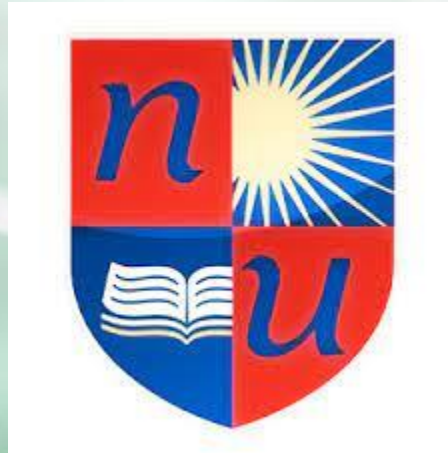


NIRMA UNIVERSITY

Institute of Technology



Electric Safety

Flow Of Presentation

- ✓ Electrical Injuries
- ✓ How to reduce electrical injuries
- ✓ Usage of electrical Protective Devices
- ✓ Various unsafe practices regarding Electrical Safety
- ✓ Indian Standards for Electrical Safety

Electrical Injuries

- There are four main types of electrical injuries:
- Electrocution (death due to electrical shock)
- Electrical Shock
- Burns
- Falls



What is Electric Shock?

- When two wires have different potential voltages current will flow if they are connected.
- In most household wiring the wires are at 230 AC volts relative to ground. The ground wire is at 0 volt because they are connected to ground
- **Contact with an energized (live) wire while touching the grounded wire =ELECTRICAL SHOCK!**



Limits of the Current

(1,000 milliamperes = 1 amp; therefore, 15,000 milliamperes = 15 amp circuit)

Current	Reaction
Below 1 milliampere	Generally not perceptible
1 milliampere	Faint tingle
5 milliampere	Slight shock felt; not painful but disturbing. Average individual can let go. Strong involuntary reactions can lead to other injuries
6-25 milliamperes (women)	Painful shock, loss of muscular control
9-30 milliamperes (men)	The freezing current or "let-go" range. Individual cannot let go, but can be thrown away from the circuit if extensor muscles are stimulated.
50-150 milliampres	Extreme pain, respiratory arrest, severe muscular contractions. Death is possible.
1,000-4,300 milliamperes	Rhythmic pumping action of the heart ceases. Muscular contraction and nerve damage occur; death likely
10,000 milliamperes	Cardiac arrest, severe burns; death probable

Electric Burns

- They are the most common shock related nonfatal injury
- Occur when you touch electrical wiring or equipment that is improperly used or maintained
- Typically occurs on the hands
- Very serious injury that needs immediate attention



Electric Fall

- In most household Electrical shock can also cause indirect or secondary injuries.
- Employees working in an elevated location who experience a shock can fall resulting in serious injury or even death.

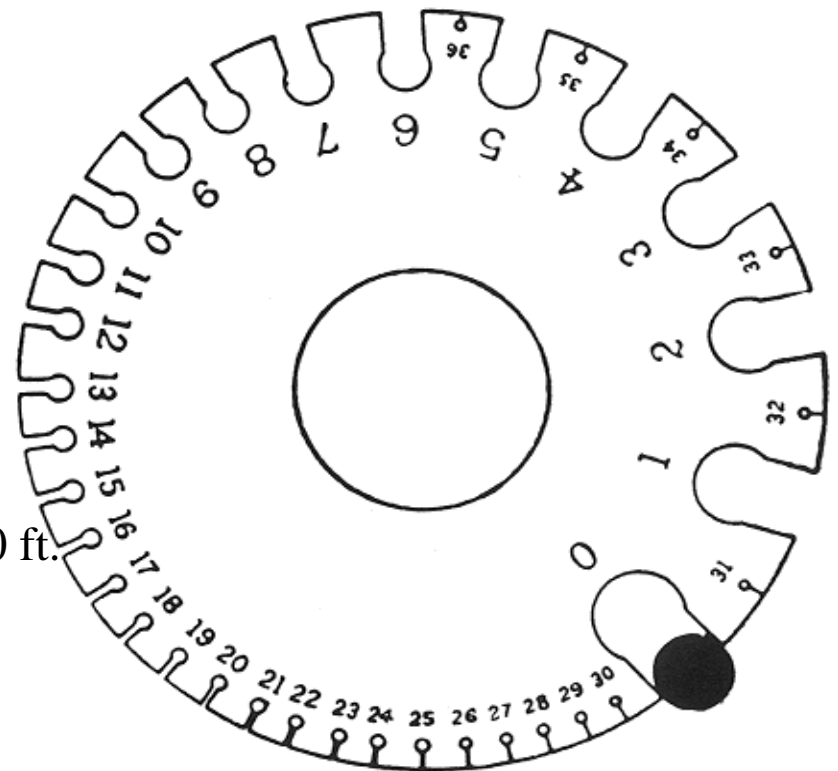


Inadequate Wiring Hazards

- Wiring hazard exists when a conductor is too small to safely carry the current.
- Tool draws more current than cord can handle ,this results in overheating, possible fire without tripping the circuit breaker
- A portable wire gauge can be used to minimize wiring hazards.

➤ *Capacity affected by*

- Size of wire
 - 14 gauge = 15 amps
 - 12 gauge = 20 amps
- Length of the cord
 - UL tag capacity
 - In general any cord over 100 ft. requires one size larger cord (14 gauge to 12 gauge)




Electrical overloading Hazards

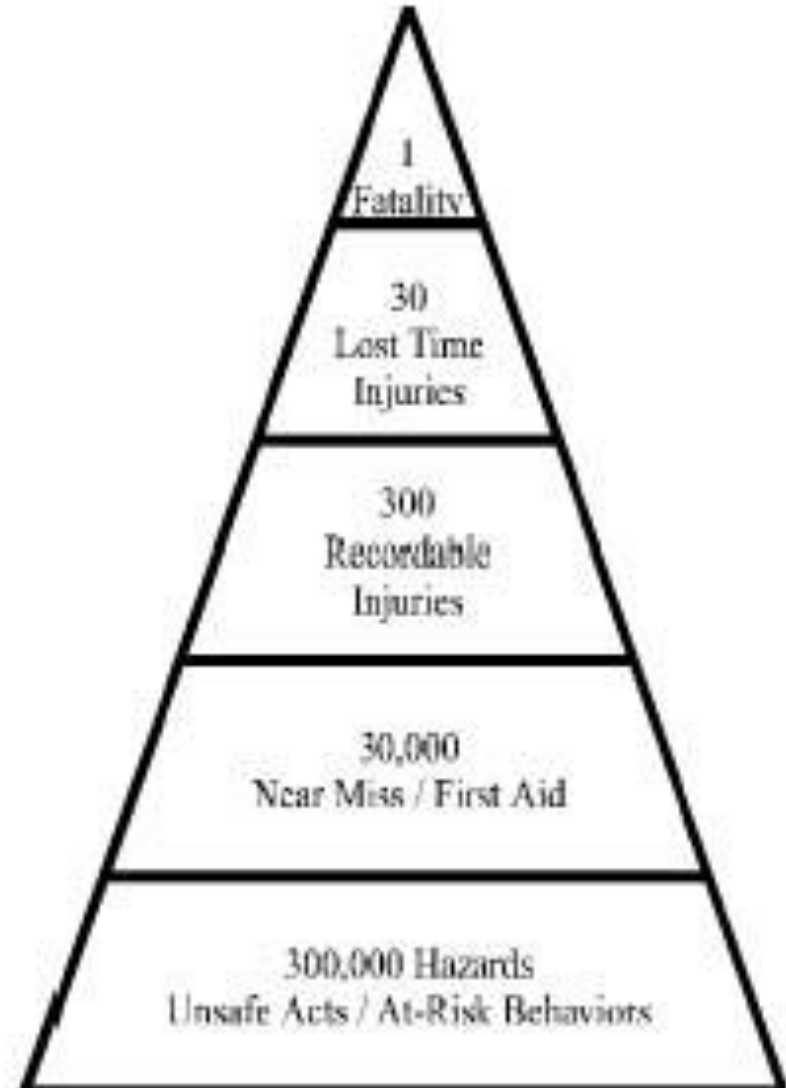
- When too many devices plugged into circuit ,it causes wires heat to very high temperature that cause possible fire.
- Due to this wire insulation melts can cause arcing that may lead to fire in area where overload exists (even inside a wall).



Electrical Accidents

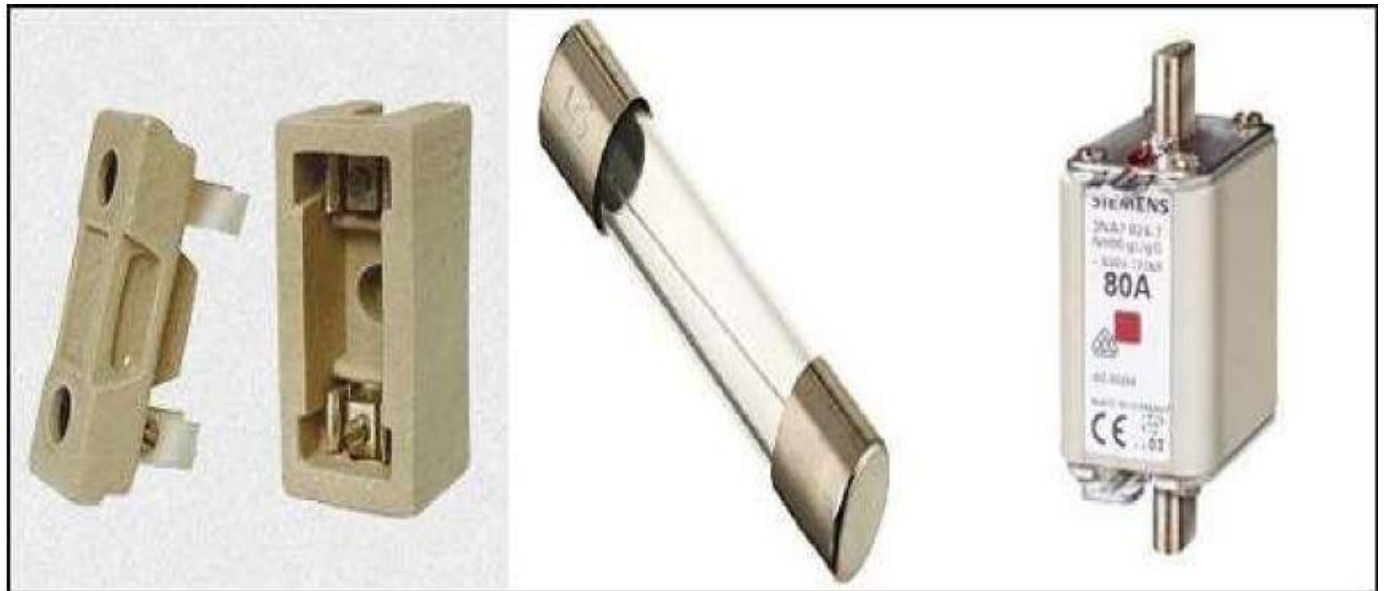


Electrician receives fatal shock
Electrician falls from ladder due to jerk reaction from shock
Electrician receives minor burn from electrical shock
Electrician receives minor shock while connecting light fixture
Electrician connects light fixture with circuit energized



Electrical protective devices

- Shut off electricity flow in the event of an overload or ground-fault in the circuit.
- Include fuses, circuit breakers, and ground-fault circuit interrupters (GFCI).
- Fuses and circuit breakers are “over current” devices, when too much current flows, the fuses melt and circuit breakers “trip” opens up.



Earth Leakage Circuit Breaker(ELCB)

- ELCBs reduce the likelihood of fatal shocks
- Detect small amount of leakage current and automatically switch off the power
- Can be used with extension cords and portable tools
- Use the right sensitivity ELCBs (30, 100, 300 mA)



Protection from Electrical Hazards

- Hand-held electrical tools pose a potential danger because they make continuous contact with the hand.
- To protect you from shock, burns, and electrocution, tools must:
 - Have a 3 wire cord with ground and be plugged into a grounded receptacle or
 - Be double insulated or
 - Be powered by a low-voltage isolation transformer



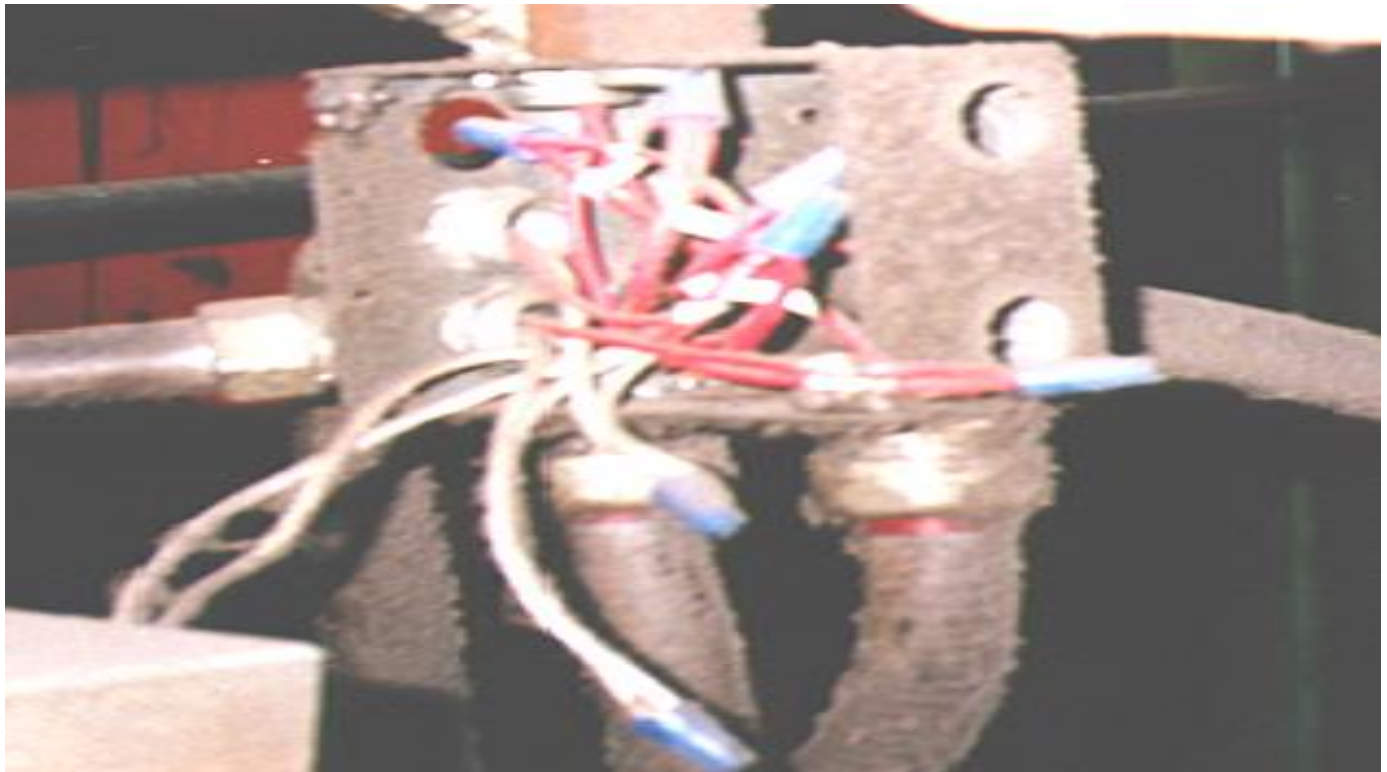
Guarding live parts

- Must guard “live” parts of electric equipment operating at >50 volts against accidental contact by:
 - Approved cabinets/enclosures or
 - Location or permanent partitions (thereby only accessible to qualified persons)
 - Elevation of 8 feet or more above the floor or working surface
 - Mark entrances to guarded locations with conspicuous warning signs



Cabinets, Boxes, Fittings

- Junction boxes, pull boxes, and fittings must have approved covers.
- Unused openings in cabinets, boxes and fittings must be closed
- Figure shows violations of these two requirements



Extension Cords

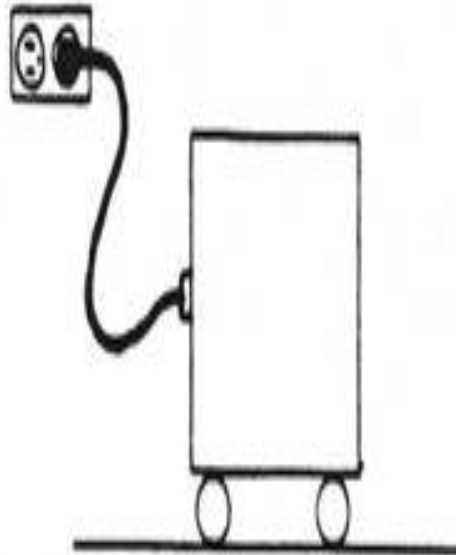
- Extension cords shall not be fastened with staples, hung from nails, or suspended by wire.



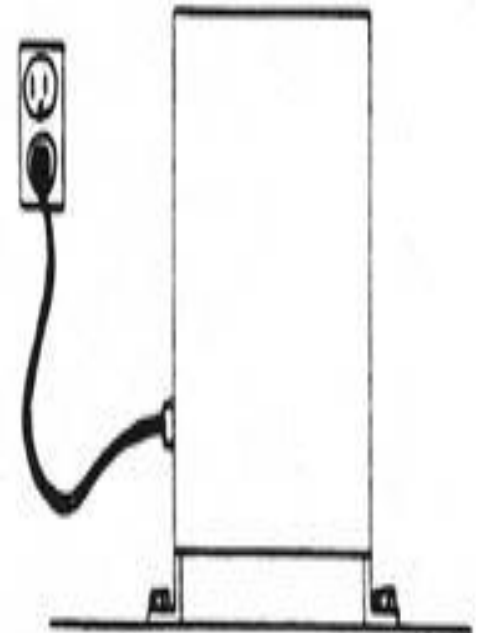
Permissible Usage of Cords



Pendant or Fixture
Wiring



Portable lamps,
tools or appliances

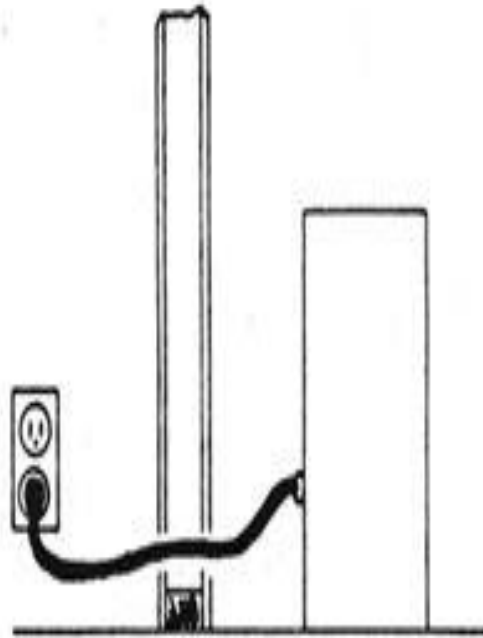


Stationary equipment
to facilitate interchange

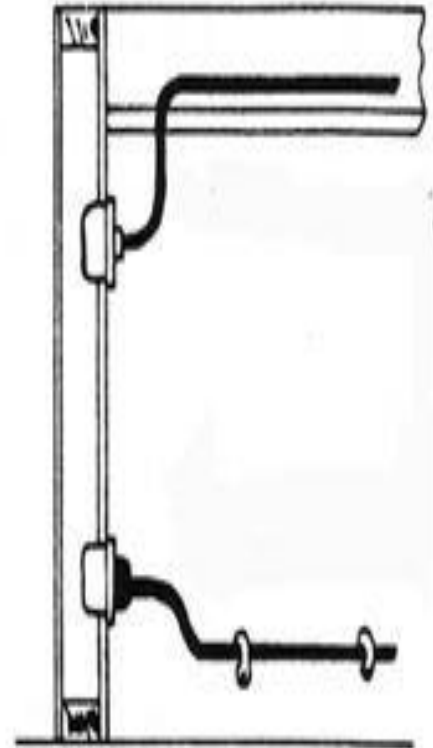
Prohibited Usage of Cords



Substitute for
fixed wiring



Run through walls, ceilings
floors, doors, or windows



Concealed behind
or attached to
building surfaces

Unsafe Practices



Unsafe Practices



Unsafe Practices



Indian Standards for Electrical Safety

- IS 732 -Electrical Wiring Installation
- IS 3043- Earthing practice
- IS 1271- Classification for Insulating materials
- IS 1646- Fire Safety of buildings for Electrical Installation
- IS 1913- Safety Requirements for electric lighting fittings
- IS 2274- Electrical wiring where voltage is 658V
- IS 3034- Fire Safety of Industrial Buildings
- IS 3106- Selection, installation and maintenance of fuse where voltage is 650V
- IS 5571- Selection of electrical equipment in hazardous area
- IS 5572- Types of hazardous areas for electrical installations



Other Standards and Codes

- NFPA 70 E & B- E-Safety & Maintenance
- NFPA 780- Lightning Protection
- API RP 2003- Static Electricity
- API RP 500- HAC
- OSHA 29 CFR- part 1910- Arc Flash
- NFPA 70- NEC
- IEEE 1584- Arc Flash Protection
- NFPA 77- Static Electricity
- OSHA CFR 1926-Personnel Electrical Safety

A decorative border on the left side of the image, featuring a green chalkboard texture. It includes two pieces of pink chalk and some faint white chalk markings, including a large 'Y' and a curved line.

Thank You