



ELECTRICAL SAFETY

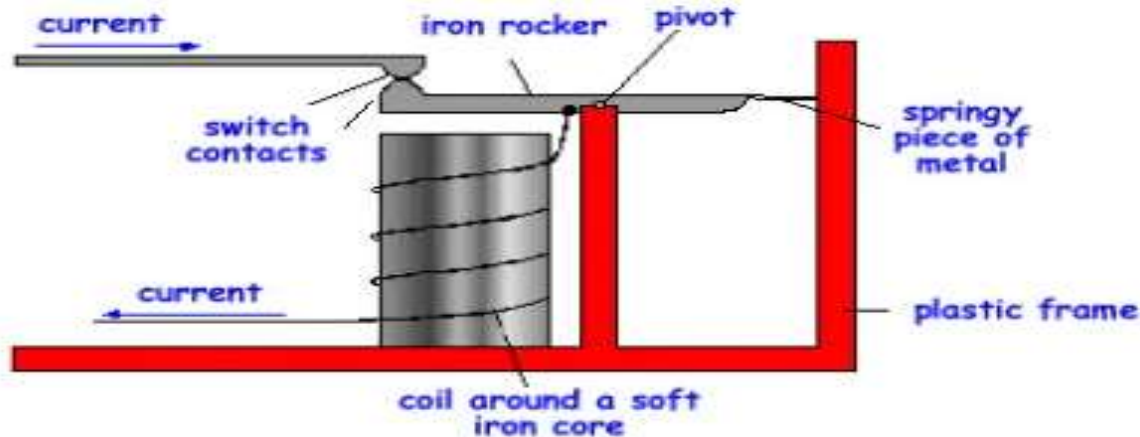
- Never carry a tool by the cord.
- Never pull the cord to disconnect it.
- Keep cords away from heat, oil, and sharp edges.
- Disconnect when not in use and when changing accessories such as blades and bits.





CIRCUIT BREAKERS

- An electrical circuit breaker is a switching device which can be operated manually and automatically for controlling and protecting an electrical power system.
- As the modern power system deals with huge currents, special attention should be given during designing of a circuit breaker to ensure it is able to safely interrupt the arc produced during the closing of a circuit breaker. This was the basic definition of circuit breaker

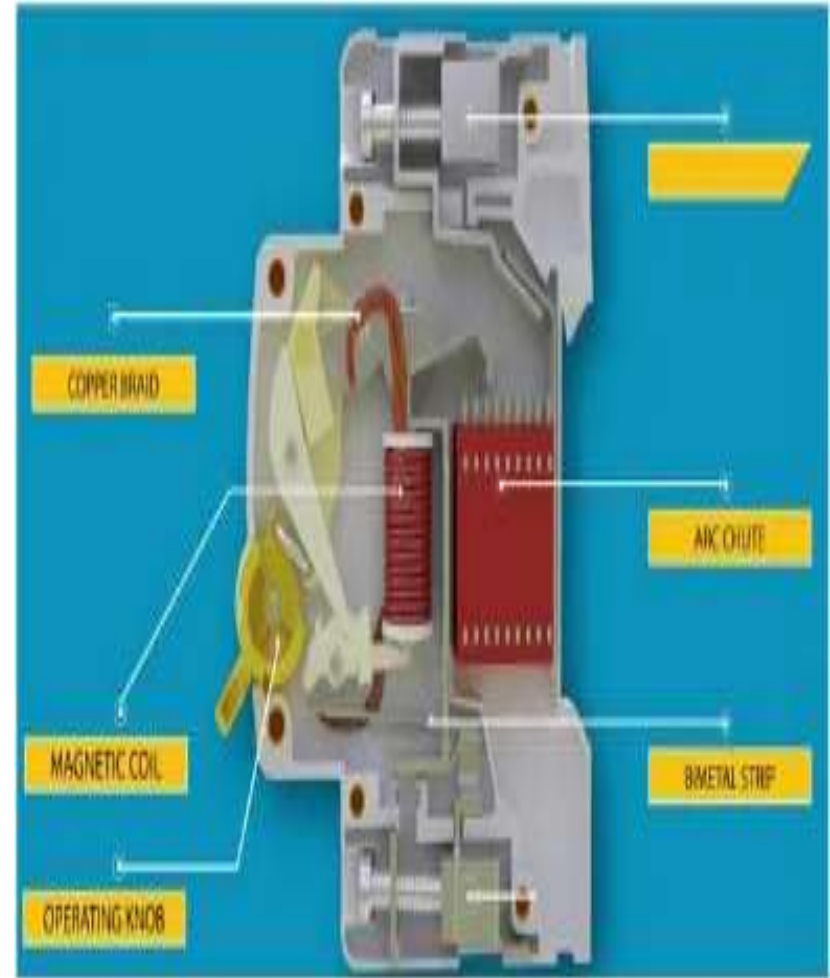




CIRCUIT BREAKERS-

MCB

- A Miniature Circuit Breaker (MCB) is an automatically operated electrical switch used to protect low voltage electrical circuits from damage caused by excess current from an overload or short circuit.
- MCBs are typically rated up to a current up to 125 A, do not have adjustable trip characteristics, and can be thermal or thermal-magnetic in operation.





MCB VS FUSES

- The **MCB** has many advantages compared to a fuse:
 - It automatically switches off the electrical circuit during the abnormal conditions of the **network** (both overload and fault conditions). The MCB is much more reliable in the detection of such conditions, as it is more sensitive to change in current.
 - The **handling of an MCB** is more **electrically safe** than a fuse.





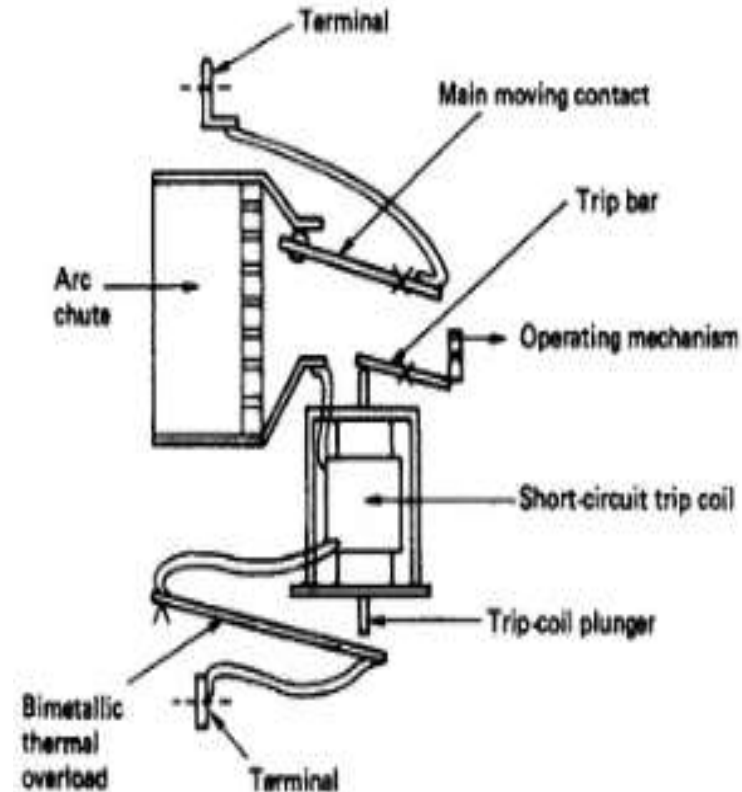
MCB VS FUSES

- As the switch operating knob comes at its off position during tripping, **the faulty zone of the electrical circuit can easily be identified.** But in case of a fuse, the fuse wire should be checked by opening fuse grip or cutout from fuse base, for confirming the blow of fuse wire. **Thus is it much detect if an MCB has been operated compared to a fuse.**
- **Quick restoration of supply can not be possible in case of fuse, as fuses have to be rewirable or replaced for restoring the supply.** But in the case of an MCB, quick restoration is possible by (literally) flipping a switch.
- **MCBs can be controlled remotely,** whereas fuses can not



WORKING PRINCIPLE OF MCB

- There is two arrangement of operation of a miniature circuit breaker.
- One due to the thermal effect of over current and other due to electromagnetic effect of over current.
- The thermal operation of the miniature circuit breaker is achieved with a bimetallic strip whenever continuous overcurrent flows through MCB, the bimetallic strip is heated and deflects by bending.



EARTH LEAKAGE CIRCUIT BRAKER (ELCB)



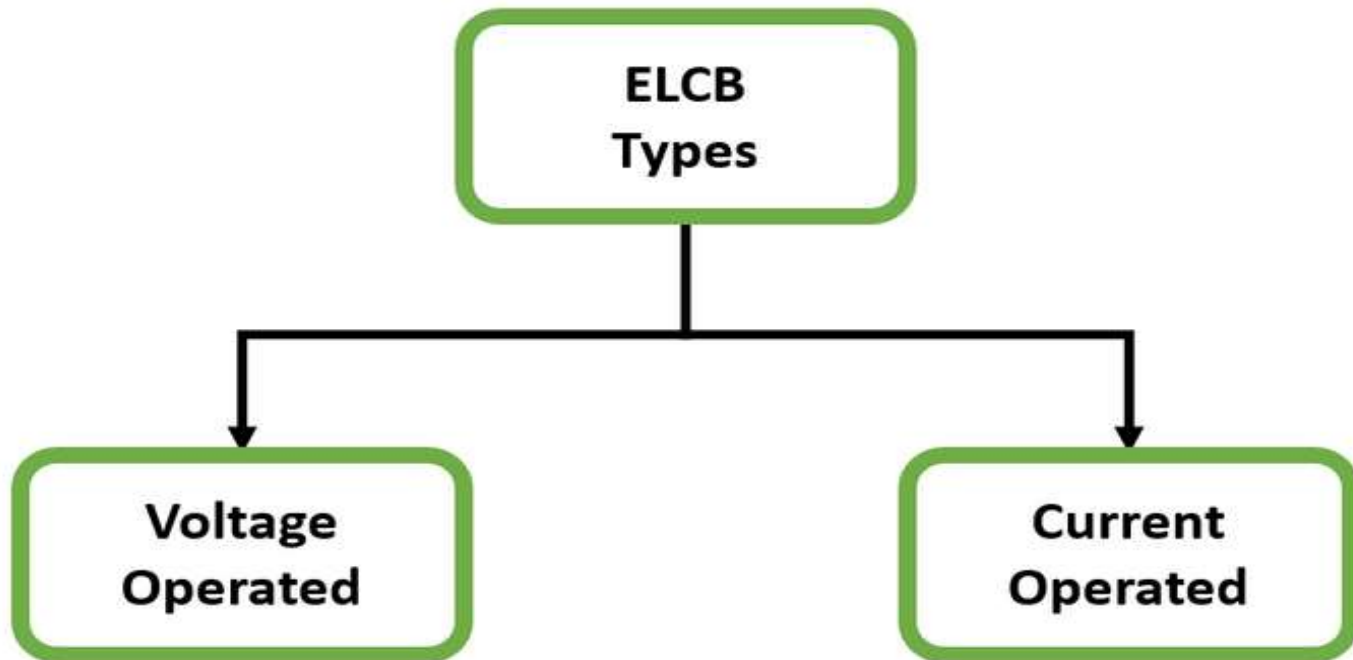
- An **ELCB** (Earth Leakage Circuit Breaker) is an electrical safety device used to directly detect currents leaking to earth from an installation and interrupt the power supply.
- The main purpose of the **ELCB** is to detect earth leakages and protect personal safety from electrical shocks and fires that are caused by short circuits.





EARTH LEAKAGE CIRCUIT BRAKER (ELCB)

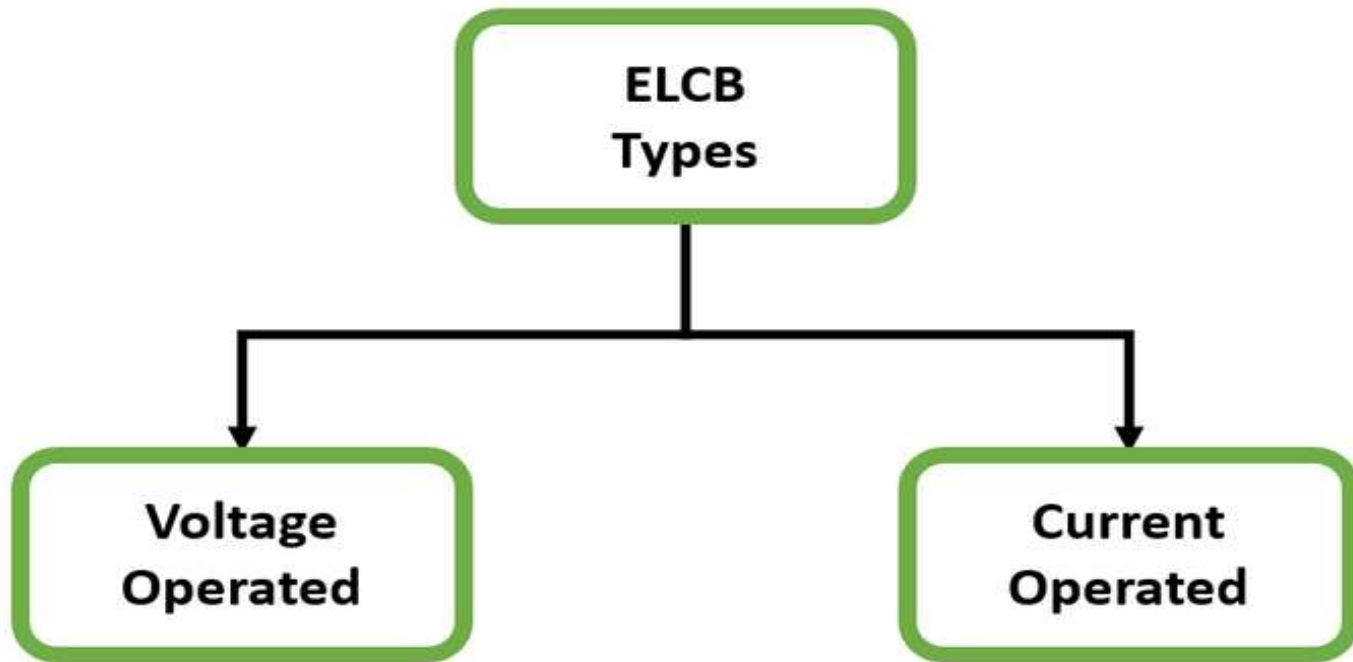
- Types of ELCB:
- The ELCB can be classified into two types





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EARTH LEAKAGE CIRCUIT BRAKER (ELCB)



- **Advantages:**
 - Voltage-operated ELCB is less sensitive to fault conditions, therefore has fewer nuisance trips.
 - They do not detect faults that are don't pass current through the circuit protective conductor (CPC) to the earth rod.
 - Current operated ELCB is not affected by parallel earth.



EARTH LEAKAGE CIRCUIT BREAKER (ELCB)



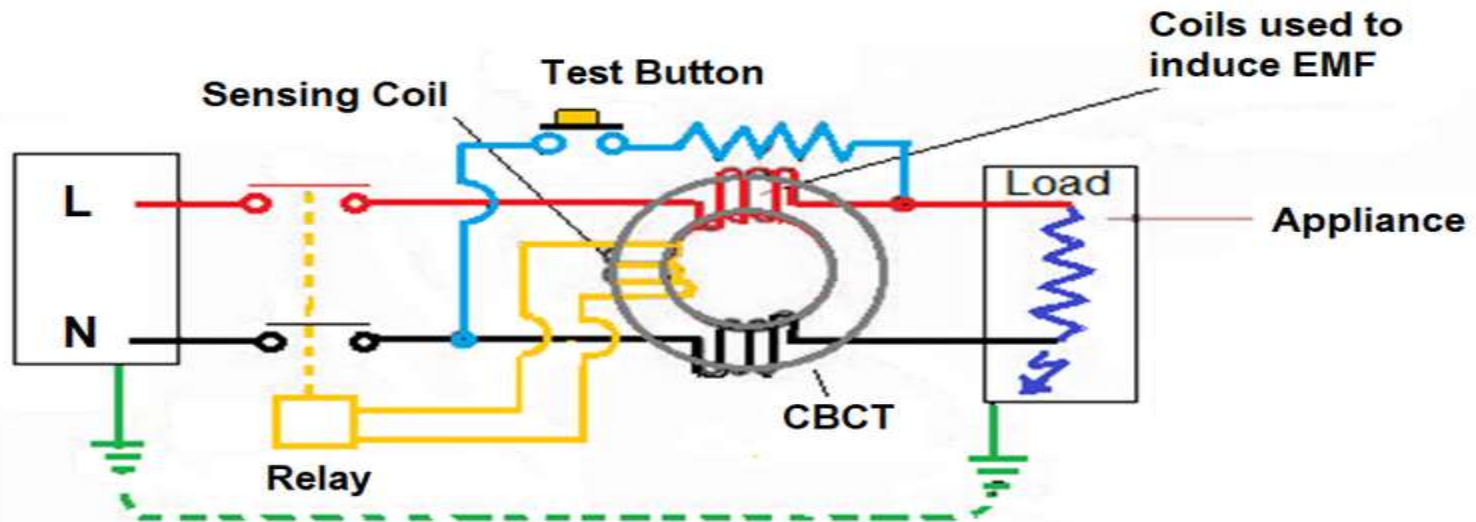
- **Disadvantages:**
 - Voltage-based ELCB devices are not used in the present days due to their drawbacks **as if the fault is between phase and circuit earth, they will isolate the supply.**
 - Voltage ELCBs are not recommended over current ELCB (RCCB) and **no longer available because of old technology.**
 - Voltage ELCBs detect faults that flow back through the main earth line.



EARTH LEAKAGE CIRCUIT BREAKER (ELCB)

- **Applications:**

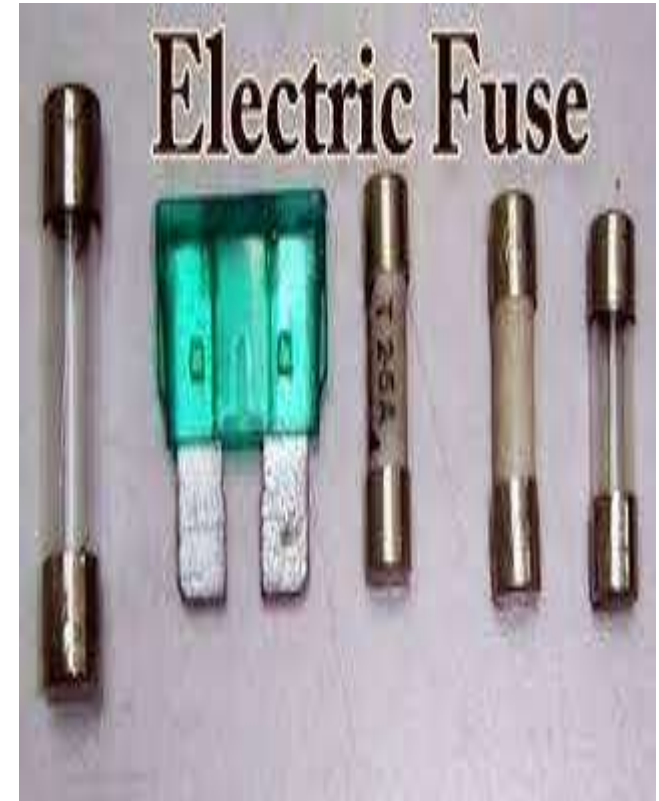
- The voltage-operated E.L.C.B. is generally used where there are **poor earthing conditions** (for example, **rocky or dry sub-soil**).
- Current operated ELCB is a popular circuit breaker used in industrial, commercial, and household applications.





ELECTRONIC FUSES

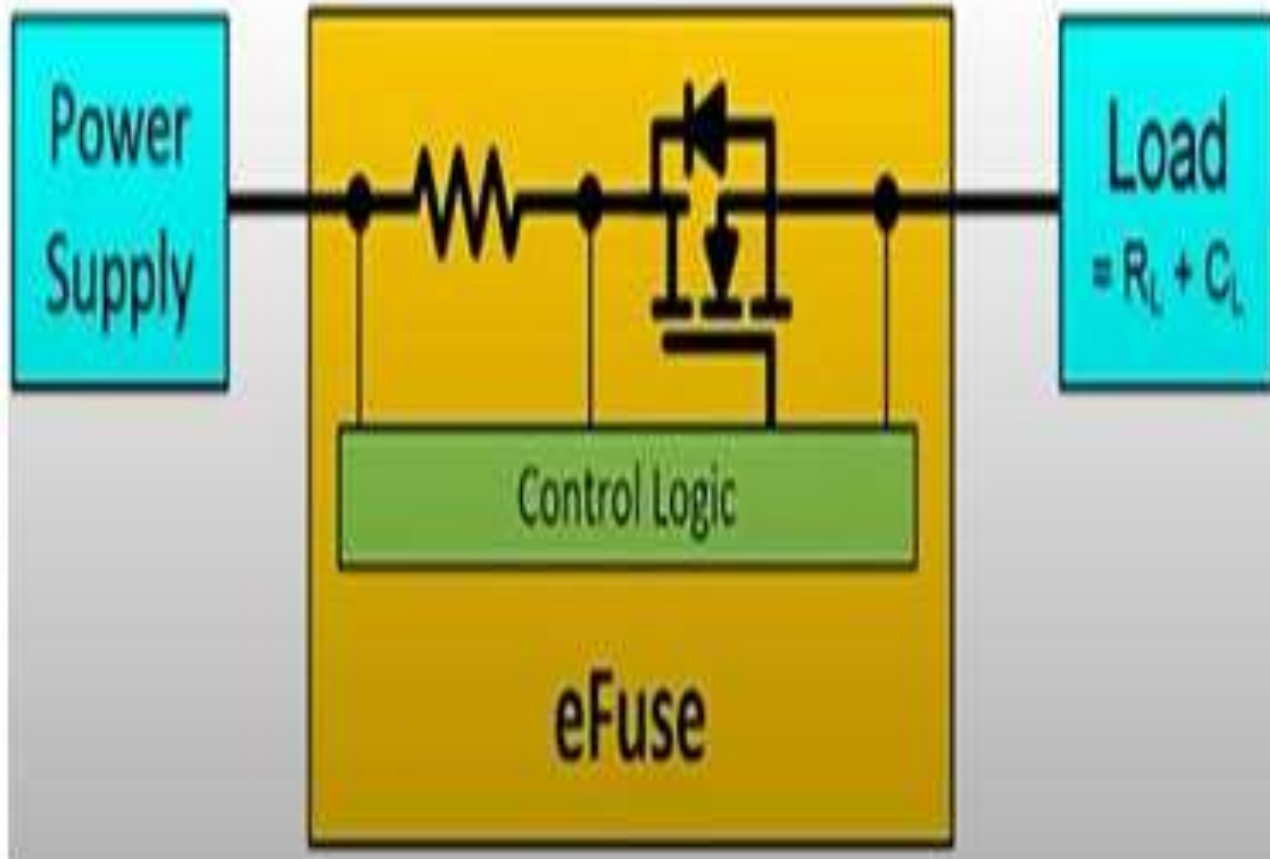
- eFuses, or electronic fuses, are integrated circuits that can **replace larger conventional fuses or other protection devices such as resettable polymeric fuses.**
- Housed in small plastic packages, such as DFN and Flip-chip, they integrate a control circuit and a power switch with low on-resistance, connecting the input port to the load.





ELECTRONIC FUSES

- **E FUSE**





ELECTRONIC FUSES



- **Advantages:**

- Due to less external components requirement, it saves board space. It is compact. It offers robust protection compare to discrete component based protection circuit. The eFuses are semiconductor ICs and hence offers rapid response during short circuits. It performs well over wide temperature range with minimal changes in its parameters. There is no change in its "ON resistance" even after faulty conditions in the circuit. It blocks the reverse current.



ELECTRONIC FUSES



- **Disadvantages:**
 - It houses more terminals. **Basic architecture of efuse consists of three terminals viz. input, output and ground.**
 - It requires **bias current to operate.**
 - It is complex in construction. **Advancement in semiconductor domain has reduced its size**