ELECTRICAL SAFETY

Electrical Injuries

AN AVERAGE OF ONE WORKER IS ELECTROCUTED ON THE JOB EVERY DAY!

There are four main types of electrical injuries:

- **Electrocution (death due to electrical shock)**
- **Electrical Shock**
- **Burns**
- **Falls**

Electrical Terminology

- **CURRENT = The movement of electrical charge.**
- **RESISTANCE = Opposition to current flow.**
- **VOLTAGE = A measure of electrical force.**
- **CONDUCTORS = Substances, such as metals, that have little resistance to electricity.**
- **INSULATORS = Substances, such as dry wood, rubber, glass and bakelite, that have high resistance to electricity.**
- **GROUNDING = A conductive connection to the earth which acts as a protective measure.**

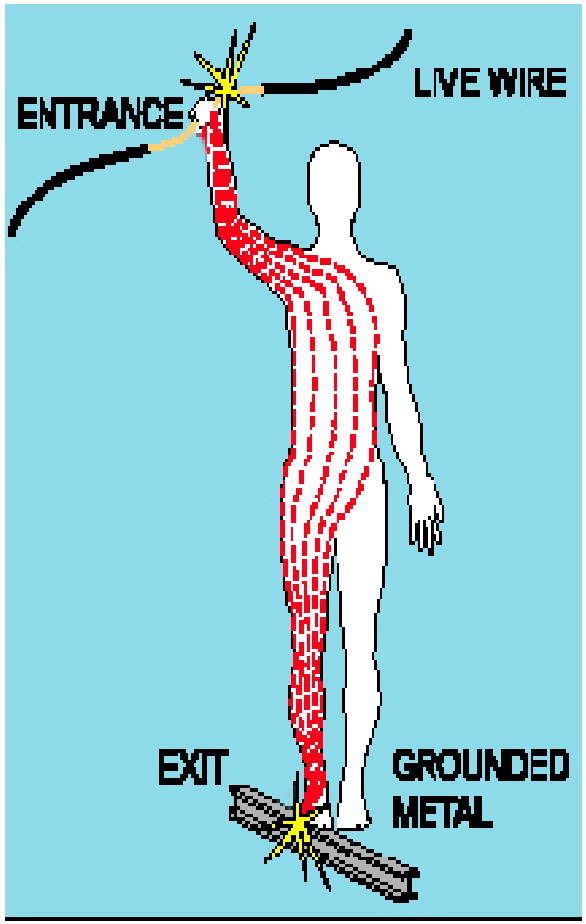
Electrical Shock

Received when current passes through the body.

Severity of the shock depends on:

- Path of current through the body
- Amount of current flowing through the body
- Length of time the body is in the circuit

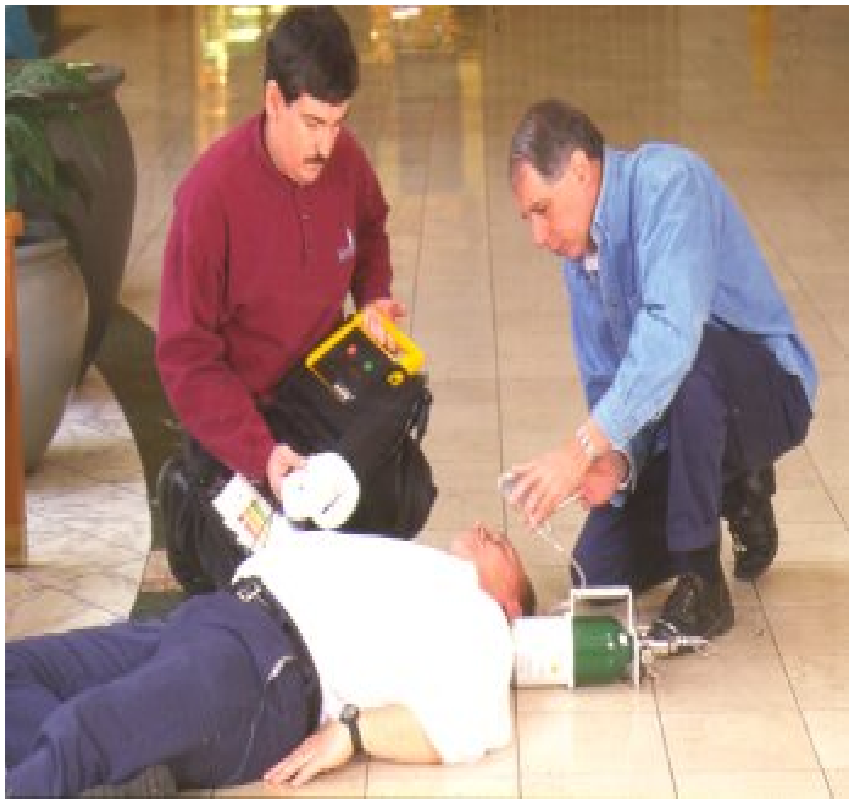
LOW VOLTAGE DOES NOT MEAN LOW HAZARD!



Dangers of Electrical Shock

Currents greater than 75mA (1/1,000 of an ampere) can cause ventricular fibrillation (rapid, ineffective heartbeat).

- **Will cause death in a few minutes unless a defibrillator is used.**
- **75mA is not much current; a small power drill uses 30 times as much.**



How is an Electrical Shock Received?

When two wires have different potential voltages, current will flow if they are connected.

- **In most household wiring, the black wires are at 110 volts relative to ground.**
- **The white wires are at zero volts because they are connected to ground.**

Contact with an energized (live) black wire while touching the white grounded wire = ELECTRICAL SHOCK!

How is a an Electrical Shock Received? (cont'd)

Georgia

Contact with an energized wire/any energized electrical component + any grounded object = SHOCK!

You can even receive an electrical shock when you are not in contact with a ground.

CONTACT BOTH WIRES OF A 240 VOLT CABLE =

SHOCK, POSSIBLE ELECTROCUTION!

Water is VERY conductive!

Reference: http://www.safteng.net

Electrical Burns

- Are the most common shock-related non-fatal 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

Falls

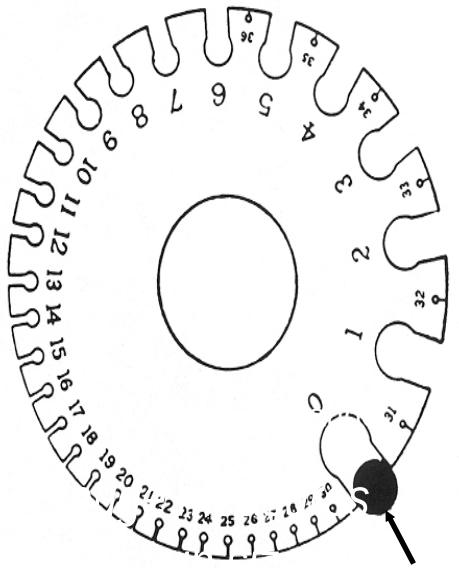
Electrical shock can also cause indirect or secondary injuries.

Employees working in an elevated location who experience a shock can fall, resulting in serious injury or even death.

Inadequate Wiring Hazards

A hazard exists when a conductor is too small to safely carry the current.
Example: Using a portable tool with an extension cord that has a wire

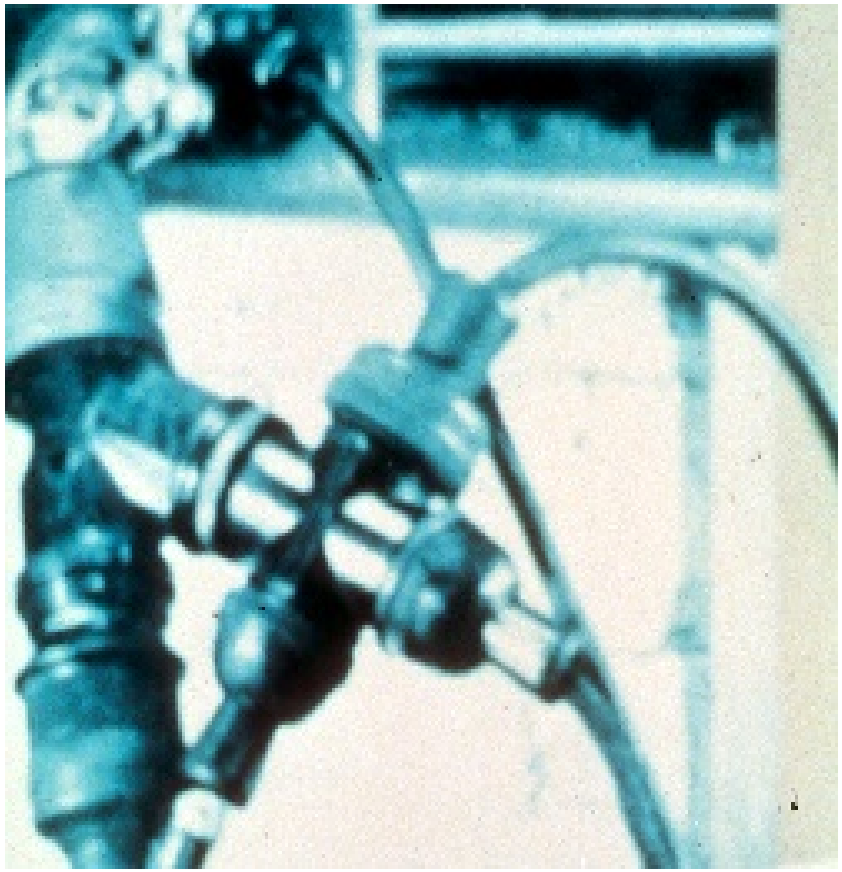
too small for the tool.



- Tool draws more current than cord can handle = overheating, possible fire without tripping the circuit breaker.
- Circuit breaker could be the right size for the circuit but not for the smaller wire extension cord.

Hazards of Overloading

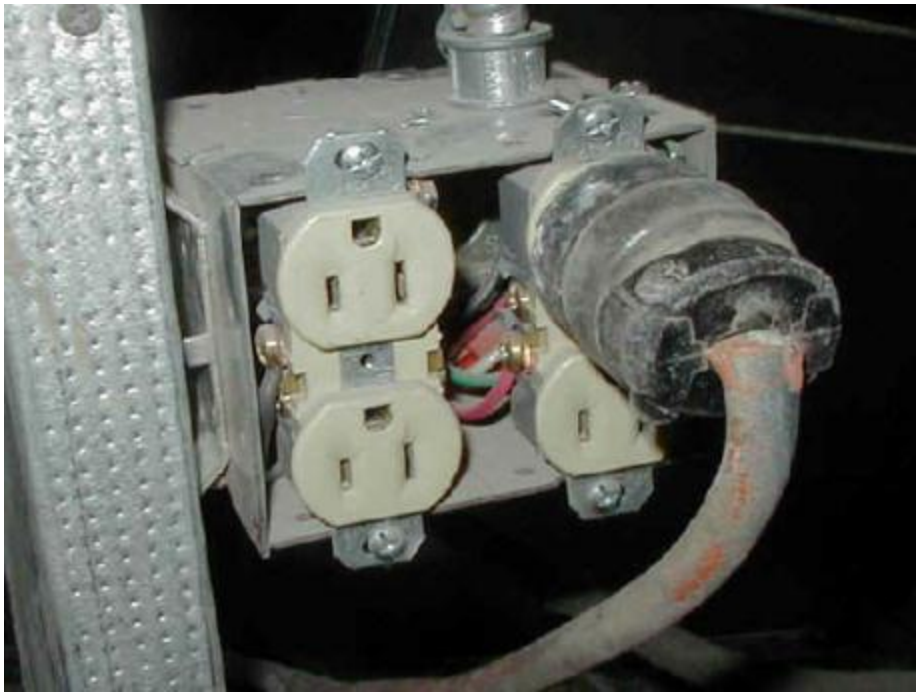
- Too many devices plugged into circuit = wires heat to very high temperature = possible fire
- Wire insulation melts = arcing may occur = fire in area where overload exists (even inside a wall)



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, or GFCIs.
- Fuses and circuit breakers are “over current” devices (too much current = fuses melt and circuit breakers “trip” open).

Missing outlet cover!



Reference: http://www.safteng.net

Ground Fault Circuit Interrupter

- Protects you from dangerous electrical shock.
- Detects a difference in current between the black and white circuit wires (could happen when electrical equipment is not working properly causing a current "leakage" known as *ground fault*).
- Ground fault detected = GFCI can shut off electricity flow in as little as 1/40 of a second protecting you from a dangerous shock.

Electrical Hazards

Ground-Fault Circuit-Interrupters (GFCIs)

Three types of GFCIs:

- **A GFCI receptacle used in place of standard receptacle.**

- **A portable GFCI plugs into a standard receptacle.**

- **A GFCI circuit breaker combines leakage current detection with the function of a circuit breaker.**

- **Whenever working in a wet area, or outdoors, employees should use one of these types of GFCI's.**

Grounding Hazards

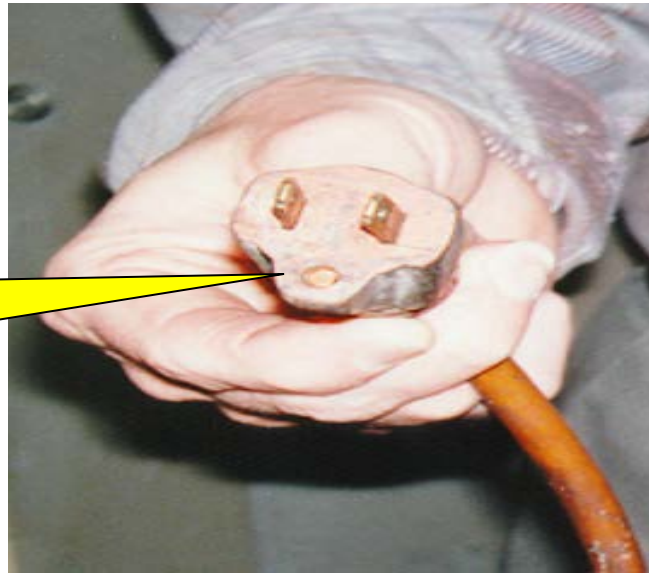
- Metal parts of an electrical wiring system that we touch should be at 0 volts relative to ground (switch plates, ceiling light fixtures, conduit, etc.).
- Housings of motors, appliances or tools that are plugged in to improperly grounded circuits may become energized.

If you come into contact with an improperly grounded electrical device YOU WILL GET SHOCKED!

GROUNDING PATH

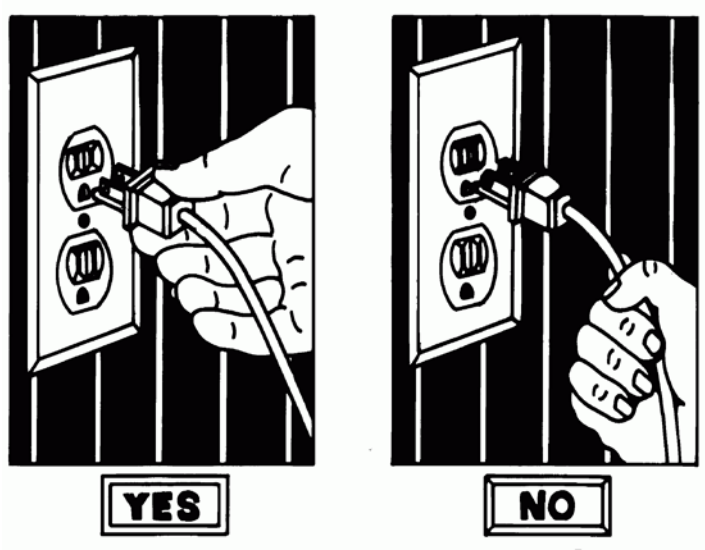
The path to ground from circuits, equipment and enclosures must be permanent and continuous.

Here the third/grounding prong is missing



Electrical Hazard Control

- **Pull the plug, not the cord. Pulling the cord could break a wire, causing a short circuit.**



Electrical Code Requirements

HAND-HELD ELECTRICAL TOOLS:

Hand-held electrical tools pose a potential danger because they make continuous good 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.**
- **Be double insulated.**
- **Be powered by a low-voltage isolation transformer.**

Guarding Live Parts

Must guard “live” parts of electrical equipment operating at ≥ 50 volts against accidental contact by:

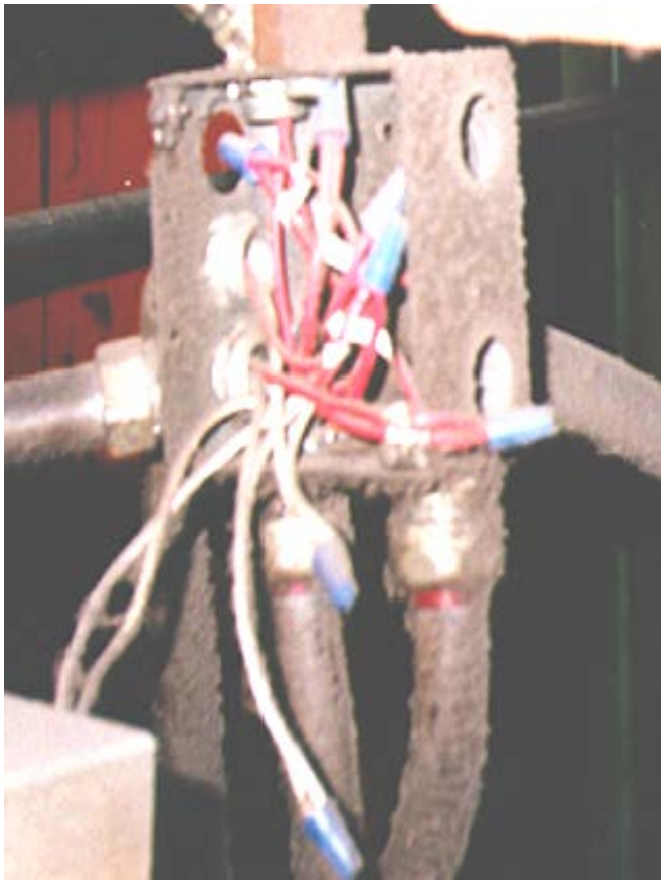
- Approved cabinets/enclosures.
- Location or permanent partitions (thereby only accessible to qualified persons).
- Elevation of 8 feet or more above the floor or working surface.
- Mark entrances to guarded locations with conspicuous warning signs.

Guarding Live Parts

- Where electrical equipment is in locations that it can suffer physical damage it must be guarded.
- Shown here is physical damage to conduit.

Cabinets, Boxes, Fittings

- Junction boxes, pull boxes and fittings must have approved covers.
- Unused openings in cabinets, boxes and fittings must be closed (no missing “knockouts”).
- Photo shows violations of these two requirements.

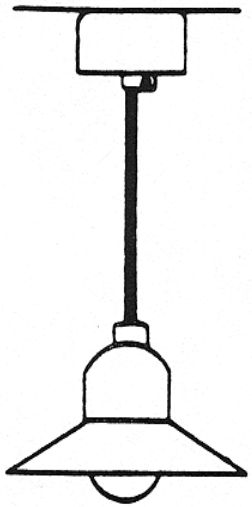


Use of Flexible Cords

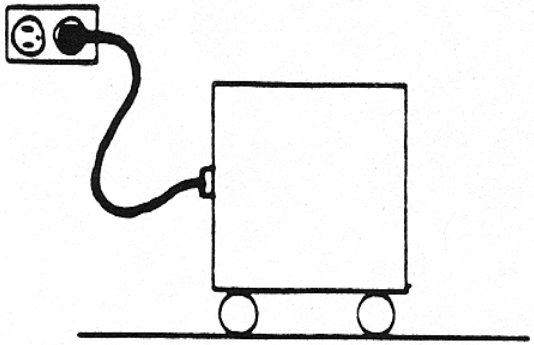
- Are more vulnerable than fixed wiring.
- Should not be used if recognized wiring methods can be used instead.
- Flexible cords can be damaged by:
  - Aging
  - Door or window edges
  - Staples or fastenings
  - Abrasion from adjacent materials
  - Activities in the area

- Improper use of flexible cords can cause shocks, burns or fire.

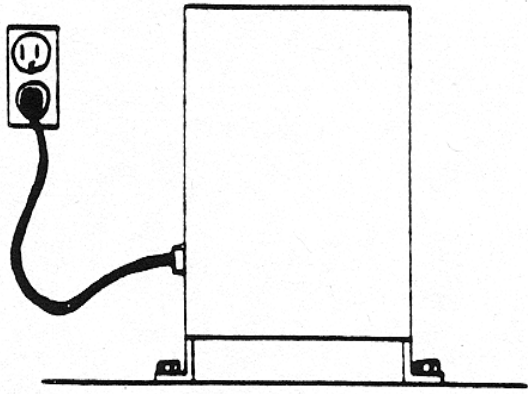
Permissible Uses of Flexible Cords



Pendant or Fixture Wiring

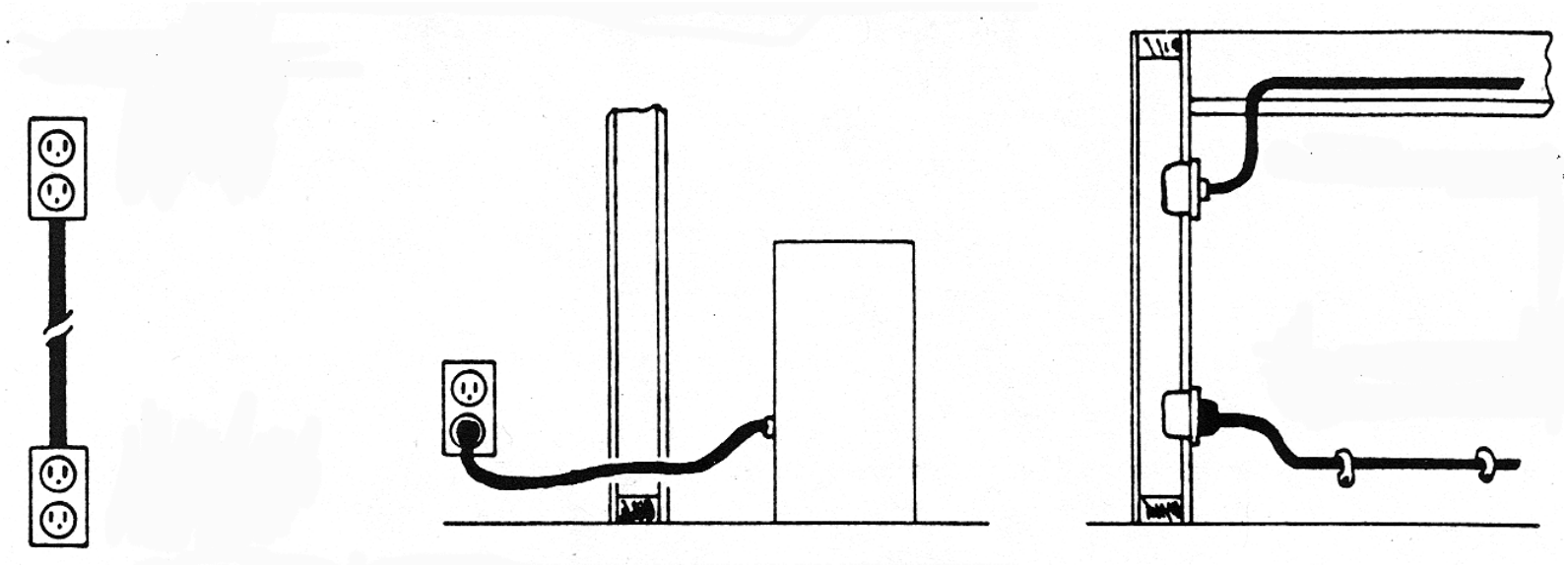


Portable lamps, tools or appliances



Stationary equipment to facilitate interchange

Prohibited Uses of Flexible Cords



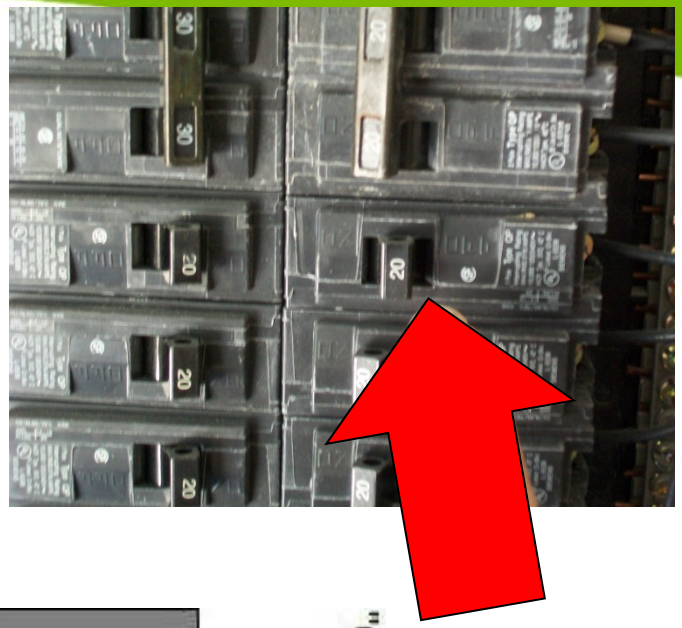
Substitute for Fixed Wiring

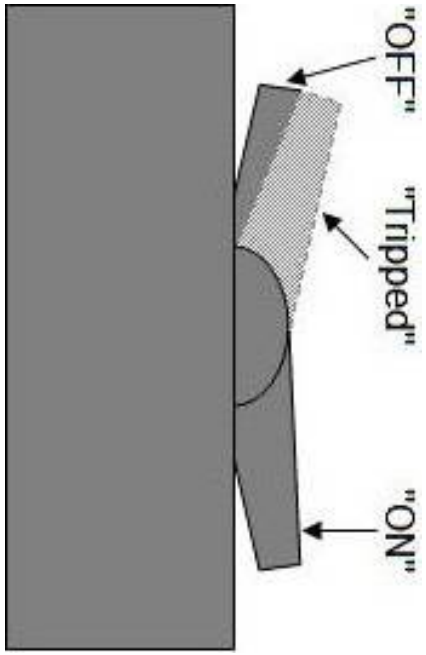
Run through walls, ceilings, floors, doors, or windows

Concealed behind or attached to building surfaces

Electrical Hazards – Clues

- Tripped circuit breakers or blown fuses
- Warm tools, wires, cords, connections or junction boxes
- GFCI that shuts off a circuit
- Worn or frayed insulation around wire or connection





Training

Train employees working with electrical equipment in safe working practices including:

- **De-energizing electrical equipment before inspecting or making repairs. (Lock Out – Tag Out)**
- **Using electric tools in good repair.**
- **Using good judgment when working near energized lines.**
- **Using appropriate protective equipment or PPE.**

Summary

Hazards

- Inadequate wiring
- Exposed electrical parts
- Wires with bad insulation
- Ungrounded electrical tools/systems
- Overloaded circuits
- Damaged power tools/equipment
- Overhead power lines

All hazards are made worse in wet conditions!

Summary

Protective Measures

- Proper grounding
- Using GFCIs
- Using fuses and circuit breakers
- Proper use of flexible cords
- Training

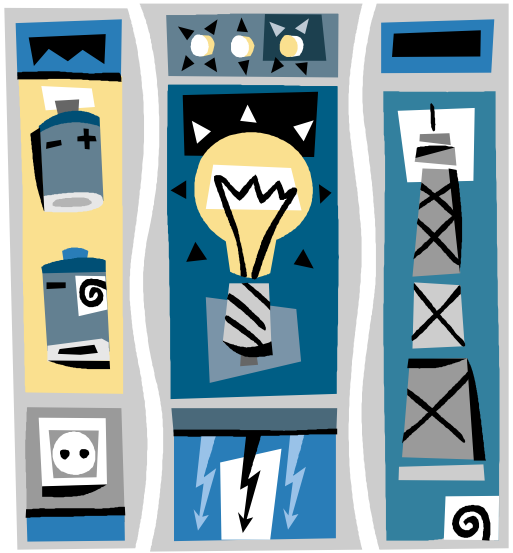
Conclusion

The bottom line with electricity:

RESPECT

HAZARD RECOGNITION

SAFETY



Questions?

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