SAMPLE WRITTEN PROGRAM
ELECTRICAL SAFETY

## 1. Purpose

Electricity is a serious work place hazard, capable of causing employee injury (shocks, electrocution, fires and explosions), serious property damage or death by electrocution. By providing maintenance personnel and other affected employees with proper training in safe electrical work practices, we hope to reduce the risk of such incidents.

## 2. Scope

This program provides guidelines to train employees in basic electrical hazard recognition and safe work practices. Training alone does not qualify or authorize any employee to perform electrical work.

All electrical wiring and equipment must comply with the National Electrical Code, OSHA regulations, and numerous other established safety and engineering standards. This training is in no way to be construed as a synopsis of all electrical requirements, nor as a substitute for formal study, training, and experience in electrical design, construction, and maintenance.

Occupations facing a higher than normal risk of electrical accidents includes:

Blue collar supervisors (1)
Electrical and electronic engineers (1)
Electrical and electronic equipment assemblers (1)
Electrical and electronic technicians (1)
Electricians
Industrial machine operators (1)
Material handling equipment operators (1)
Mechanics and repairers (1)
Painters (1)
Riggers and roustabouts (1)
Stationary engineers (1)
Welders

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Footnote (1) Workers in these groups do not need to be trained if their work or the work of those they supervise does not bring them or the employees they supervise close enough to exposed parts of electric circuits operating at 50 volts or more to ground for a hazard to exist.

[55 FR 32016, Aug. 6, 1990]

## 3. Responsibilities

Management is responsible for:

- identifying Qualified Person(s) to work with the facilities' electrical systems,
- implementing updates to OSHA electrical safety and lockout/tagout standards as adopted,
- providing employee safety training for qualified and affected workers,
- providing all necessary Personal Protective Equipment (PPE) for employees,
- ensuring electrical safety inspections are conducted,
- assuring all electrical safety hazards are corrected,
- and ensuring that all new electrical equipment and components comply with codes and regulations (Appendix A).

Employees are responsible for:

- the immediate reporting of electrical safety hazards,
- not working on electrical equipment without proper training and authorization, and
- for inspecting equipment prior to using it.

Risk Management shall be responsible for:

- the electrical training program at the location,
- assuring employee safety training for qualified and affected workers is conducted on an annual, new employee and as needed basis (as new hazards are identified),
- periodically assessing the electrical operations at the location in order to identify new or developing electrical hazards (Appendix B)
- utilizing the training material provided to conduct employee training,
- documentation of training (Appendix C)
- review of the Electrical Safety Program.

## 4. Definitions

Authorized/Qualified Person - A qualified person is an individual recognized by location management as having sufficient understanding of the equipment, device, system, or facility to positively control any hazards it presents. Qualification and authorization to perform electrical or electronics work is based on a combination of formal training, experience, and on-the-job training.

Circuit Breaker - (600 volts nominal or less). A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without injury to itself when properly applied within its rating.

Conductor - Current carrying portion of the wire.

Enclosure - The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts, or to protect the equipment from physical damage.

Electric current - The flow of electrons through a conductor.

Extension Cord - Flexible cord that provides a convenient method of bringing AC power to a device that is not located near a power source. They are used as temporary power sources.

Ground - A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Ground-Fault Circuit-Interrupter - A device designed to protect personnel by stopping the flow of electricity when the current flowing back to ground exceeds a predetermined (set) value.

Insulator - A material that does not allow current to freely move from one point to another.

Qualified worker - An employee who is trained and authorized to perform work on electrical equipment and components.

Resistance - Electrical resistance is the restriction of current flowing or moving through any material. (Resistance is measured in ohms) *Skin offers about 1000 ohms of resistance.*

Unqualified worker - An employee who has not been trained or authorized to perform electrical work.

Volt - The unit measure of electrical potential.

## 5. Hazard Control

The following engineering, administrative and work practice control methods will be used to prevent occurrence of electrical-related incidents:

Engineering Controls

- All electrical distribution panels, breakers, disconnects, switches, and junction boxes must be completely enclosed
- Water-tight enclosures must be used if any of these components could possibly be exposed to moisture
- Structural barriers must be used to prevent accidental damage to electrical components
- Conduit must be supported for its entire length, and non-electrical attachments to conduit are prohibited
- Non-rigid electrical cords must have strain relief wherever necessary

Administrative Controls

- Only trained, authorized/qualified employees may repair or service electrical equipment
- Contractors must be licensed to perform electrical work
- Physical barriers must be used to prevent unauthorized persons from entering areas where new installation or repair of electrical components or equipment is being performed
- Only authorized employees may enter electrical distribution rooms
- All electrical control devices must be labeled properly
- Senior facility management must authorize any work on energized electrical circuits

Work Practice Controls

- Employees covered under this policy must wear electrically rated personal protective equipment including safety shoes or boots
- Use only tools that are properly insulated
- Non-conductive gloves will be available for work on electrical equipment
- Electrical-rated matting will be placed in front of all electricity-distribution panels

## 6. Electrical Equipment Inspections

Shall consist of an inspection and assessment of electrical issues and personal protective equipment:

- **Electricity** - equipment, switches, breakers, fuses, switch-boxes, junctions, special fixtures, circuits, insulation, extensions, tools, motors, grounding, national electric code compliance.

- **Personal Protective Equipment (PPE)** - type, size, maintenance, repair, age, storage, assignment of responsibility, purchasing methods, standards observed, training in care and use, rules of use, method of assignment.

*Electrical Equipment*

Inspect all electrical equipment for hazards that could cause employee injury or death. Consider the following factors when determining the safety of the equipment:

- Suitability for the intended use
- Proper insulation
- Heating effects under conditions of use
- Arcing effects
- Classification by type, size, voltage, current capacity, and intended use

*Personal Protective Equipment (PPE)*

The employer shall provide PPE for use by employees working in areas where they could be exposed to electrical hazards. Employees are required to observe the following procedures for PPE use:

- PPE use is mandatory when contact with exposed electrical sources is likely
- Only use PPE that is designed for the work being performed
- Inspect and test all PPE prior to use
- Use a protective outer cover (leather, for example) if the work being performed might damage the PPE's insulation
- Wear non-conductive headgear if there is danger of electrical burns or shock from contact with exposed, energized equipment
- Wear eye and/or face protection any time there is danger of flying objects, flashes or electrical arcs produced by an electrical explosion

## 7. Employee Training

*Qualified Employees*

Training for those employees qualified to perform electrical work will consist of:

- Specific equipment procedures;
- The training requirements outlined in OSHA standard 29 CFR 1910.331 to 1910.339.

*Unqualified Employees*

Employees not qualified or authorized to perform work on electrical equipment and components will be trained in general electrical safety precautions for the purpose of hazard awareness.

The following electrical safety rules also apply to unqualified employees:

- Do not conduct any electrical repairs
- Report all electrical hazards to your supervisor
- Do not operate equipment if you believe there is an electrical hazard
- Do not allow electrical equipment or components to contact water
- Remember that even low-voltage electricity can be physically harmful
- Do not use cords or plugs that are missing the 'ground' prong
- Do not overload electrical receptacles

## 8. Action Steps

- All electrical wiring and equipment must comply with the National Electrical Code, OSHA regulations, and numerous state and local safety and engineering standards.
- Schedule location assessments to identify electrical hazards that develop during normal operations.
- Use Appendix B and list the electrical hazards found during the location assessment.
- Correct all electrical hazards as soon as possible.
- Determine which employees need to be trained on electrical safety.
- Reference to the Lockout / Tagout training program when training employees on Electrical Safety.
- Use Appendix C and Appendix D to document employee training.
- Review the programs effectiveness and make changes where and when necessary.

## 9. Safe Work Practices and Deenergizing/Reenergizing Procedures

The following safe work practices shall be followed as a minimum when working on or near electrical equipment:

a. Electrical equipment shall be deenergized, if possible, before and while work is done on the equipment. Follow all lockout and tagout procedures. Only equipment that is infeasible to deenergize due to design or testing requirements or that would create an increased hazard to other individuals from being deenergized can be worked on in a live condition. Facility management approval to work live is mandatory before such work may begin.

(The OSHA standard exempts circuits of less than 50 volts from this requirement, providing there is no increased risk of exposure to electrical burns or to explosion from electrical arcs.)

b. A tag shall also be attached to the lockout lock stating that the electrical equipment should not be turned on and the tag should not be removed.

Tagouts are not necessary when:

i. only one circuit or piece of equipment is deenergized,
ii. the lockout period does not extend beyond one work shift, and
iii. the employees exposed to the reenergization hazards are familiar with this exemption.

c. Deenergized electrical equipment shall be tested using properly rated equipment to insure that the electrical equipment is deenergized. This testing shall be done using insulated gloves and other body protection as necessary, depending upon the voltage to be tested.

d. Reenergizing electrical equipment can be performed only when:

i. A qualified person shall conduct tests and visual inspections, as necessary, to verify that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed, so that the circuits and equipment can be safely energized.

ii. Employees exposed to the potential electrical hazard are warned to stay clear of circuits and equipment

iii. Each lock and tag is removed by the employee who placed them on the equipment, except as noted in the LOTO removal exemption procedure.

e. If work is to be performed on live electrical equipment appropriate insulating personal protective equipment shall be worn, as necessary, including glove, boots, insulating clothes, insulating hard hat, etc.

f. All capacitors on equipment being serviced are considered "energized" until they are properly discharged.

g. No employee shall plug in or unplug a power cord or extension cord with wet hands.

h. No handling of power cords that have been immersed in water or other conductive liquid is allowed without proper personal protection being used by the employee.

i. Power cords used in any area that has any conductive liquid present must be approved for such service.

j. If a power cord or extension cord circuit is deenergized by a circuit protection device, such as a circuit breaker or ground fault interrupter, the cause of the failure must be determined prior to reenergization of the power source. If the cause of the circuit interruption can be determined as an overload, no examination of the circuit is needed.

k. No overcurrent protection equipment can be altered to perform over its rated service capacities.

l. Circuits that repeatedly trip or repeatedly blow fuses shall be investigated and any load problems corrected.

m. Circuit breakers shall not be used as switches for electrical equipment.

n. Use of power cords or extension cords near flammable liquids shall not be permitted unless sufficient safety measures have been taken and properly rated equipment is used. Proper storage containers are also required for the materials used if they are located near a potential ignition source.

o. Only non-conductive ladders should be used when working on or near any electrical equipment.

p. Employees may not enter spaces that contain energized electrical equipment unless proper illumination is provided.

q. Electrical test equipment shall be inspected on a regular basis and such equipment repaired as necessary.

r. Where live parts present an electrical contact hazard, employees may not perform housekeeping duties at such close distances to the parts that there is a possibility of contact, unless adequate safeguards (such as insulating equipment or barriers) are provided.

s. Servicing of energized components in a conductive area (water, steel floor grates etc.) can be performed only after sufficient insulting equipment has been placed in such location.

t. Electrically conductive cleaning materials are not to be used while performing energized servicing operations, unless procedures are followed to prevent electrical shock.

u. Under no circumstance shall an employee "blindly" reach into an area that contains energized components.

v. On electrical panels hinged doors, cabinet covers shall be secured to prevent accidental closure which could hit the employee and knock him/her into the energized components causing an injury.

w. Safe work distance shall be maintained when working on an energized electrical source. The following table lists the required safe contact distances of servicing employees:

VOLTAGE RANGE/MINIMUM APPROACH DISTANCE

300 volts or less/avoid contact
Over 300 volts but less than 750 volts/1 foot
Over 750 volts but less than 2,000 volts/1 foot 6 inches
Over 2000 volts but less than 15,000 volts/2 feet

Note: Voltages over 15,000 volts require even greater distances. However, if they are encountered in this facility they will be serviced by electrical utility personnel and not company personnel.

## 10. Safe Use and Maintenance of Electrical Equipment

a. Plug and Cord Electrical Connections

Equipment used within the facility with a cord and plug, including extension cords, shall be handled in a safe manner so as not to damage the insulating covering. These cords may not be fastened or hung in such a manner that could cause damage to the insulating covering. The power connections must not be placed in such a manner as to create a hazard to the employees working in the area. For example, an extension cord cannot be placed or hung in an area where material handling equipment could come in contact with it, causing breakage, resulting in an electrical shock.

Power cord use within the facility is acceptable only if daily inspections are performed of all exposed cords. These visual inspections should be performed prior to the beginning of the shift, looking for any defects, such as broken insulation, damaged pins, deformities or loose parts. If a power cord is found to be defective, repair or replacement must be performed before using such cord.

b. Grounded Electrical Equipment and Power Tools

Grounding type equipment and power tools must use a grounding type of power cord and/or extension cord containing a grounding conductor. Alterations of grounding-type connections are not allowed, such as a non-grounded adaptor on a grounding-type cord.

Portable electrical equipment shall not be lowered or raised using their cords. Such equipment shall be visually inspected before each use and repaired as necessary.

## 11. PPE When Working on or Near Live Circuits

Only qualified personnel are allowed to perform any service on the live (energized) electrical components of any equipment within the facility. Servicing of energized components of equipment is acceptable only when deenergization will interfere with or preclude the repair operations to be performed. Other than these limited operations, lockout/tagout energy control procedures must be implemented. Normal energy control procedures are required during operations such as switch or motor replacement, etc. (See lockout/tagout procedures for all Company equipment.)

When working with conductive materials near energized equipment components, extra care must be taken to prevent contact between a worker's body and the energized components. This shall be done by insulating such materials or the use of additional personal protective equipment on the employee. Operations on live components located with a confined or enclosed space, such as a manhole or vault, additional personal protective equipment may be necessary and shall be worn.

The employer must provide protective shields, barriers or insulating materials, which the employee must use when performing any operations on live equipment components. Servicing employees shall have personal protective equipment available from the employer at all times. This equipment must be in good condition and be replaced as needed.

a. Special Insulating Tools
Electric shock protective equipment (non-conductive) and employee personal protective equipment must be used during servicing of energized components. For example, if a service employee is to replace a fuse in an energized fuse box, a sufficiently protective fuse puller must be used.

Non-conductive tools must be used whenever possible during servicing operations on energized equipment.

All ropes and chains used near energized equipment must be of a non-conductive material.

All ladders used within the facility near exposed energized equipment components must have non-conductive side rails.

b. Insulated Cloths/Clothing
Use fire rated clothing. Synthetic materials or fabrics that may melt are prohibited. Employee clothing must be of non-conductive material. Thus, rings, watches and necklaces are not permitted during these operations. However, if these items are worn and are sufficiently covered by a non-conductive insulating material, they are permitted.

c. Head Protection
Employees must wear a protective insulating head covering if their head is near a potential source of live electrical energy.

d. Electrical Arc-Eye Protection
During operations where an electrical arc may be present, adequate eye protection must be provided for the servicing employee.

e. Welding-Safety Curtains
If any welding operations are to be performed within the facility during production hours, and other personal may be affected by the welding arc, a safety curtain capable of shielding all employees in the area must be in place prior to any work beginning.

f. Warning Signs/Barriers
Signs should be placed in the area of live repairs being performed to warn other employees in the facility of the hazard present. Barriers of a non-conductive material shall be place around the working area where energized equipment components are exposed and other personnel could come in contact with the components. When signs and barricades will not provide sufficient protection of the other employees, then an

attendant will be placed at the site of the repair to verbally warn and protect employees from the hazards present.

## 12. New Equipment

New equipment shall be approved by a certified laboratory to comply with OSHA and other National Electrical Code Standards. Custom designed and built equipment shall be inspected and certified by a person qualified to determine its compliance with applicable electrical safety standards.

## 13. References


Ohio Bureau of Worker's Compensation, Sample Written Program – Electrical Safety, Retrieved March 21, 2008 from http://www.ohiobwc.com/downloads/brochureware/publications/SWPrograms/ElectricalSafety.pdf

Small Business Handbook, OSHA Small Business Safety and Health Management Series, **OSHA 2209-02R 2005**


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PURDUE UNIVERSITY NORTH CENTRAL

CONSTRUCTION ADVANCEMENT FOUNDATION

CORPORATE SEAL OF MICHIGAN CITY, INDIANA

Lewellyn TECHNOLOGY

Appendix A

# Electrical Safety Check List

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| □ | Do you require compliance with OSHA standards for all contract electrical work? |
| □ | Are all employees required to report any obvious hazard to life or property in connection with electrical equipment or lines as soon as possible? |
| □ | Are employees instructed to make preliminary inspections and/or appropriate tests to determine conditions before starting work on electrical equipment or lines? |
| □ | When electrical equipment or lines are to be serviced, maintained, or adjusted, are necessary switches opened, locked out or tagged, whenever possible? |
| □ | Are portable electrical tools and equipment grounded or of the double insulated type? |
| □ | Are electrical appliances such as vacuum cleaners, polishers, vending machines, etc., grounded? |
| □ | Do extension cords have a grounding conductor? |
| □ | Are multiple plug adaptors prohibited? |
| □ | Are ground-fault circuit interrupters installed on each temporary 15 or 20 ampere, 120 volt alternating current (AC) circuit at locations where construction, demolition, modifications, alterations, or excavations are being performed? |
| □ | Are all temporary circuits protected by suitable disconnecting switches or plug connectors at the junction with permanent wiring? |
| □ | Do you have electrical installations in hazardous dust or vapor areas? If so, do they meet the National Electrical Code (NEC) for hazardous locations? |
| □ | Are exposed wiring and cords with frayed or deteriorated insulation repaired or replaced promptly? |
| □ | Are flexible cords and cables free of splices or taps? |
| □ | Are clamps or other securing means provided on flexible cords or cables at plugs, receptacles, tools, equipment, etc., and is the cord jacket securely held in place? |
| □ | Are all cord, cable and raceway connections intact and secure? |
| □ | In wet or damp locations, are electrical tools and equipment appropriate for the use or location or otherwise protected? |
| □ | Is the location of electrical power lines and cables (overhead, underground, under floor, other side of walls, etc.) determined before digging, drilling, or similar work is begun? |
| □ | Are metal measuring tapes, ropes, hand-lines or similar devices with metallic thread woven into the fabric prohibited where they could come in contact with energized parts of equipment or circuit conductors? |

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| □ | Is the use of metal ladders prohibited where the ladder or the person using such ladder could come in contact with energized parts of equipment, fixtures, or circuit conductors? |
| □ | Are all disconnecting switches and circuit breakers labeled to indicate usage or equipment served? |
| □ | Are disconnecting means always opened before fuses are replaced? |
| □ | Do all interior wiring systems include provisions for grounding metal parts of electrical raceways, equipment and enclosures? |
| □ | Are all electrical raceways and enclosures securely fastened in place? |
| □ | Are all energized parts of electrical circuits and equipment guarded against accidental contact by approved cabinets or enclosures? |
| □ | Is sufficient access and working space provided and maintained around all electrical equipment to permit ready and safe operations and maintenance? |
| □ | Are all unused openings (including conduit knockouts) in electrical enclosures and fittings closed with appropriate covers, plugs, or plates? |
| □ | Are electrical enclosures such as switches, receptacles, junction boxes, etc., provided with tight-fitting covers or plates? |
| □ | Are disconnecting switches for electrical motors in excess of two horsepower able to open the circuit when the motor is stalled without exploding? (Switches must be horsepower rated equal to or in excess of the motor rating.) |
| □ | Is low voltage protection provided in the control device of motors driving machines or equipment that could cause injury from inadvertent starting? |
| □ | Is each motor disconnecting switch or circuit breaker located within sight of the motor control device? |
| □ | Is each motor located within sight of its controller or is the controller disconnecting means able to be locked open or is a separate disconnecting means installed in the circuit within sight of the motor? |
| □ | Is the controller for each motor that exceeds two horsepower rated equal to or above the rating of the motor it serves? |
| □ | Are employees who regularly work on or around energized electrical equipment or lines instructed in cardiopulmonary resuscitation (CPR)? |
| □ | Are employees prohibited from working alone on energized lines or equipment over 600 volts? |

Performed by _____

Signature _____ Date _____

Action Items _____

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Appendix B

# Periodic Inspection for Electrical Hazards

Facility _____ Date ____/____/____

| Area/Building/Other Identifier | Hazard Description |
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Performed by _____

Action Items _____

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Appendix C

## Training Record

**Description of Training:** _____

**Date of Training:** _____/_____/_____ **Quiz Used** _____**Yes** _____ **No**

**Trainer:**_____ **Trainer Signature:**_____

**Training Material Used:** _____

| Print Your Name | Sign Your Name |
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Appendix D

# Electrical Safety Quiz

***SELECT THE BEST ANSWER.***

1. The most dangerous place to use electrical equipment is?

   A. indoors.
   B. outdoors.
   C. near water.
   D. near other electrical equipment.

2. You discover the electrical cord on a drill has been damaged and some of the cord's insulation is missing. You should?

   A. wrap tape around the damaged spot to prevent electrical shocks.
   B. check to see if the drill still works.
   C. tag the drill out-of-service and notify the department responsible for equipment maintenance.
   D. make sure that the cord does not come in contact with the floor.

3. The safest ladder to use around electricity is?

   A. wood.
   B. fiberglass.
   C. aluminum.
   D. a step stool.

4. The earth, water, concrete and the human body are all conductors of electricity

   A. True

   B. False

5. The effects of an electrical shock on the body depend upon all of the following *EXCEPT:*

   A. current
   B. path
   C. duration
   D. body weight

6. Injuries from electricity can include which of the following?

   A. electric shock that may or may not result in electrocution.
   B. falls.
   C. burns.
   D. all of the above.

7. Open knock-outs on outlet boxes:

   A. must be reported and repaired as soon as possible.
   B. are permitted by OSHA.
   C. are common because replacing knock-outs is expensive.
   D. pose no hazard as the electrical wiring has been re-routed.

8. Which of the following is acceptable by OSHA standards?

   A. an unqualified employee flipping tripped breakers in a breaker box.
   B. plugging and extension cord into a second extension cord.
   C. removing a ground pin if needed to plug into a two-prong outlet.
   D. a qualified person repairing an extension cord.

9. Flexible cords can be used in the workplace:

   A. as a substitute for permanent wiring.
   B. if they are run behind walls to reduce the chance of abrasion and damage.
   C. if heavy or extra heavy duty cords are needed for temporary purposes.
   D. if any obvious splices are repaired with electrical tape.

10. It is the responsibility of all employees to understand and use electrical safety everyday.

   A. True

   B. False

# Electrical Safety Quiz (Answer Key)

***SELECT THE BEST ANSWER.***

1. The most dangerous place to use electrical equipment is?

   A. indoors.
   B. outdoors.
   C. near water.
   D. near other electrical equipment.

2. You discover the electrical cord on a drill has been damaged and some of the cord's insulation is missing. What should you do?

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   B. check to see if the drill still works.
   C. tag the drill out-of-service and notify the department responsible for equipment maintenance.
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3. The safest ladder to use around electricity is?

   A. wood.
   B. fiberglass.
   C. aluminum.
   D. a step stool.

4. The earth, water, concrete and the human body are all conductors of electricity.

   A. True

   B. False

5. The effects of an electrical shock on the body depend upon all of the following *EXCEPT:*

   A. current.
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   C. duration.
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   D. if any obvious splices are repaired with electrical tape.

10. It is the responsibility of all employees to understand and use electrical safety everyday.

    A. True

    B. False