

Pages 190-215

(C) For multi-employer worksites, the procedures shall address how all the affected employers will coordinate their work activities, so that operations of one employer will not endanger the employees of any other employer. If the permit-required confined space requirements of section 5157 or the requirements of section 8355 apply to one or more of the other employers, then the procedures shall also include coordination with those employers;

**(2) Employee Training.** Employees, including standby persons required by subsection (e)(1)(D), shall be trained in the operating and rescue procedures, including instructions as to the hazards they may encounter.

**(d) Pre-entry**

The applicable provisions of this subsection shall be implemented before entry into a confined space.

**(1)** Lines that may convey flammable, injurious, or incapacitating substances into the space shall be disconnected, blinded, or blocked off by other positive means to prevent the development of dangerous air contamination, oxygen enrichment and/or oxygen deficiency within the space. The disconnection or blind shall be so located or done in such a manner that inadvertent reconnection of the line or removal of the blind is effectively prevented.

Exception: This subsection does not apply to public utility gas distribution systems.

NOTE: This subsection does not require blocking of all laterals to sewers or storm drains. Where experience or knowledge of industrial use indicates materials resulting in dangerous air contamination may be dumped into an occupied sewer, all such laterals shall be blocked.

**(2)** The space shall be emptied, flushed, or otherwise purged of flammable, injurious or incapacitating substances to the extent feasible.

**(3)** The air shall be tested with an appropriate device or method to determine whether dangerous air contamination, oxygen enrichment and/or an oxygen deficiency exists. A written record of such testing results shall be made and kept at the work site for the duration of the work. Affected employees and/or their representatives shall be afforded an opportunity to review and record the testing results. If an electronic or thermal device is used to test a confined space that contains or is likely to develop dangerous air contamination due to flammable and/or explosive substances, then the device must be approved for use in such explosive or flammable conditions as required by section 2540.2.

**(4)** Where interconnected spaces are blinded off as a unit, each space shall be tested and the results recorded, in accordance with subsection (d)(3), and the most hazardous condition so found shall govern procedures to be followed.

**(5)** If dangerous air contamination, oxygen enrichment and/or oxygen deficiency does

(e) related to the use of respiratory protective equipment shall apply during entry into and work within such spaces.

**(e) Confined Space Operations**

**(1)** Entry Into and Work Within Confined Spaces. The requirements of this subsection apply to entry into and work within a confined space whenever an atmosphere free of dangerous air contamination, oxygen enrichment and/or oxygen deficiency cannot be ensured through the implementation of the applicable provisions of subsection (d), or whenever, due to the existence of an emergency, it is not feasible to ensure the removal of dangerous air contamination, oxygen enrichment and/or an oxygen deficiency through the implementation of the applicable provisions of subsection (d).

(A) Tanks, vessels, or other confined spaces with side and top openings shall be entered from side openings when practicable.

Note: For the purposes of this Order, side openings are those within 3 1/2 feet of the bottom.

(B) Appropriate, approved respiratory protective equipment, in accordance with Section 5144, shall be provided and worn.

(C) An approved safety belt with an attached line shall be used. The free end of the line shall be secured outside the entry opening. The line shall be at least 1/2-inch diameter and 2,000-pounds test.

Exception: Where it can be shown that a safety belt and attached line would further endanger the life of the employee.

(D) At least one employee shall stand by on the outside of the confined space ready to give assistance in case of emergency. At least one additional employee who may have other duties shall be within sight or call of the standby employee(s).

1. The standby employee shall have appropriate, approved, respiratory protective equipment, including an independent source of breathing air which conforms with Section 5144(e), available for immediate use.

2. A standby employee (or employees) protected as prescribed by subsection (e)(1)(D) 1. may enter the confined space but only in case of emergency and only after alerting at least one additional employee outside of the confined space of the existence of an emergency and of the standby employee's intent to enter the confined space.

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(E) When entry must be made through a top opening, the following requirements shall also apply.

1. The safety belt shall be of the harness type that suspends a person in an upright position.

1. Inform the contractor that the workplace contains a confined space and that confined space entry is allowed only through compliance with a confined space program meeting the requirements of this section, section 5157 or section 8355, depending on which section applies to the contractor;
2. Apprise the contractor of the elements, including the hazards identified and the host employer's experience with the confined space, that make the space in question a confined space;
3. Apprise the contractor of any precautions or procedures that the host employer has implemented for the protection of employees in or near the confined space where the contractor's personnel will be working;
4. Coordinate entry operations with the contractor, when both host employer personnel and contractor personnel will be working in or near the confined space, as required by subsection (c)(1)(C); and
5. Debrief the contractor at the conclusion of the confined space operation regarding the confined space program followed and any hazards confronted or created in the confined space during entry operations.

(K) In addition to complying with the confined space requirements that apply to all employers, each contractor who is retained to perform confined space entry operations shall:

1. Obtain any available information regarding confined space hazards and entry operations from the host employer;
2. Coordinate entry operations with the host employer, when both host employer personnel and contractor personnel will be working in or near a confined space, as required by subsection (c)(1)(C); and
3. Inform the host employer of the confined space program that the contractor will follow and of any hazards confronted or created in the confined space, either through a debriefing or during the entry operation.

**(2) Precautions for Emergencies Involving Work in Confined Spaces.**

(A) At least one person trained in first aid and cardiopulmonary resuscitation (CPR) shall be immediately available whenever the use of respiratory protective equipment is required subsection (e)(1). Standards for CPR training shall follow the principles of the American Heart Association or the American Red Cross.

(B) An effective means of communication between employees inside a confined space and a standby employee shall be provided and used whenever the provisions of subsection (e)(1) require the use of respiratory protective equipment or whenever employees inside a confined space are out of sight of the standby employee(s). All affected employees shall be trained in the use of such a

## Exhibit A - Entry Permits

### CONFINED SPACE ENTRY PERMIT

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#### INSTRUCTIONS (Nobody will enter a confined space until permit is complete)

1) Complete permit before entry begins. 2) Post permit at entrance to confined space until work in the confined space is complete. 3) Send permit to Safety Manager for review within 24 hours of completion of the work in the confined space.

#### GENERAL INFORMATION

JOBSITE:																																																																																					
PERMIT BEGINS: Date: _____	Time: _____ AM/PM																																																																																				
PERMIT EXPIRES: Date: _____	Time: _____ LOCATION & DESCRIPTION OF CONFINED SPACE:																																																																																				
PURPOSE OF ENTRY:																																																																																					
NAMES OF AUTHORIZED INDIVIDUALS (Please Print)																																																																																					
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### CONFINED SPACE ENTRY PERMIT

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#### ISOLATION REQUIREMENTS (Please circle appropriate method, check YES or NO, and initial)

**CONFINED SPACE ENTRY PERMIT****Page 3 of 3**

<b>HOT WORK PERMIT</b>					
IS A HOT WORK PERMIT REQUIRED?		<u>YES</u>	NO	IF YES, IS IT ATTACHED TO THIS PERMIT?	
				YES	NO
<b>SIGNATURE OF ATTENDANTS AND ENTRANTS</b>					
The confined space job and its safety aspects have been explained to us, and we have read and understand the above permit. We consider it safe to proceed with the confined space entry work. (Please sign, date and initial below.)					
<u>ATTENDANTS</u>			<u>ENTRANTS</u>		
1)	Date	Initials	1)	Date	Initials
2)	Date	Initials	2)	Date	Initials
3)	Date	Initials	3)	Date	Initials
4)	Date	Initials	4)	Date	Initials
<b>SIGNATURE OF PERSON AUTHORIZING ENTRY</b>					
SIGNATURE:		DATE:		TIME: AM / PM	
<b>CANCELLATION OF PERMIT</b>					
DATE CANCELED:		TIME CANCELED: AM / PM		CANCELED BY: (Signature)	
REASON PERMIT WAS CANCELED:					
<b>EVALUATION (Review within 24 hours of completion of the work in the confined space).</b>					
EVALUATED BY: (Signature)		DATE:		TIME: AM / PM	

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**Exhibit B - Hot Work Permit****Exhibit B**

Welding &amp; Cutting Hot Work Permit

# Electrical Safety

## Purpose

To eliminate unsafe conditions involving electrical equipment and tools, including faulty insulation, improper grounding, loose electrical connections, defective parts, ground faults in equipment and unguarded live electrical parts.

## References

OSHA 29 CFR 1926.400 to 1926.449

National Electrical Code (NEC)

## Policy

### General Requirements

- Each project must provide a safe place to work for every employee, which includes protecting the employee from electrical hazards such as fault currents to ground.
- When an electrical ground fault occurs, the current flows through the path with minimum impedance to ground. It is imperative that an employee does not inadvertently become the conductor of the current.
- There are two approved methods of protecting the worker from a ground fault. These methods are in addition to other requirements for equipment grounding conductors. They are:
  - Use of ground fault circuit interrupters (GFCI).
  - An assured equipment-grounding conductor program.

### GROUND FAULT CIRCUIT INTERRUPTER (GFCI)

The two major aspects in the effective use of GFCI's are:

- Attention shall be given to the proper installation and maintenance of GFCI's within the requirements of the National Electric Code (NEC). The system shall be tested prior to being activated into service and the test results documented and kept on file.
- If fault trip-out occurs after the circuit has been tested and activated into service, a thorough investigation must be made to determine the cause. The necessary repairs or corrections shall be made before re-using. Application of a silicone solution may be helpful if the fault trip-out is due to excessive moisture.

In purchasing GFCI's, the specifications shall state that GFCI's shall conform to Underwriters Laboratories Standard 943, "Ground Fault Circuit Interrupters."

Each circuit protected by a circuit breaker GFCI requires its own neutral conductor.

prongs on plugs, and other similar substandard conditions. Equipment found to be damaged or defective shall not be used until repaired and equipment suspected of being damaged or defective shall be inspected and tested prior to using.

To verify inspection and testing, a piece of color-coded tape will be affixed to each item inspected by the inspector. Four colors of tape shall be used. The expiration date of each inspection period may be pre-printed on the tape to avoid conflicts with other similar color-coded tapes on the project. The color code system is as follows:

#### **Color Coding Scheme (Quarterly)**

January 1 through March 31 .....	White
April 1 through June 30 .....	Green
July 1 through September 30 .....	Red
October 1 through December 31 .....	Orange

The inspection tape shall not be used for any other purpose. The project supervisor shall strictly control use of tape. Color scheme may vary according to region.

Any electrical tool, cord set, or piece of electrical equipment which bears an expired inspection sticker, or no inspection sticker shall be considered defective and is not to be used until it is inspected.

Only the electrical inspectors are authorized to remove inspection tape. Unauthorized removal or defacing of inspection tape shall be cause for disciplinary action.

It shall be the responsibility of each subcontractor to ensure that his electric tools and electrical equipment are tested and documented.

#### **LIGHTING**

- All fluorescent light fixtures in job trailers should have either a full cover or individual plastic sleeves over the tubes.
- Temporary lighting shall have lamps that are protected from accidental contact or breakage.

#### **DAMAGED EXTENSION CORDS**

If the outer insulation is cut or torn open one-half inch or less ***and*** the insulation of the conductors are not damaged (bare copper showing), ***contact the Safety & Compliance Manager*** for approved weather proofing tape.

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If the cut or torn area is more than one-half inch in length and/or the conductor insulation is cut, cracked, mashed, or has any bare copper showing, the cord is to be cut at the damaged area, tagged "out of service" (noting the problem), and sent back to the shop for repair.



**Direct Electrical Hazard:** A potential source of personal injury resulting from the flow of electrical energy through a person (electrical shocks and burns).

**Indirect Electrical Hazard:** A potential source of personal injury resulting from electrical energy that is transformed into other forms of energy (e.g., radiant energy, such as light, heat, or energetic particles; magnetic fields; chemical reactions, such as fire, explosions, the production of noxious gases and compounds; and involuntary muscular reactions).

**First Line Protection:** The primary protective system and/or operational procedure provided to prevent physical contact with energized equipment.

**General Supervision:** The condition that exists when an individual works under a supervisor's direction but not necessarily in the continuous presence of the supervisor.

**Grounding Point:** The most direct connection to the source of a potential electrical hazard such as the terminals of a capacitor. Such a point must be indicated by a yellow circular marker.

**Grounds, Electrical:** Any designated point with adequate capacity to carry any potential currents to earth. Designated points may be building columns or specially designed ground-network cabling, rack, or chassis ground. Coldwater pipes, wire ways, and conduits must not be considered electrical grounds.

**Grounds, Massive:** Large areas of metal, concrete, or wet ground that make electrical isolation difficult or impossible.

**Implied Approval:** Approval is implied when a supervisor, knowing the qualifications of an individual, assigns that individual a task, or responsibility for, a device, system, or project.

**Qualified Person:** An individual recognized by management as having sufficient understanding of a device, system, or facility to be able to positively control any hazards it may present. Must, Should, and May: "Must" indicates a mandatory requirement. "Should" indicates a recommended action. "May" indicates an optional or permissive action, not a requirement or recommendation.

**Safety Watch:** An individual whose sole task is to observe the operator and to quickly de-energize the equipment, using a crash button or circuit breaker control in case of an emergency, and to alert emergency personnel. This person should have basic CPR training.

## ***Arc Flash and Shock***

### Protection from Electric Shock and Arc Flash

About 50 electrical workers are killed in construction every year in the U.S. by electric

- **Anticipate problems.** If it can go wrong, it might. Make sure you have the right PPE and tools for the worst-case scenario.
- **Get training.** Make sure you and everyone working with you is a qualified person with appropriate training for the job.\*

### To De-Energize or Not to De-Energize

One of the most important decisions in planning an electric task is whether to de-energize. Whenever possible, live parts to which you might be exposed should be put into an **electrically safe work condition**, unless your employer can demonstrate that de-energizing creates more or worse hazards or is not practical because of equipment design or operational limitations.

You might need to work on live equipment to avoid interrupting life-support systems, de-activating emergency alarm systems, or shutting down ventilation equipment for hazardous locations, for instance. And de-energizing would not be practical during testing of live electric circuits or work on circuits that are part of a continuous process that cannot be completely shut down.

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\* OSHA defines an electrical-qualified person as “one familiar with the construction and operation of the equipment and the hazards involved.”

### De-Energizing

#### An Electrically Safe Work Condition

The most important principle of electric safety is, **assume electric circuits are energized unless you make sure they are not**. Test every circuit and conductor every time you work on them. The National Fire Protection Association lists six steps to ensure conditions for electrically safe work.

- Identify all sources of power to the equipment.
- Interrupt the load current, and then open the disconnecting devices for each power source.
- Where possible, visually verify that blades of disconnecting devices are fully open or that draw out-type circuit breakers are fully withdrawn.
- Apply lockout/tagout devices in accordance with a formal, written policy.
- Test each phase conductor or circuit part with an adequately rated voltage detector to verify that the equipment is de-energized. Check the voltage detector before and after each test to be sure it is working.

- Properly ground all possible sources of induced voltage and stored electric energy (such as, capacitors) before touching. If conductors or circuit parts that are being de-energized could contact other exposed conductors or circuit parts, apply ground-connecting devices rated for the available fault current.

## **Working On or Near Live Circuits**

Working on live circuits means actually touching energized parts. Working near live circuits means working close enough to energized parts to pose a risk even though you make be working on de-energized parts. Common tasks where you need to work on or near live circuits include:

- Taking voltage measurements
- Opening and closing disconnects and breakers.
- Racking breakers on and off the bus
- Removing panels and dead fronts
- Opening electric equipment doors for inspection.

There should be standard written procedures and training for these common tasks. For instance, when opening and closing disconnects, use the **left-hand rule** when possible (stand to the right side of the equipment and operate the disconnect mechanism with your left hand). For other situations where you could work on or near live circuits, your employer should institute a written live work permit system which must be authorized by a qualified supervisor.

### **Live-work permit system**

A live work permit should, at a minimum, contain this information:

- A description of the circuit and equipment to be worked on and location.
- The date and time covered by the permit.
- Why live work will be done.
- Results of shock hazard analysis and determination of shock protection boundaries
- Results of flash hazard analysis and determination of flash protection boundary
- PPE to be worn and description of safe work practices to be used.
- Who will do the work and how unqualified persons will be kept away?
- Evidence of completion of job briefing, including description of job-specific hazards.

### **Approach distances to exposed live parts.**

The National Fire Protection Association defines three approach distances for shock hazards and one for arc flash.

**Electric shock** (see table 1).

The **limited approach boundary** is the closest distance an unqualified person can approach, unless accompanied by a qualified person.

The **restricted approach boundary** is the closest distance to exposed live parts a qualified person can approach without proper PPE and tools. Inside this boundary,

[illegible]



**Task (Assumes Equipment Is Energized, and Work, Is Done Within the Flash Protection Boundary)**

Electrical Safety Matrix	Hazard Risk Category	V-rated Gloves	V-rated Tools	Natural Fiber Clothing	Long sleeve Shirt	11 cal/cm² Hooded Jacket	Denim Jeans	Hardhat	Safety Glasses	Hearing Protection	8 cal/cm² Face shield	45 cal/cm² Flashsuit	Hot Work Form 12.1	Competent Standby
Task (Assumes Equipment Is Energized, and Work, Is Done Within the Flash Protection Boundary)														
600 V (nominal) Class Switchgear (with power circuit breakers or fused switches) (continued)														
Work on control circuits with energized parts 120V or below, exposed	0	•	•	•			•	•	•					
Work on control circuits with energized parts >120V, exposed	2	•	•	•	•	•	•	•	•	•	•		•	
Insertion or removal (racking) of CBs from cubicles, doors open	3			•	•		•	•	•	•		•	•	•
Insertion or removal (racking) of CBs from cubicles, doors closed	2			•	•	•	•	•	•	•	•		•	
Application of safety grounds, after voltage test	2	•		•	•	•	•	•	•	•	•		•	
Conductor insertion/removal	3	•	•	•	•		•	•	•	•		•	•	•
Other 600 V Class (250 V through 600 V, nominal) Equipment														
Lighting or small power transformers (600 V maximum)														
Removal of bolted covers (to expose bare, energized parts)	2			•	•	•	•	•	•	•	•		•	
Opening hinged covers (to expose bare, energized parts)	1			•	•	•	•	•	•				•	
Work on energized parts, including all testing	2	•	•	•	•	•	•	•	•	•	•		•	
Application of safety grounds, after voltage test	2	•		•	•	•	•	•	•	•	•		•	
Revenue meters (kW-hour, at primary voltage and current)														
Insertion or removal	2	•		•	•	•	•	•	•	•	•		•	
Cable trough or tray cover removal or installation	1			•	•	•	•	•	•				•	
Miscellaneous equipment cover removal or installation	1			•	•	•	•	•	•				•	
Work on energized parts, including all testing	2	•	•	•	•	•	•	•	•	•	•		•	
Application of safety grounds, after voltage test	2	•		•	•	•	•	•	•	•	•		•	
NEMA E2 (fused contactor) Motor Starters, 2.3kV through 7.2 kV (nominal)														
Contactor operation with enclosure doors closed	0			•			•	•	•					
Reading a panel meter while operating a meter switch	0			•			•	•	•					
Removal of bolted covers (to expose bare, energized parts)	4			•	•		•	•	•	•		•	•	•
Contactor operation with enclosure doors open	2			•	•	•	•	•	•	•	•		•	
Work on energized parts, including voltage testing	3	•	•	•	•		•	•	•	•		•	•	•
Work on control circuits with energized parts 120V or below, exposed	0	•	•	•			•	•	•					
Work on control circuits with energized parts >120V, exposed	3	•	•	•	•		•	•	•	•		•	•	•
Insertion or removal (racking) of starters from cubicles, doors open	3			•	•		•	•	•	•		•	•	•
Insertion or removal (racking) of starters from cubicles, doors closed	2			•	•	•	•	•	•	•			•	
Application of safety grounds, after voltage test	3	•		•	•		•	•	•	•	•	•	•	•
Opening hinged covers (to expose bare, energized parts)	3			•	•		•	•	•	•		•	•	•

Risk Category
Gloves
Tools
Clothing
Sleeve Shirt
Hooded Jacket
Jeans
Hardhat
Glasses
Protection
Face shield
Flashsuit
Form 12.1
Standby

Figure 1. Hazard / risk analysis flow



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