
Electrical Safety in Construction

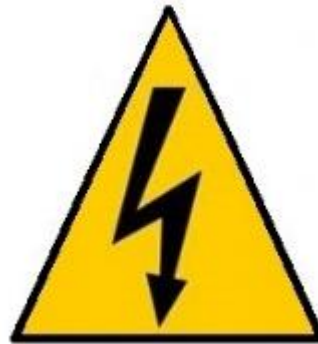
- ***29 CFR 1926 Subpart K – Electrical***

Presented by: ETTA, OSH Division 919-807-2875

Objectives

In this course, we will discuss the following:

- Common electrical hazards
- Standards relating to those hazards
- Electrical equipment defects/hazards
- Tools/techniques used in identifying hazards



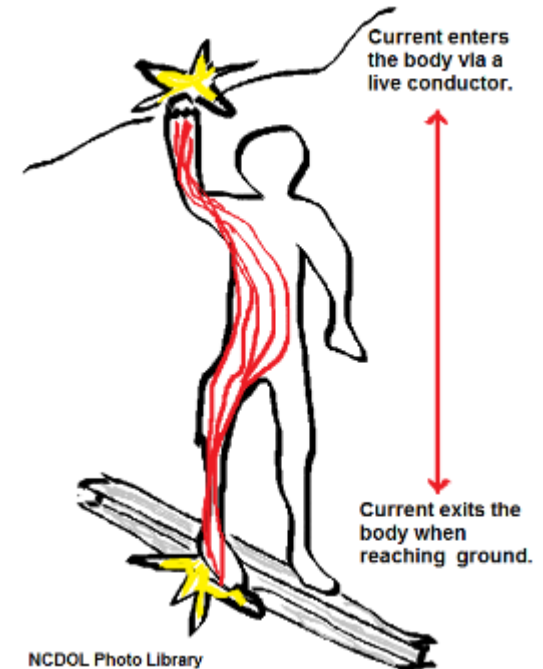
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29 CFR 1926 - Subpart K

- 1926.400 – Introduction
- 1926.402 – Applicability
- 1926.403 – General requirements
- 1926.404 – Wiring design and protection
- 1926.405 – Wiring methods, components, and equipment
- 1926.406 – Specific purpose equipment and installations
- 1926.407 – Hazardous (classified) locations
- 1926.408 – Special systems
- 1926.416, 417, 431, 432, 441 – Safety-related practices and maintenance
- 1926.449 – Definitions

Common Electrical Hazards

- Electric shock/electrocution occurs, when current flows through the body damaging the body
- Electrical burns are caused by arc blast or hot conductors
- Indirect falls from ladders, scaffolds or other walking and working surfaces



Common Electrical Hazards

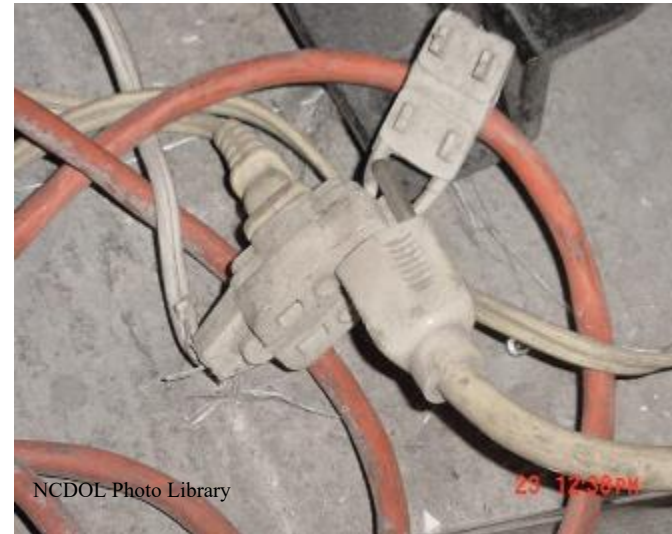
- Explosions can occur due to electricity (ignition source)
 - Example
 - » When the atmosphere contains flammable vapors
- Electrical fires can be caused by overloading a circuit, appliance, faulty wiring, etc.



General Requirements

1926.403(b)(1)

- Electrical equipment must be free from recognized hazards that can cause death or serious physical harm to employees
 - Suitability for installation
 - Mechanical strength and durability
 - Electrical insulation
 - Heating effects under condition of use
 - Arcing effects
 - Classification by type, size, voltage, current capacity, specific use



General Requirements

1926.403(b)(2)

- Listed, labeled, or certified equipment must be installed and used in accordance with instructions included in the listing, labeling or certification



Nationally Recognized Testing Laboratories

- Canadian Standards Association (CSA International)
- Communication Certification Laboratory, Inc. (CCL)
- Curtis-Straus LLC (CSL)
- FM Approvals LLC (FM)
- Intertek Testing Services NA, Inc. (ITSNA)
- MET Laboratories, Inc. (MET)
- NSF International (NSF)
- National Technical Systems, Inc. (NTS)
- SGS U.S. Testing Company, Inc. (SGSUS)
- Southwest Research Institute (SWRI)
- TUV SUD America, Inc. (TUVAM)
- TUV SUD Product Services GmbH (TUVPSG)
- TUV Rheinland of North America, Inc. (TUV)
- Underwriters laboratory Inc. (UL)
- Wyle Laboratories, Inc. (WL)



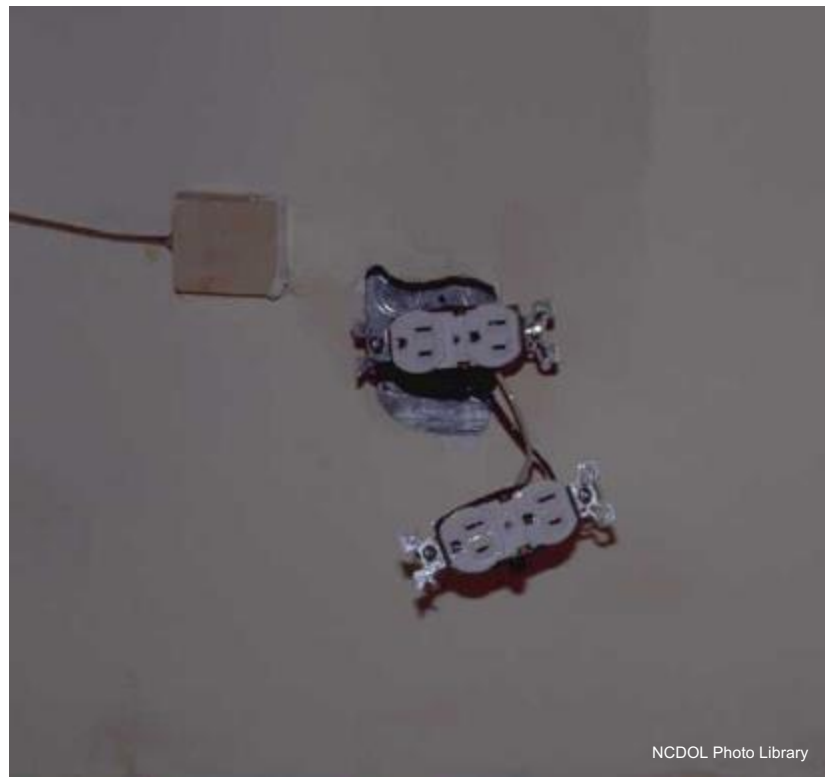
Box Not Approved as a Pendant



General Requirements

1926.403(b)(2)

- Equipment shall be installed and used in accordance with instructions



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Used in Accordance With Instructions



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General Requirements

1926.403(h)

- Each service, feeder, and branch circuit, at its disconnecting means or over current device, shall be legibly marked to indicate its purpose



General Requirements

1926.403(i)(2)

- Live parts of electric equipment operating at 50 volts or more shall be guarded against accidental contact by cabinets or other forms of enclosures, or by another suitable method

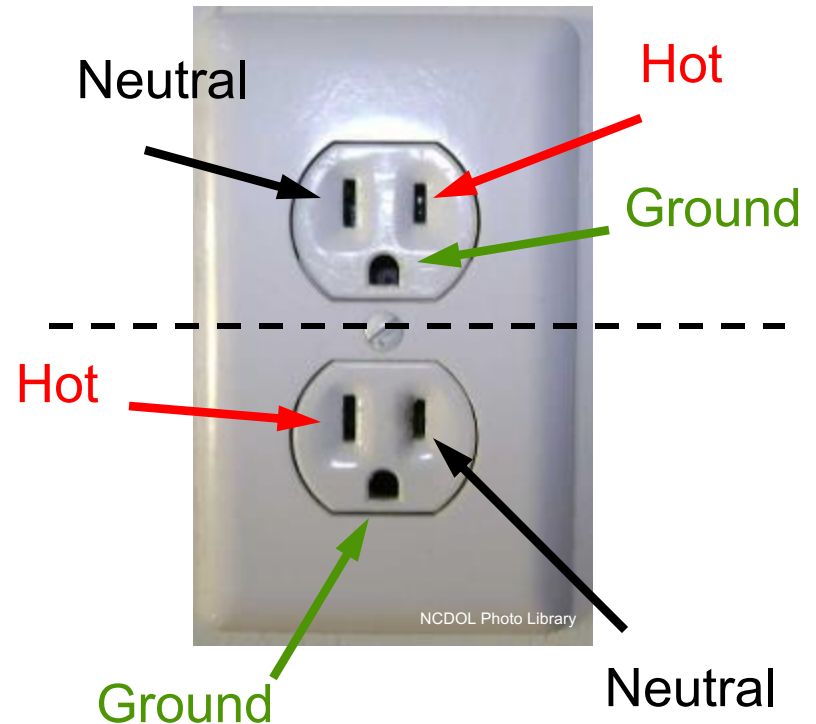


Wiring Design and Protection

1926.404(a)(2)

- Polarity of connections
 - No grounded conductor may be attached to any terminal or lead so as to reverse designated polarity

Correct Polarity



Reversed Polarity

Wiring Design and Protection 1926.404(b)(1)(i)

- Employer shall use either ground fault circuit interrupters

Or

- An assured equipment grounding conductor program to protect employees



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Wiring Design and Protection

1926.404(f)(3)

- Portable generators need not be grounded if:
 - Supplies only equipment mounted on the generator and/or cord and plug equipment is plugged into receptacle mounted on the generator
 - Noncurrent-carrying metal parts of equipment and grounding conductor terminals of the receptacle are bonded to generator frame



Wiring Design and Protection

1926.404(f)(3)

- Vehicle-mounted generators; vehicle frame may serve as system grounding if:
 - Frame of the generator is bonded to the vehicle frame **and**
 - Generator supplies only equipment located on the vehicle and/or equipment plugged into the generator **and**



Wiring Design and Protection

1926.404(f)(3)

- Noncurrent-carrying metal parts of equipment and grounding conductor terminals of the receptacles are bonded to the generator frame, **and**
- System complies with all other provisions of this section



Wiring Design and Protection

1926.404(f)(6)

- Path to ground from circuits, equipment, enclosures must be permanent and continuous



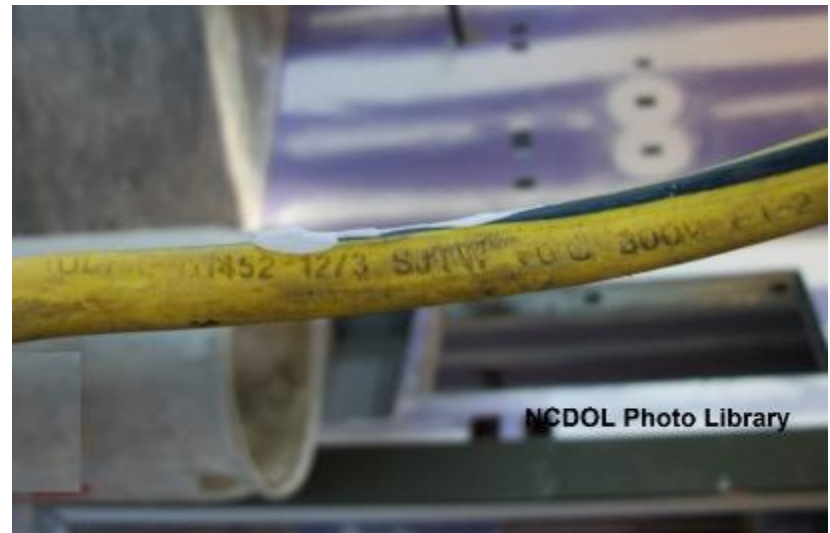
Wiring Design and Protection 1926.404(f)(7)(iv)

- Equipment connected by cord and plug
 - Noncurrent-carrying metal parts which may become energized must be grounded if:
 - » In a hazardous location
 - » Operated at over 150 V to ground
 - Except guarded motors and appliances permanently insulated from ground
 - » Hand held motor-operated tools
 - » Equipment used in wet and/or conductive locations
 - » Portable hand lamps



Wiring Design and Protection 1926.405(a)(2)(ii)(I)-(J)

- Flexible cords and cables must be protected from damage
- Extension cord sets used with portable electric tools and appliances must be of three-wire type and must be designed for hard or extra-hard usage



Wiring Design and Protection

1926.405(b)(1)

- Conductors entering boxes, cabinets, or fittings must be protected from abrasion



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Wiring Design and Protection

1926.405(b)(1)

- Unused openings in cabinets, boxes and fittings must be effectively closed



Wiring Design and Protection

1926.405(b)(2)

- All pull boxes, junction boxes, and fittings must be provided with a cover
- If metal covers are used, they must be grounded



Wiring Design and Protection 1926.405(g)(1)(i)

- Flexible cords and cables must be suitable for conditions of use and location
- **Permitted** uses of flexible cords and cables
 - Pendants and fixture wiring
 - Portable lamps and appliances
 - Elevators cables, cranes, and hoists
 - Stationary equipment to facilitate their frequent interchange
 - Appliances where the fastening means and mechanical connections are designed to permit removal for maintenance and repair

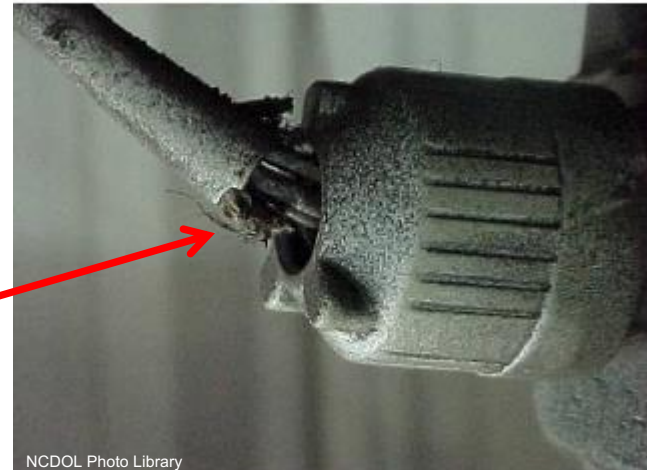
Wiring Design and Protection 1926.405(g)(1)(iii)

- **Prohibited** uses of flexible cords and cables
 - As substitute for fixed wiring of structure
 - Run through holes in walls, ceilings or floors
 - Run through doors, windows or similar openings
 - Attached to building surfaces
 - Concealed behind building walls, ceilings, or floors



Wiring Design and Protection 1926.405(g)(2)(iv)

- Flexible cords shall be connected to devices and fittings so that strain relief is provided
 - Will prevent pull from being directly transmitted to joints or terminal screws



Safety-Related Work Practices 1926.416(b)(2)

- Working spaces, walkways, and similar locations shall be kept clear of cords so as not to create a hazard to employees



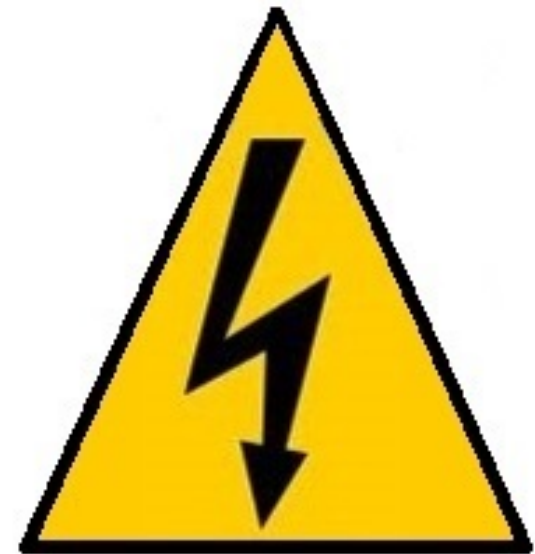
Safety-Related Work Practices 1926.416(e)

- Extension cords shall not be stapled, hung from nails or suspended by wire
- Worn or frayed electric cords must not be used



Tools for Identifying Hazards

- An electrical receptacle voltage tester with GFCI tester
 - Line voltage probes

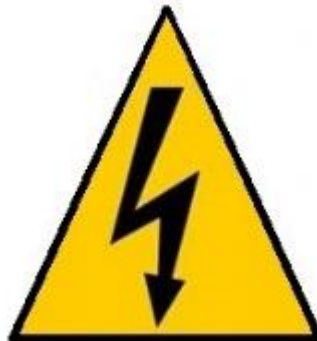


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Summary

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Thank You For Attending!

Final Questions?