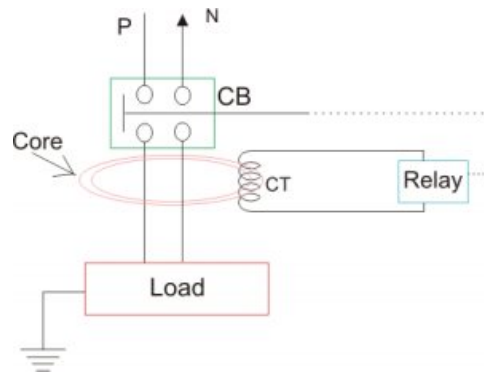
If the voltage difference crosses, a predetermined limit, the current through the relay becomes sufficient to actuate the relay for tripping the associated circuit breaker to disconnect the power supply to the equipment.

The typicality of this device is, it can detect and protect only that equipment or installation with which it is attached. It cannot detect any leakage of insulation in other parts of the system. Study your Electrical MCQs to learn more about the operation of ELCBs.

Current ELCB or Residual Current Circuit Breaker (RCCB)

The working principle of current earth leakage circuit breaker or RCCB is also very simple as voltage operated ELCB but the theory is entirely different and residual current circuit breaker is more sensitive than ELCB.

Actually, ELCBs are of two kinds, but it is general practice to refer voltage based ELCB as simple ELCB. And current based ELCB is referred to as RCD or RCCB. Here one CT (Current Transformer) core is energized from both phase wise and neutral wire.



Single Phase Residual Current ELCB. The polarity of the phase winding and neutral winding on the core is so chosen that, in normal condition mmf of one winding opposes that of another.

As it is assumed that, in normal operating conditions the current goes through the phase wire will be returned via neutral wire if there's no leakage in between.

As both currents are same, the resultant mmf produced by these two currents is also zero-ideally.

The relay coil is connected with another third winding wound on the CT core as secondary. The terminals of this winding are connected to a relay system.

In normal operating condition there would not be any current circulating in the third winding as there is no flux in the core due to equal phase and neutral current.

When any earth leakage occurs in the equipment, there may be part of phase current passes to the earth, through the leakage path instead of returning via neutral wire.

Hence the magnitude of the neutral current passing through the RCCB is not equal to phase current passing through it.

