Flexible Products & Services:

Electrical Safety

Safety Awareness

Introduction

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

General Requirements for Electrical Equipment

- Examination – free from recognized hazards
- Installation – in accordance with labeling
- Marking – manufacturer's name, voltage, current, wattage

- Disconnect switches- labeled to indicate the circuit's function
- Working clearances in front of electrical equipment
- Guarding of live parts operating at 50 volts or more
  - Cabinets, secured rooms – proper labeling
  - Must also protect from physical damage (forklifts)

Training Requirements

- Applies to:
  - Supervisors*, electricians, machine operators*, painters*, engineers*, and welders
  - (*) Do not have to be trained if they do not work close to exposed parts
- Requirements depend on job tasks:
  - PPE, installation, safe clearances, skills to distinguish exposed parts, determine voltage

Electrical Terminology

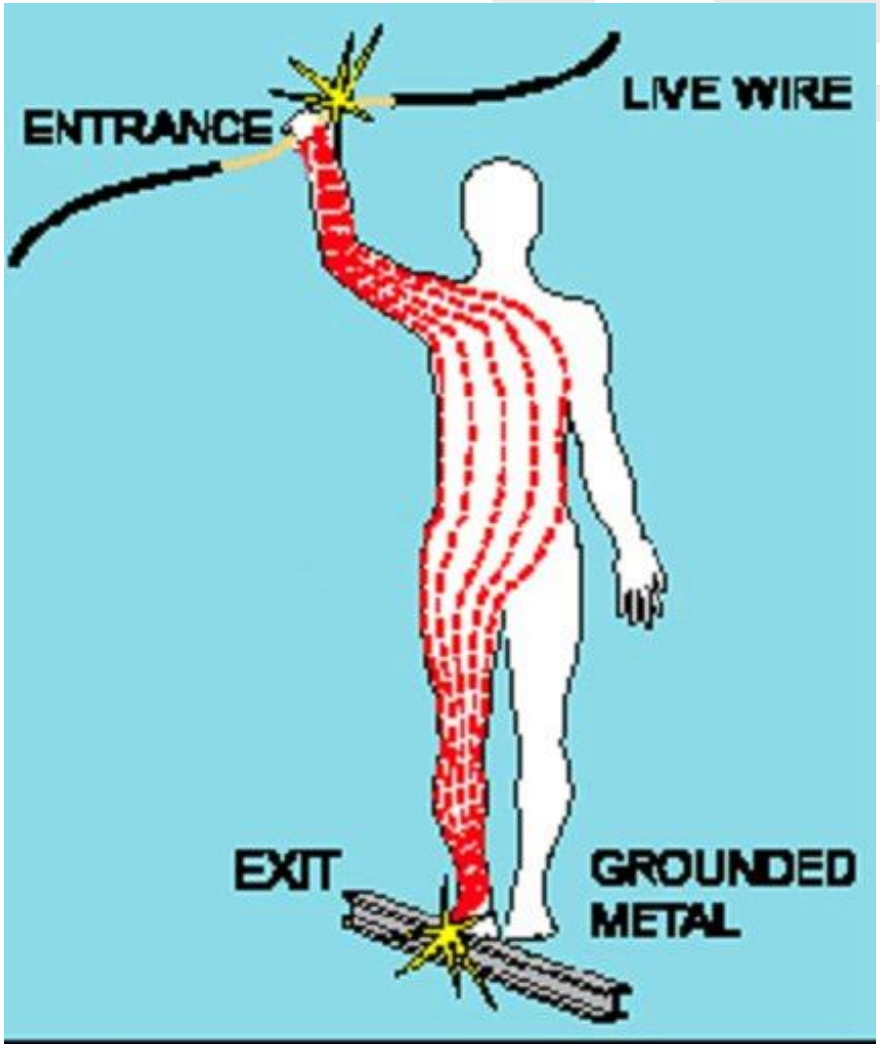
- Current – the movement of electrical charge
- Resistance – opposition to current flow
- Voltage – a measure of electrical force
- Conductors – substances, such as metals, that have little resistance to electricity
- Insulators – substances, such as wood, rubber, glass, and bakelite, that have high resistance to electricity

Working on or near exposed electrical parts

- Don’t work on or near exposed electrical parts unless:
  - The part is de-energized
  - The part is locked/tagged out

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



Electrical Burns

- Most common shock-related, nonfatal injury
- Occurs 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

Entrance wound to the hand caused by contacting a high-voltage wire. (Photo taken in emergency room.)

The same hand after surgery to remove dead tissue. Extensive muscle damage in the thumb and forearm is apparent. The skin has been split open to release pressure.

Falls

- Electric shock can also cause indirect or secondary injuries
- Workers in elevated locations who experience a shock can fall, resulting in serious injury or death

Inadequate wiring hazard

- 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
  - The tool will draw more current than the cord can handle, causing overheating and a possible fire without tripping the circuit breaker
  - The circuit breaker could be the right size for the circuit but not for the smaller-wire extension cord

Overload hazards

- If too many devices are plugged into a circuit, the current will heat the wires to a very high temperature, which may cause a fire
- If the wire insulation melts, arcing may occur and cause a fire in the area where the overload exists, even inside a wall

Electrical Protective Devices

- These 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 (GFCIs)
- Fuses and circuit breakers are overcurrent devices
  - When there is too much current:
    - Fuses melt
    - Circuit breakers trip open

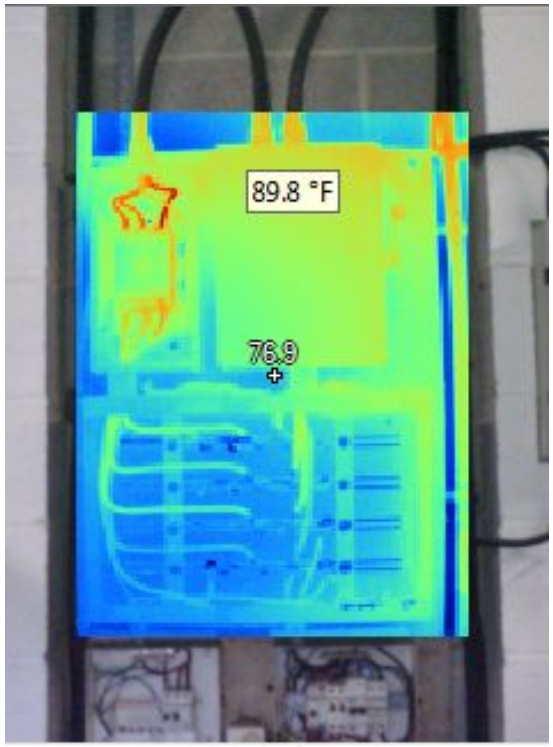
Guarding of Live parts

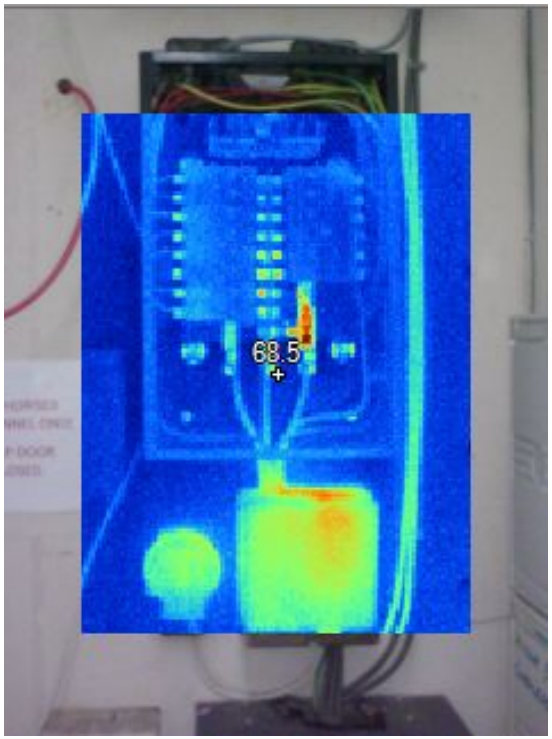
- Must enclose or guard electric equipment in locations where it would be exposed to physical damage

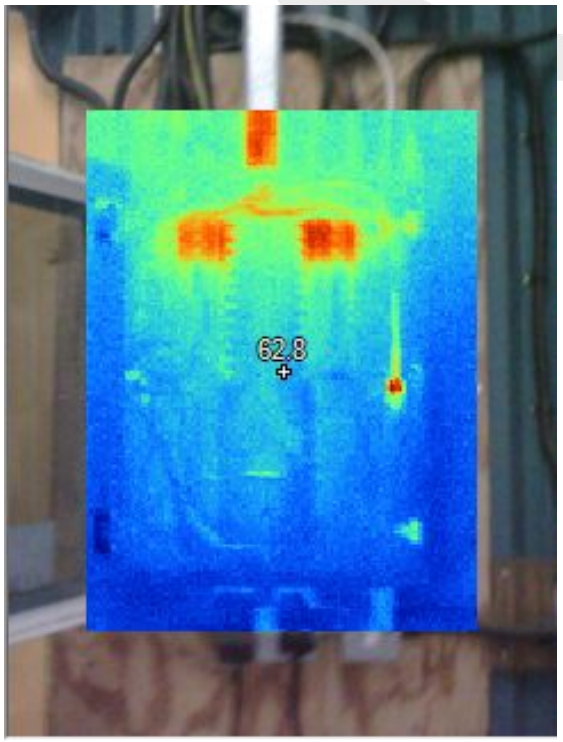
Cabinets, Boxes and Fittings

- Junction boxes, pull boxes and fittings must have approved covers
- Unused openings in cabinets, boxes and fittings must be closed (no missing knockouts)

Thermal imaging

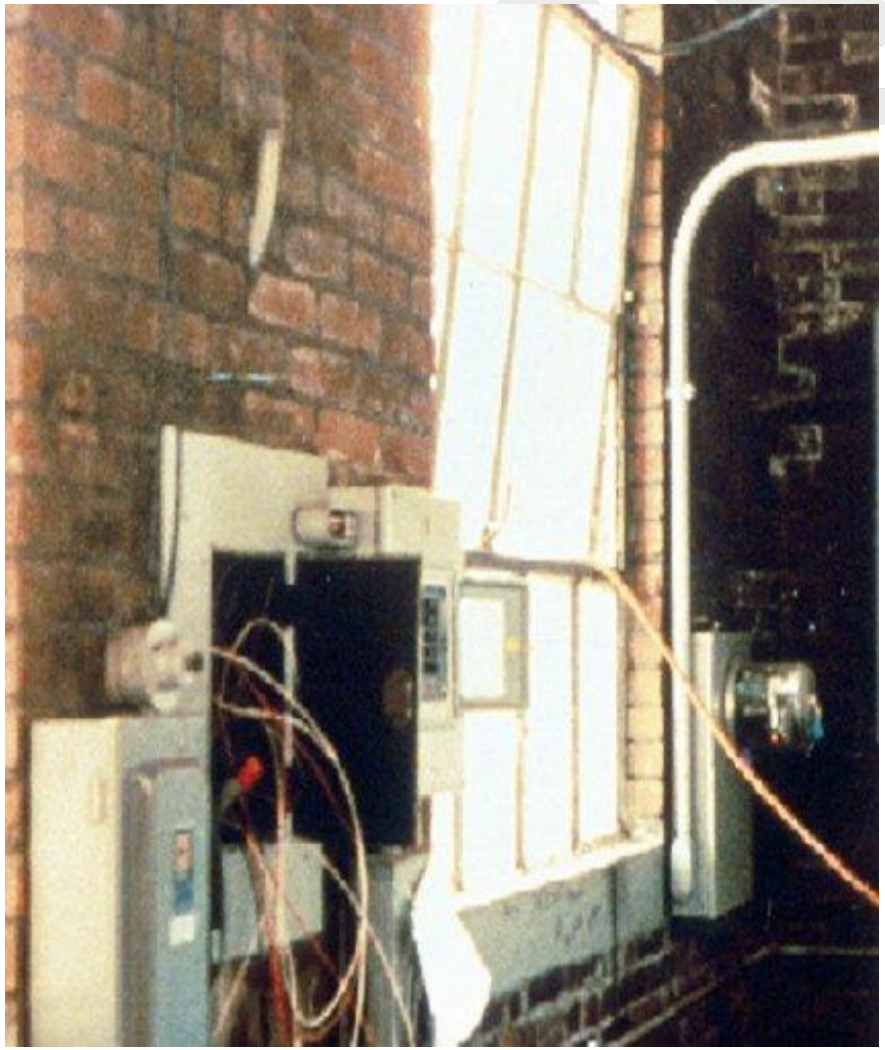






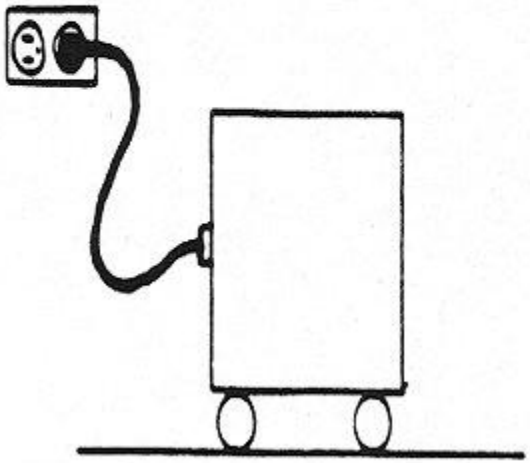
Use of Flexible Cords

- More vulnerable than fixed wiring
- 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

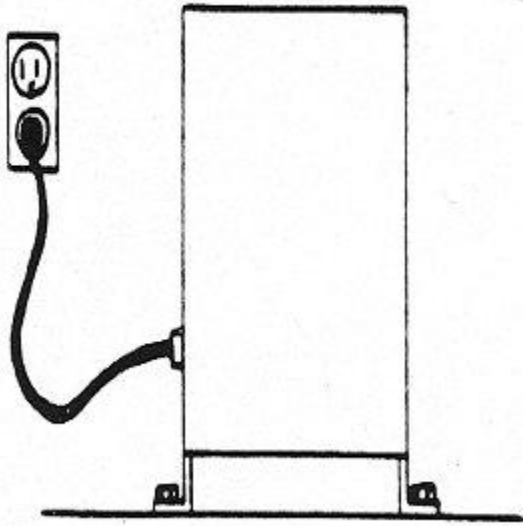


Permissible Uses of Flexible Cords - examples

Pendant, or
Fixture Wiring

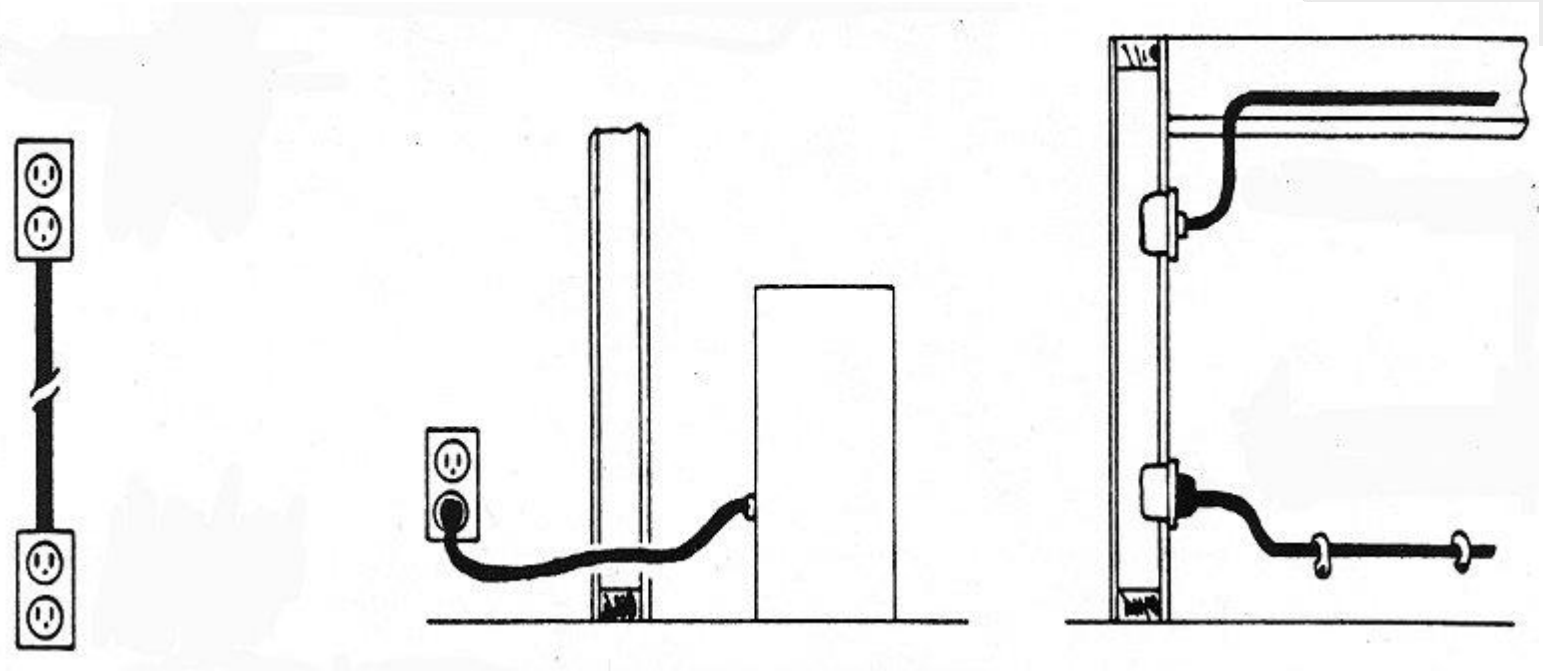


Portable lamps,
tools or appliances



Stationary equipment-to
facilitate interchange

Prohibited Uses of Flexible cords - examples



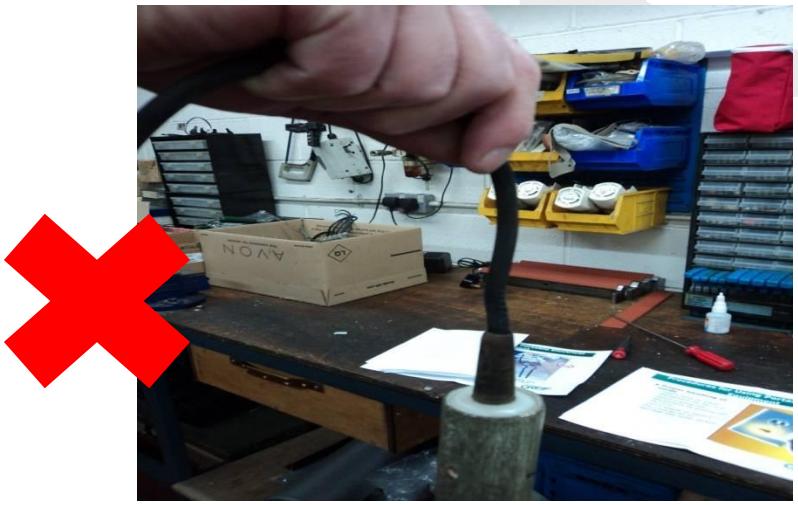
Substitute for fixed wiring

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

Concealed behind or attached to building surfaces

Procedures for using Portable Appliances

- Proper handling of cords
  - Don’t raise or lower equipment by its cord
  - Don’t unplug the equipment by pulling on its cord
  - Don’t staple or fasten the cord so as to damage the outer jacket



Procedures for using Portable Appliances

- Equipment inspection
  - Visually check for:
    - Loose parts
    - Deformed or missing parts
    - Damaged jackets or insulation

Procedures for using Portable Appliances

- Equipment inspection
  - Remove defective equipment from service
  - Check the plug and receptacle mating configuration before connecting

Procedures for using Portable Appliances

- Plugging/unplugging cord and cord-connected equipment and flexible cords
  - Ensure hands are dry
  - Never pull the plug out by the cord

Use of Nonconductive Ladders

- Portable ladders must have nonconductive side rails when used near energized parts
- Metal ladders can conduct electricity and cause arcing and shocks

Clues that Electrical Hazards Exist

- Tripped circuit breakers or blown fuses
- Warm tools, wires, cords, connections, or junction boxes
- G_{round} F_{ault} C_{ircuit} $I_{nterrupter}$ that shuts off a circuit
- Worn or frayed insulation around wire or connection

https://www.youtube.com/watch?v=vhtQGQbuq6w

https://www.youtube.com/watch?v=WNot2owIv8c

Summary

- Hazards
- Inadequate wiring
- Exposed electrical parts
- Wires with bad insulation
- Ungrounded electrical systems and tools
- Overloaded circuits
- Damaged power tools and equipment
- Using the wrong PPE and tools
- Overhead power lines
- All hazards are made worse in wet conditions
- Protective Measures
- Proper grounding
- Using GFCIs
- Using fuses and circuit breakers
- Guarding live parts
- Proper use of flexible cords
- Training