4.11 Electrical Safety in General and Local Context

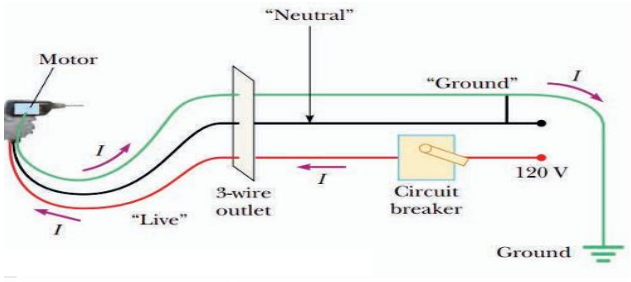
4.11.1 Case Grounding and Protection Devices

Case Grounding

Case grounding is the third wire added to the electrical cords. In presence of case ground, if short circuit occurs, the path of least resistance for the current is from the high voltage (phase, hot, live) wire through the case and back to ground through the third wire (0V). the resulting of high current blows a fuse or strip a circuit breaker before the consumer is injured.

Electrical standards are represented by color of the wires.

- Phase (live or hot): red, yellow, or blue
- Neutral (zero volt): Black
- Ground: Greenish yellow



Grounding plug (three-prong plug) uses a dedicated grounding wire to ground objects that may become conductors (thus dangerous). A polarized plug identifies the ground side of the line for use as a grounding safety feature.

Protection Devices

1, Fuse

A fuse is metal wire (thin metal strip) that have a property of having low melting point which is inserted into electrical circuit as protective device. Fuse is cheapest protection device in an electric circuit against **short circuit** and **overloading** of circuits. Fuse provides protection against excessive current which can flow in circuit during short-circuits. Under normal working conditions the current flowing through the circuit is within safe limits but, when fault (such as short circuit) or load greater than the circuit capacity is connected to it the current exceeds the limiting value, resulting in fuse wire, that gets heated up melts and breaks the current. Thus, fuse protects the machine or electric equipment against excessive currents. E.g. Automatic Voltage regulator (AVR) uses fuse to operate.

Fuse 

Figure 4.26 A Fuse.

AVR 

Figure 4.27 Voltage stabilizer.

2, Ground Fault Interrupters (GFI) and Residual Current Devices (RCD)

Residual Current Devices (RCDs), also known as Residual Current Circuit Breakers (RCCBs) or Ground Fault Circuit Interrupters (GFCIs) in some regions, are electrical safety devices that provide protection against electric shock and fire hazards. RCDs monitor the electrical current flowing through a circuit and quickly disconnect the power supply if they detect a difference in the current between the live and neutral conductors, indicating a leakage of current to ground.

RCDs are typically installed in electrical distribution boards or as standalone devices in power outlets. They are commonly used in areas where there is a higher risk of electric shock, such as bathrooms, kitchens, outdoor outlets, and construction sites. RCDs help prevent serious injuries or fatalities by quickly cutting off power in the event of a fault, reducing the risk of electric shock or fire.

4.11.2. Effect of Electric Current on human body

Coming inContact with an electric conductor (with potential difference), causes voltage across a human body (or part of it) thus causing a current through the body that can be dangerous. A person could be electrocuted by touching a **live wire** (high voltage, phase) while inContact with the ground. Electric shock results in fatal burns or cause the muscle of vital organs, such as heart, to malfunction. Degree of damage (caused by electric shock to the body) depends on:

1. Magnitude of current
2. The length of time it takes
3. Part of the body through which it passes

Current	Effect
$\leq 0.5mA$	Sensation of shock, but ordinarily do little or no danger
$\geq 10mA$	Hand and muscles contract, unable to let go of the live wire
$\sim 100mA$	Fatal
$\sim 1A$	Produces series burns (sometimes fatal)

Important Safety Tips Used to Prevent Accident or Shock

- Never use appliances with frayed or damaged electric cord.
- Unplug appliances before working on them, such as when prying toast out of a jammed toaster.
- Avoid all water when using plugged-in appliances.
- Never touch power lines with anything, including kite string and ladders.
- Always respect warning signs and labels

Section Summary

- Safety of an electrical installation could be ensured by proper insulation, good earthling system and adopting adequate protection and control systems.
- Electrical hazards can cause burns, shocks and electrocution avoid accident. (death). You should follow proper rules and regulations to avoid accident.
- Qualified electricians are recommended to inspect electrical equipment.
- In damp locations, inspect electric cords and equipment to ensure they are in good condition; use a ground-fault circuit interrupter (GFCI).

Exercise

1. How can birds sit on live wires and not get an electric shock?

2. How can electric current cause sensation of shock when it flows through body?

3. How can electric current cause the muscle of vital organs, such as heart, to malfunction?

5. You are often advised not to flick electric switches with wet hands; you must dry your hands first. You a real so advised to never throw water on an electric fire. Why is this so?

6. Identify the factors that determine the damage caused to the human body by an electric shock.

8. Explain the following in detail.

A, live (phase, hot) wire

B, Neutral (0v) wire

C, Grounding Wire

9. Explain how **RCD** operates.

10, Explain properties of the AC and DC in detail.

11.List Safety Tips Used to Prevent Accident or Shock that may be caused by electric.