

Lock-out/Tag-out and Other Electrical Concerns

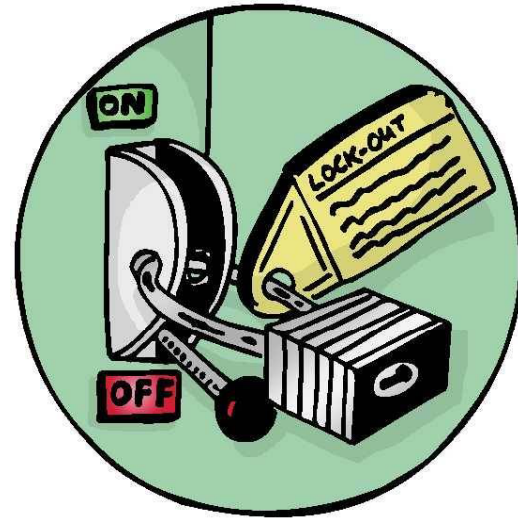
OSHA 1910.147 & Subpart S 1910.301-399

NGFA – AAI Safety Seminar
Johnston, IA

Presenter: Jim Maness, JEM Consulting

June 13, 2013

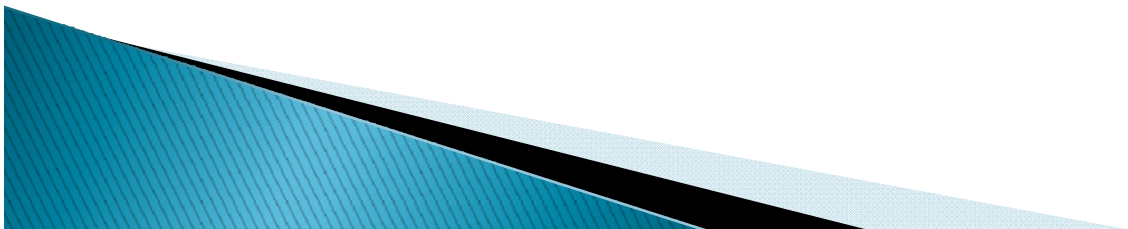
Lockout / Tagout



- Lockout is used to control the release of hazardous energy and prevent equipment from starting by applying a lockout device and lock.
- A padlock is placed on the appropriate energy isolating device that secures equipment in the off or closed position

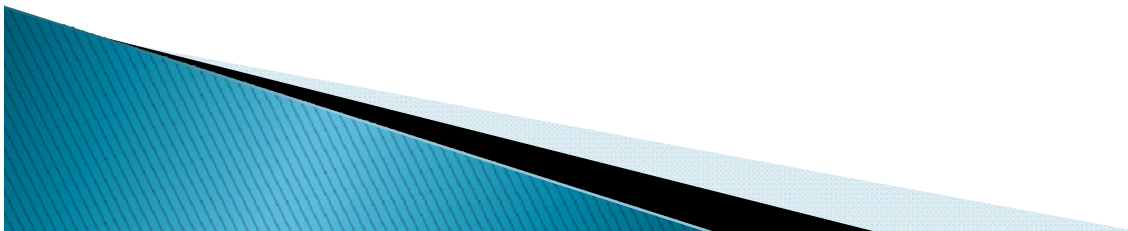
Tagout

- Tagout is the placement of a tag on the lockout device that identifies:
 - ① The person who placed the lock
 - ② The date of lockout
- Used if energy isolating device is not capable of being locked out. (1/2/1990)



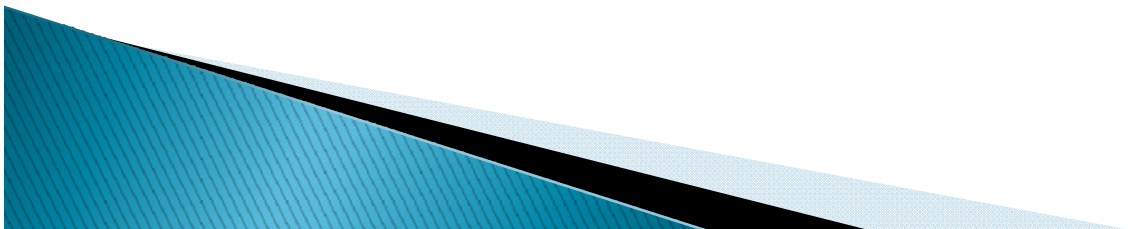
Five Causes of Lockout/Tagout Injuries

- ① Failure to stop equipment
- ② Failure to disconnect from power source
- ③ Failure to dissipate (bleed, neutralize) residual energy
- ④ Accidental restarting of equipment
- ⑤ Failure to clear work areas before restarting



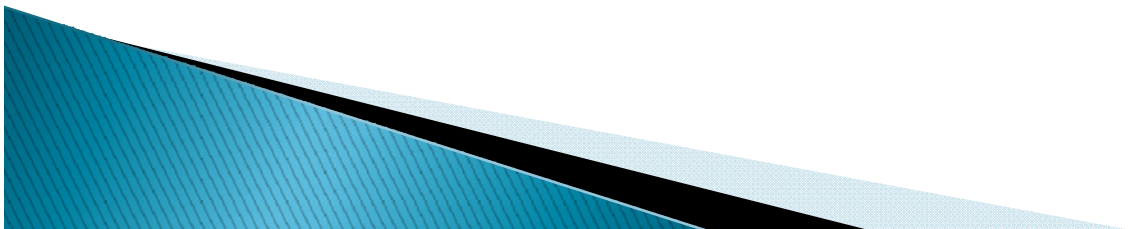
Definitions

- **Authorized Employee** – One who is trained in the procedures to lockout the specific machines or equipment in order to perform the adjustments or maintenance.
- **Affected Employee** – One whose job duties are interrelated to the operation of the equipment being locked out. Example: A person that feeds product to the equipment being shut down.
- **Energy Isolating Device**

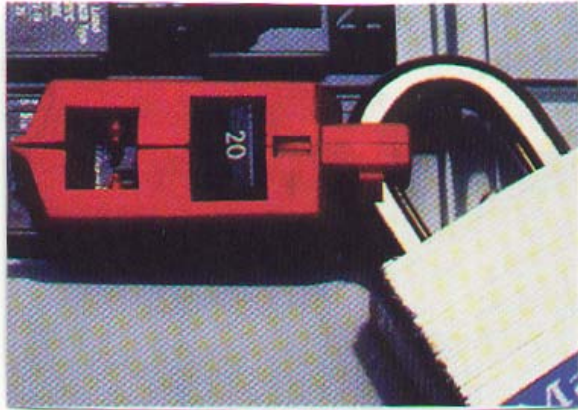


Application of Standard §1910.147

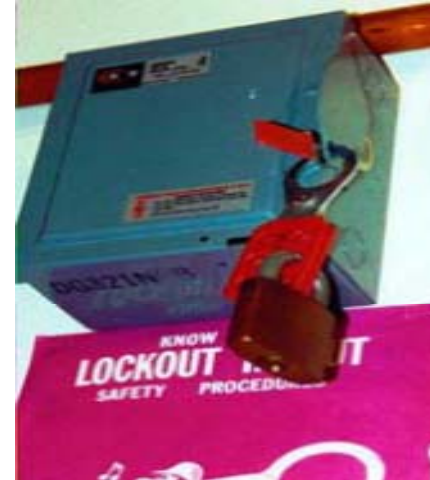
- ▶ Normal production operations are not covered by this standard. (Use proper guards.)
- ▶ Servicing and/or maintenance ARE covered IF:
 - An employee is required to remove or bypass a guard.or
 - An employee is required to place any part of the body into an operating area.



Typical Electrical Lockout Devices



*Electrical
circuit
breaker*



*Lock with
Hasp*

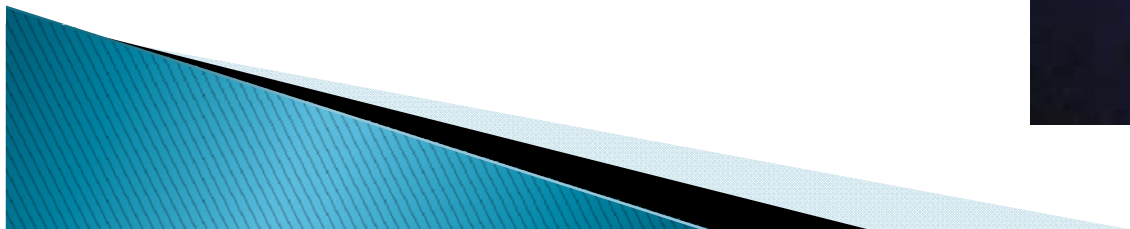
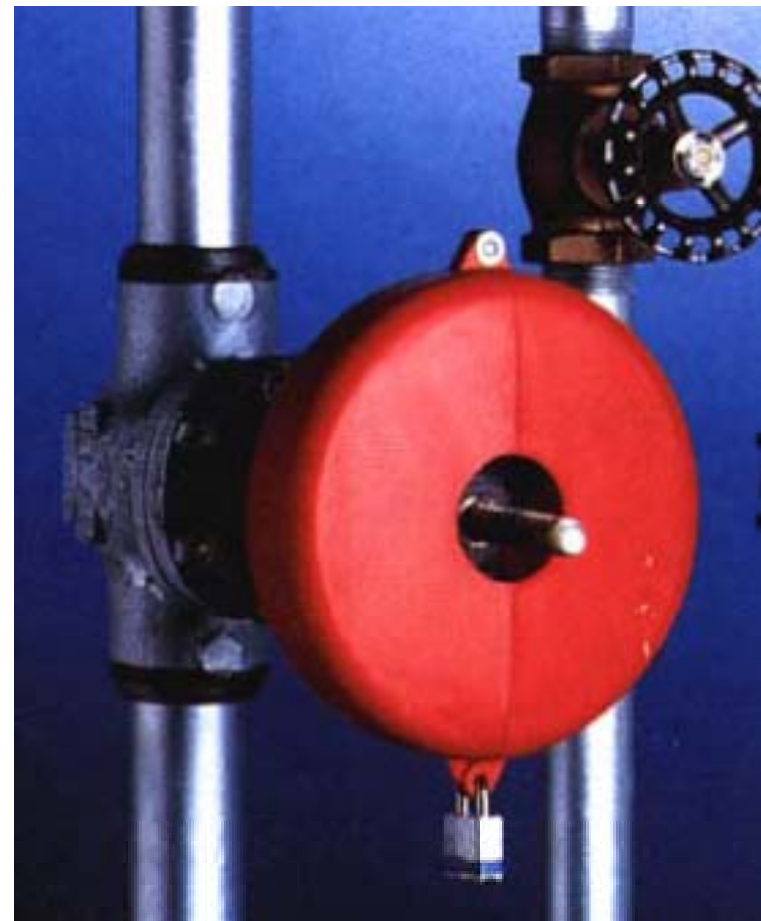
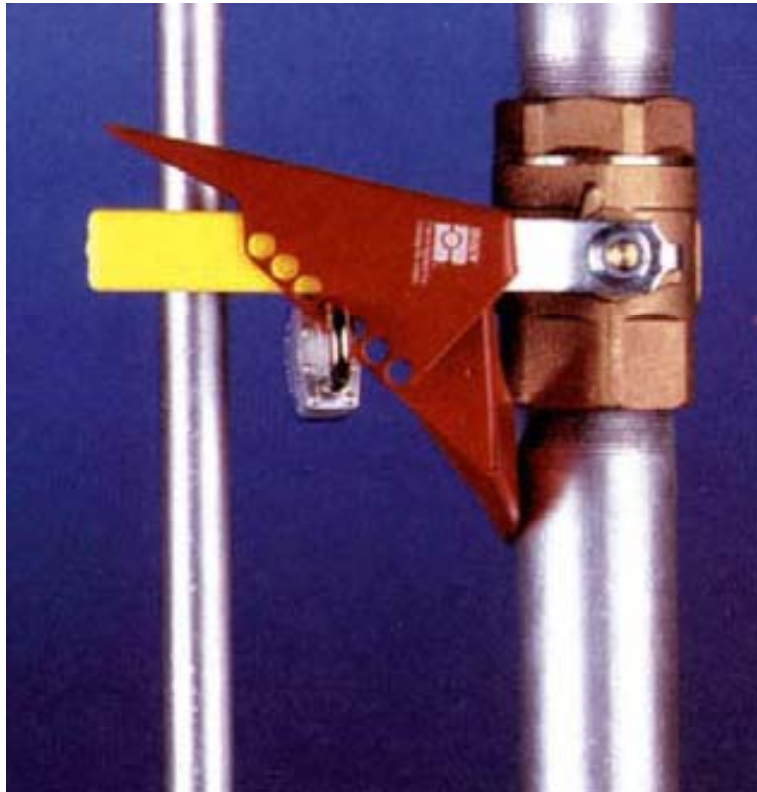


Multiple Lock Hasp

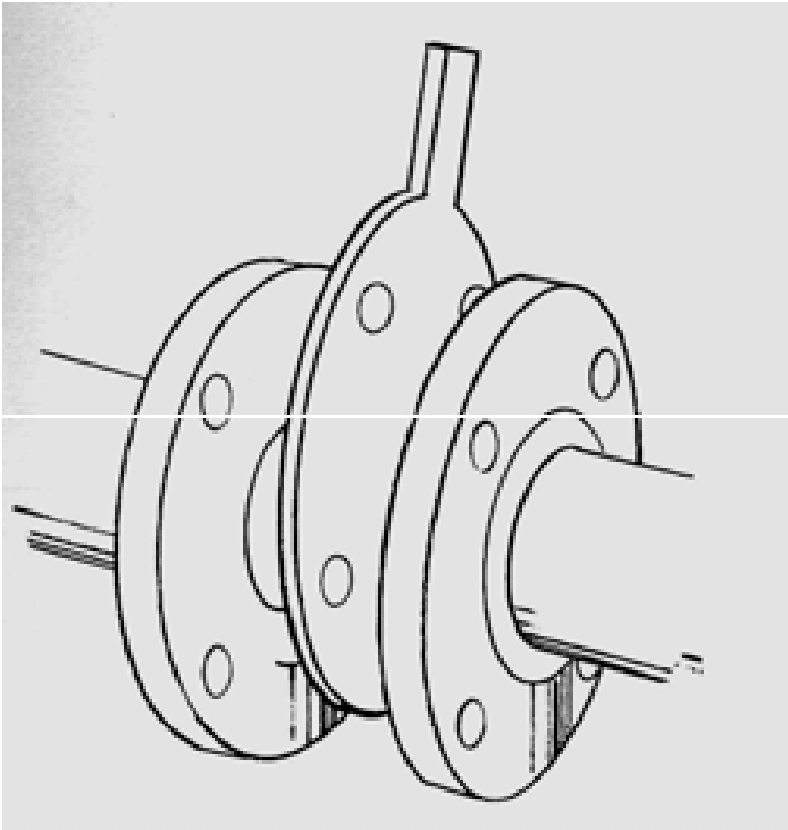


*Electrical
Plug
Cover*

Liquids and Gas Lockout Devices



Pipe Lockout Examples

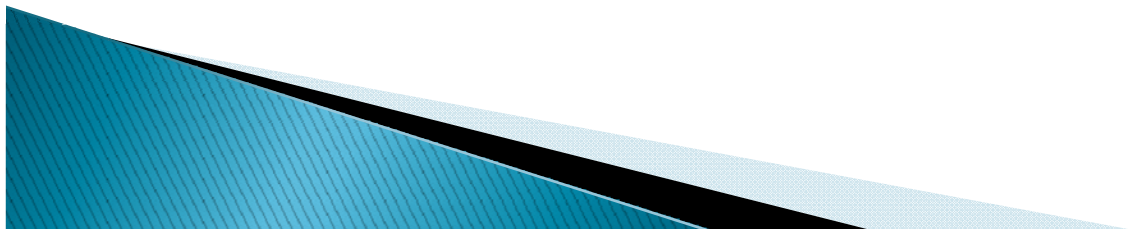


Blanking Device



Blanking Device with Tag

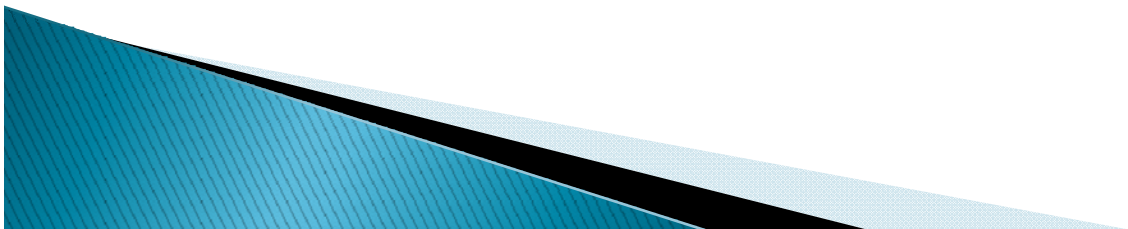
Pneumatic Lockout Examples



Hazardous Energy Sources Found in the Workplace

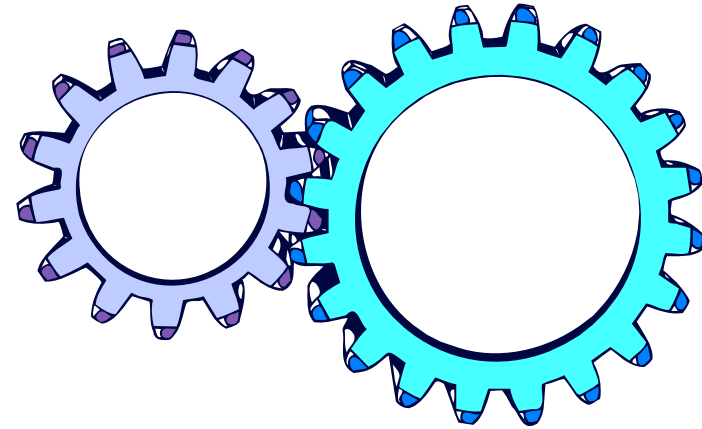
❖ Electrical

- Generated
 - AC from electric company
- Static or Stored Electrical Energy
 - Batteries
 - Capacitors



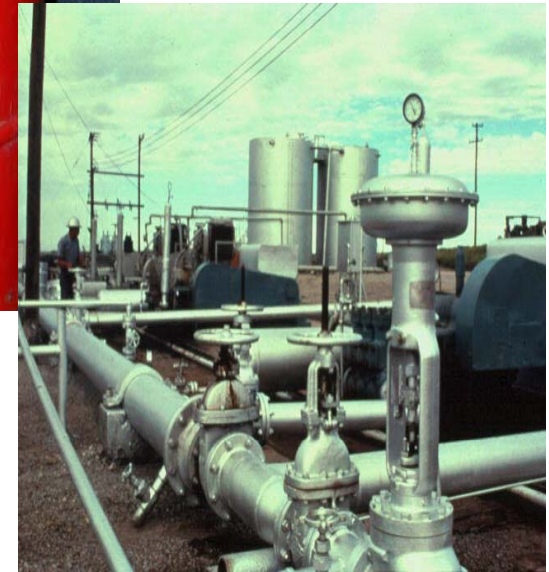
Hazardous Energy Sources Found in the Workplace

- **Mechanical**
 - Transitional
 - Rotational



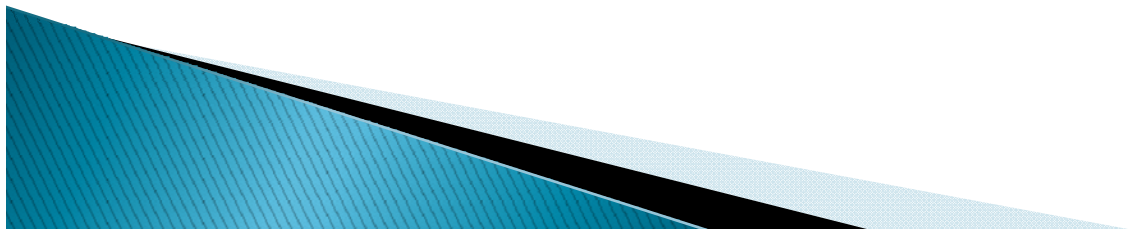
Hazardous Energy Sources Found in the Workplace

- Chemical
 - Ammonia
 - Nitrogen
 - Hydrogen
 - Propane
 - Caustics
 - Acids



Hazardous Energy Sources Found in the Workplace

- Potential
 - Pressure
 - Hydraulic
 - Pneumatic
 - Vacuum
 - Springs
 - Gravity



Hazardous Energy Sources Found in the Workplace

- Thermal
 - Machines or Equipment
 - Steam
 - Hot liquids



6-Step Lockout Procedure

- ① Alert all affected employees that equipment is being locked out.
- ② Properly shutdown and deactivate equipment.
- ③ Dissipate any stored energy.
- ④ Properly isolate ALL energy sources.
- ⑤ Apply lockout devices and tags.
- ⑥ *VERIFY* LOCKOUT by trying to start the equipment.

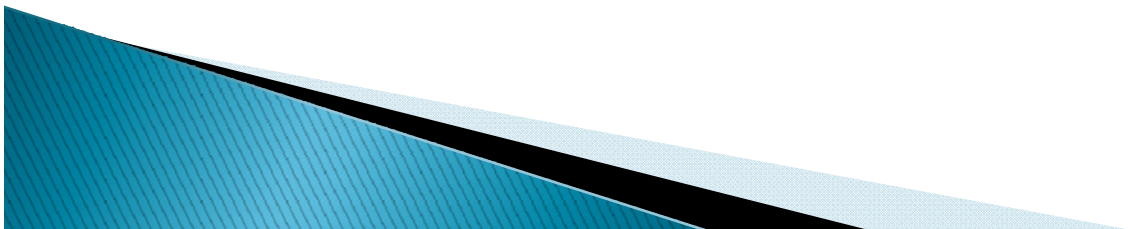
“Lock, Tag, and Try”



Lockout Procedure

- **EACH ENERGY SOURCE MUST BE ISOLATED.**
 - May require more than one lock per person.
 - Is your system automated?

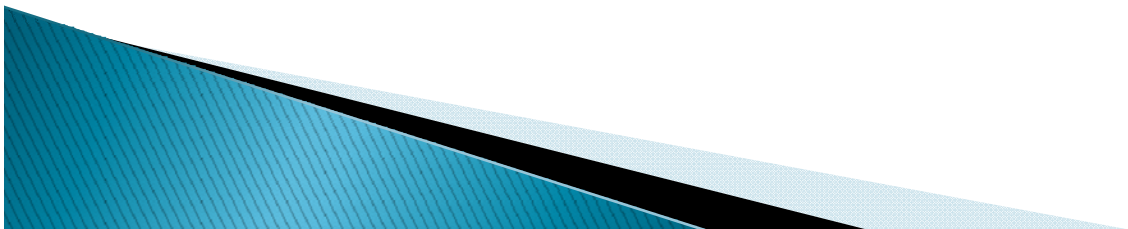
- **EACH EMPLOYEE MUST INSTALL THEIR OWN LOCK(S).**



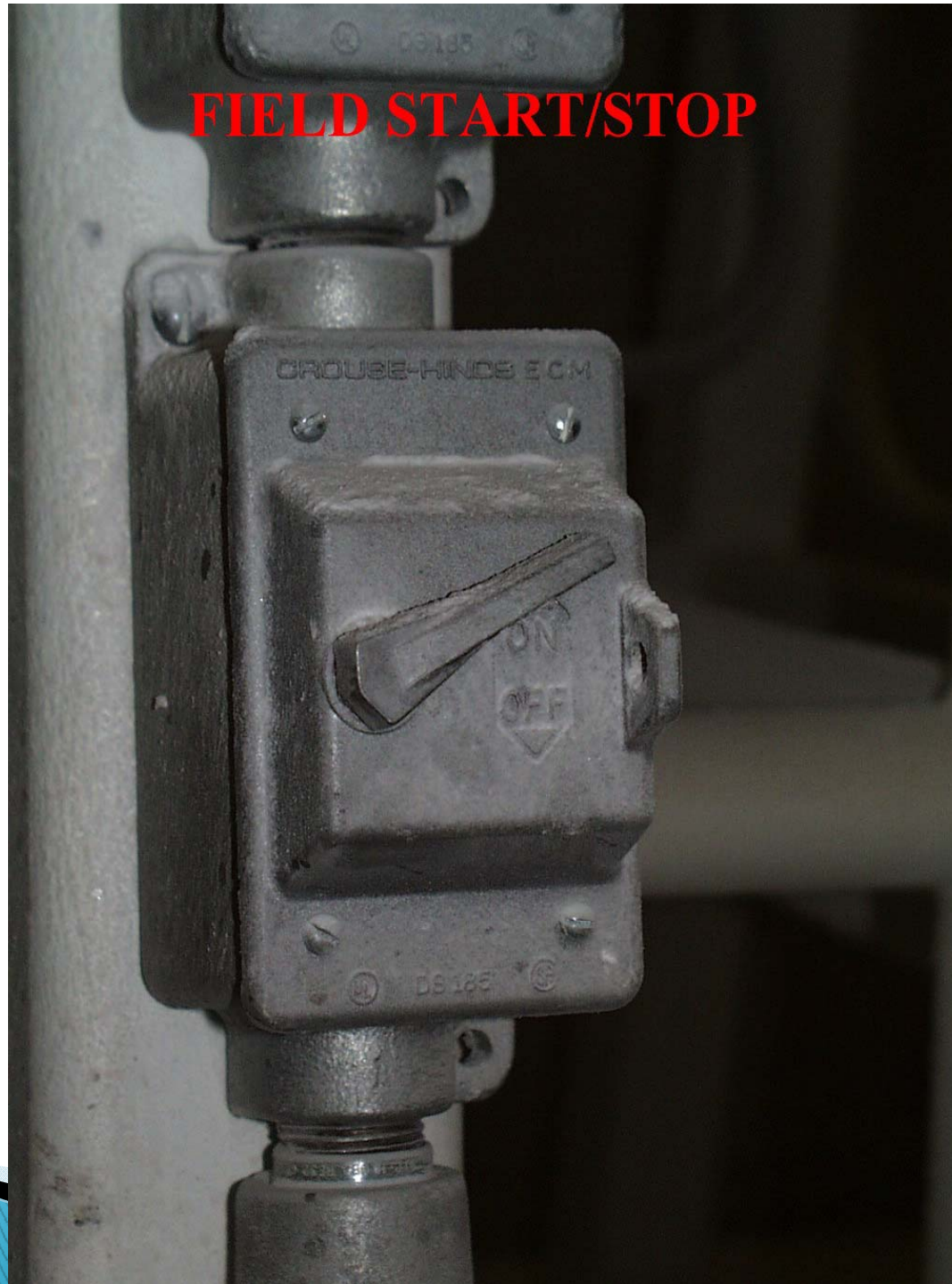
Lockout Procedure

ONLY POWER DISCONNECTS MAY BE USED FOR ELECTRICAL LOCKOUT.

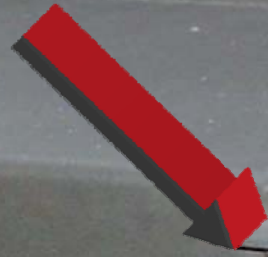
- Field start/stop switches are not to be used.
- Equipment limit switches are not suitable for electrical energy isolation.



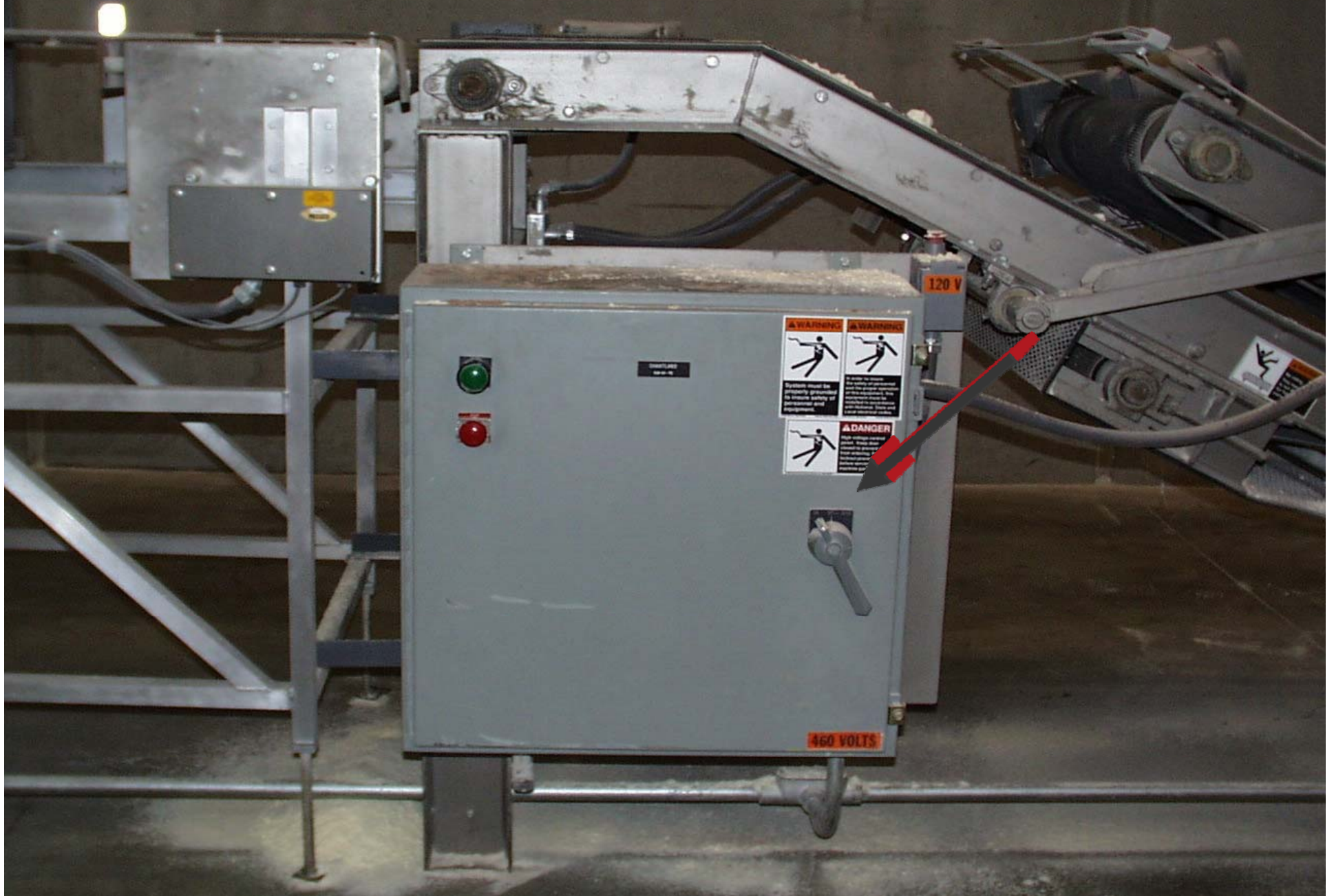
FIELD START/STOP



LIMIT SWITCH



ELECTRICAL DISCONNECT



WARNING **WARNING**
Person must be properly grounded to insure safety of personnel and equipment.
A single slip and fall can result in serious injury or death. This danger is increased when the person is working on or near energized equipment.

DANGER
Slip and fall hazard. This danger is increased when the person is working on or near energized equipment.

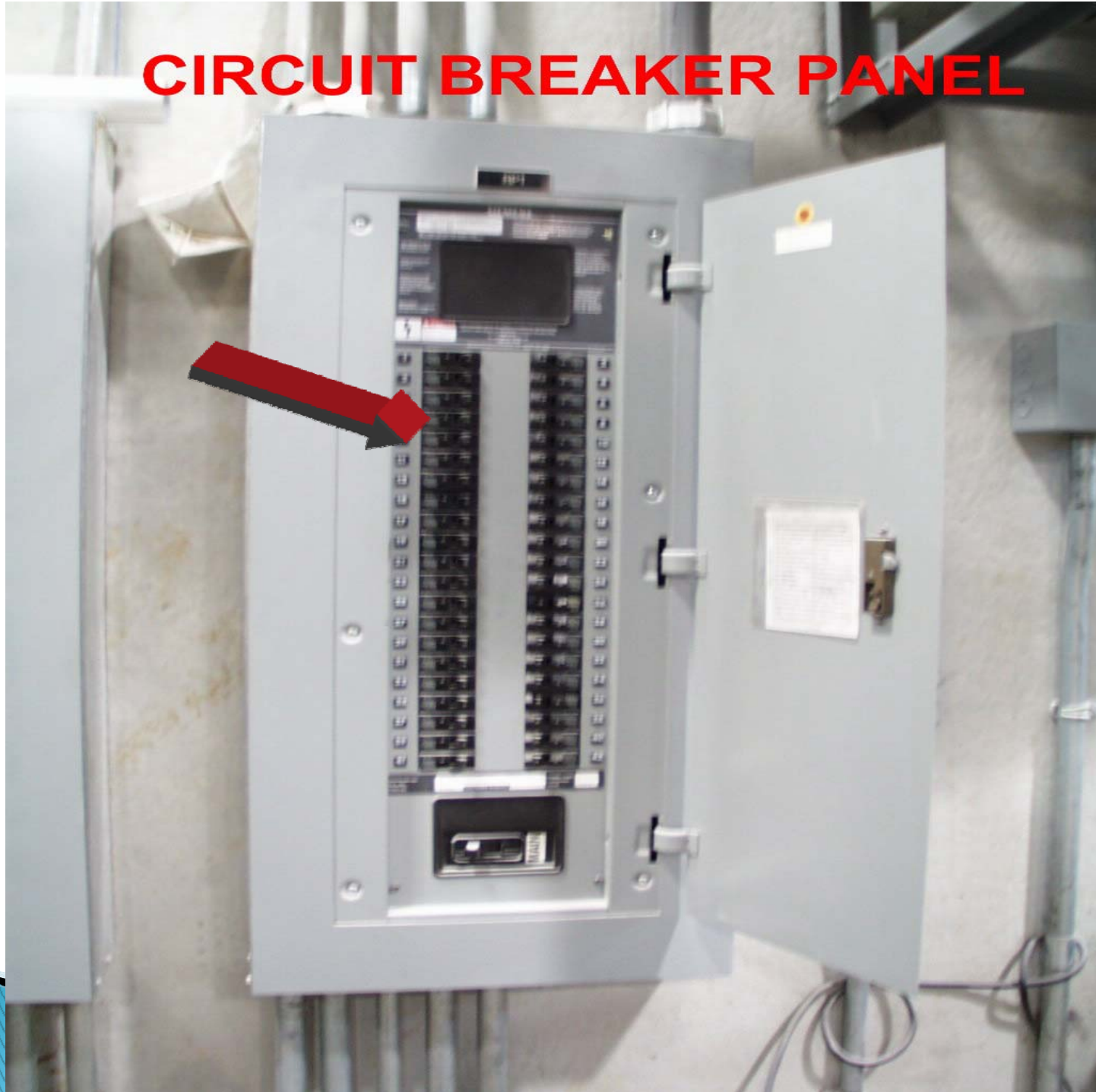
120 V

460 VOLTS

Electrical Disconnects

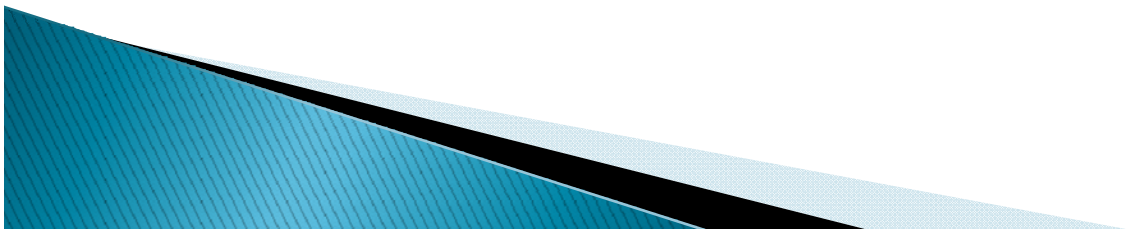


CIRCUIT BREAKER PANEL



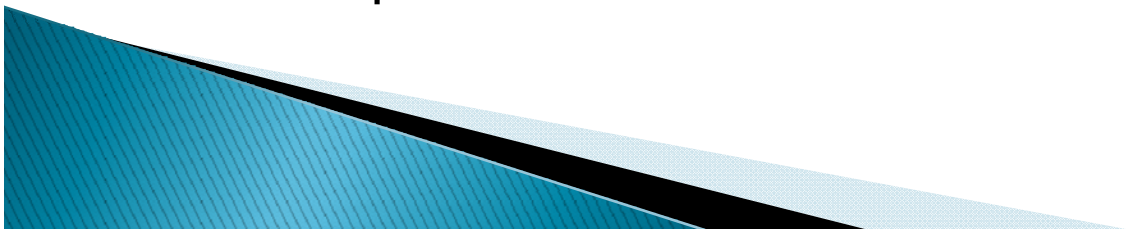
Five Step Restart Procedure

- ① Remove all tools and loose items.
- ② Reinstall guards.
- ③ Alert all affected employees that equipment is being turned back on.
- ④ Remove lockout devices.
- ⑤ Restart using proper startup procedures.



Written Lockout Tagout Program

- ▶ Written machine specific procedures are needed (except when all of the following exist):
 - A machine has no potential or stored energy.
 - Single energy source readily identifiable.
 - Use of single device completely deactivates and de-energizes equipment.
 - Machine is isolated from energy source.
 - *Lockout device is under the exclusive control of authorized employee.*
 - No hazards for others are created.
 - There have been no LO/TO incidents while using this exception.



Lockout-Tagout Posted Procedure

LOCKOUT PRO™


| | | |
|---|--|----------------------------|
| ID#: Created: 3/9/2010 Revised: 6/5/2010 | Facility: Shreveport Description: # 1 Checker Packer Bag Hanger | Location: 2nd Floor |
|---|--|----------------------------|

| | | |
|---|----------------|---|
| 3 | Lockout Points | Note: Disconnect # 32 in the 4th Floor MCC Room will de-energize all electrical power to the # 1 Checker Packer. |
|---|----------------|---|

Lockout Application Process

1. Notify affected personnel. 2. Properly shut down machine. 3. Isolate all energy sources. 4. Apply lockout devices, locks, & tags. 5. Verify total de-energization of all sources.

Lockout Steps

| Step # | Action | Info |
|--------|--|--|
| 1 | Electrical Primary Feed The E-1 Disconnect is located in the 4th Floor MCC Room. Disconnect # 32 Turn Disconnect to the off position and lock out. | Use a Lock and hasp device. Shutting off this disconnect will de-energize electrical supply to the entire packing devices on the 2nd floor. |
| 2 | Electrical Local Disconnect The E-2 Disconnect is located on the East side of the machine. Turn Disconnect to the off position and lock out. Use a Lock and hasp device. |  |
| 3 | Note Test Start Attempt to start the equipment to verify the machine will not run. Always confirm the proper device is locked out. | Use PLC controls and/or operator push buttons to test. |

Lockout-Tagout Posted Procedure



LOCKOUT PRO™

| | | |
|---|-----------------------------|----------------------------|
| ID#: Created: 3/9/2010 Revised: 6/5/2010 | Facility: Shreveport | Location: 2nd Floor |
| Description: # 1 Checker Packer Bag Hanger | | |

| | | |
|----------|-----------------------|---|
| 3 | Lockout Points | Note: Disconnect # 32 in the 4th Floor MCC Room will de-energize all electrical power to the # 1 Checker Packer. |
|----------|-----------------------|---|

Lockout Application Process

1. Notify affected personnel. 2. Properly shut down machine. 3. Isolate all energy sources. 4. Apply lockout devices, locks, & tags. 5. Verify total de-energization of all sources.

| Lockout Steps | | |
|--|--|--|
| Step # | Action | Info |
| 4  Pneumatic Shut Off Valve | The P-1 Dump Valve is located on the East side of the machine. Turn Dump Valve to the off position and lock out. Use a Lock and hasp device. |  |



What is wrong with this picture?



Special Situation #1

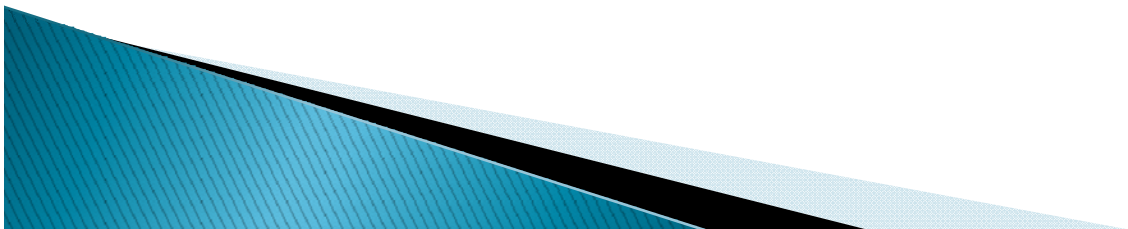
→ **When servicing lasts longer than one shift:**

① You and your relief exchange locks at shift-change time.

OR

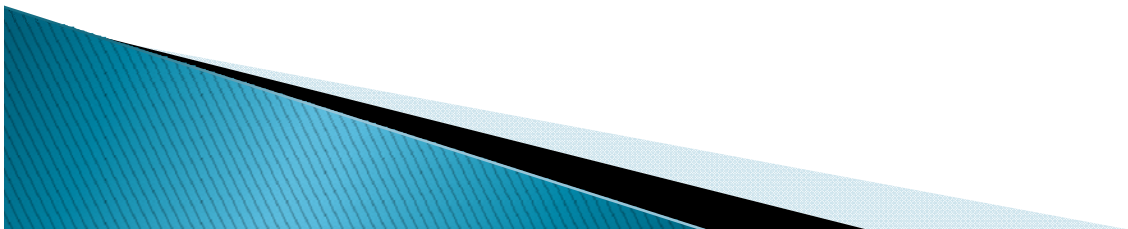
② Your supervisor locks the equipment in the interim.

NO EQUIPMENT SHOULD BE LEFT UNLOCKED IN AN UNSAFE CONDITION



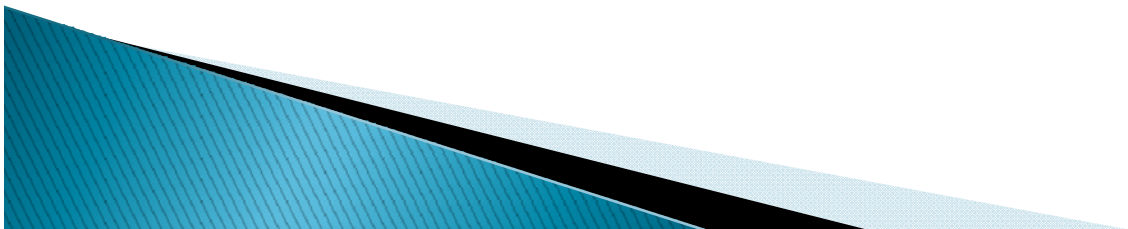
Special Situation #2

- When contractors are performing service or maintenance at your workplace:
 - There should be a company representative overseeing the contractor's project who will coordinate all lockouts with the Contractor's Representative.



Special Situation #3

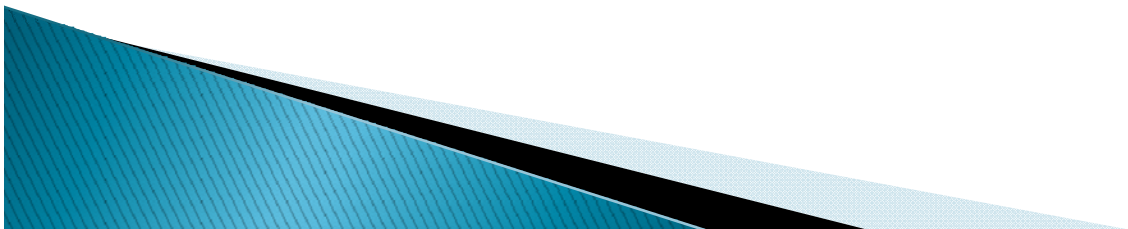
- The employee is required to take a copy of the LO/TO procedure with him/her unless:
 - The lockout procedure is posted on the equipment or
 - The lockout process is redundant, (i.e. the employee locks this equipment out numerous times and is familiar with the specific lockout requirements).



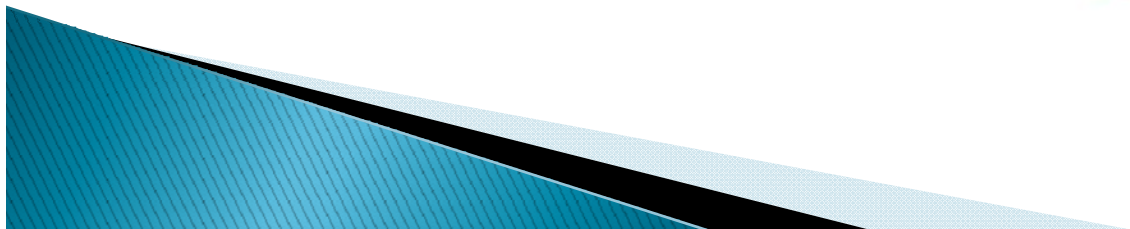
Special Situation #4

When the number of employees placing locks makes it impractical for each to lockout all energy sources.

- ★ A specific type of GROUP LOCKOUT is performed.
- ★ Discuss potential scenario...



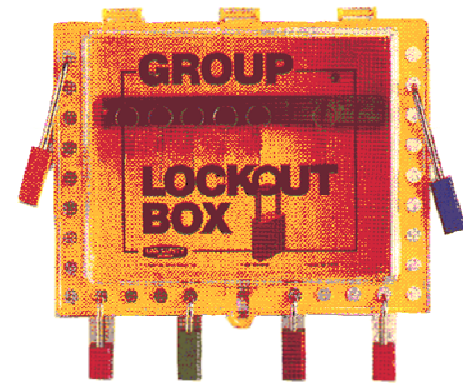
Thirty Five Locks Needed?



Special Situation #4

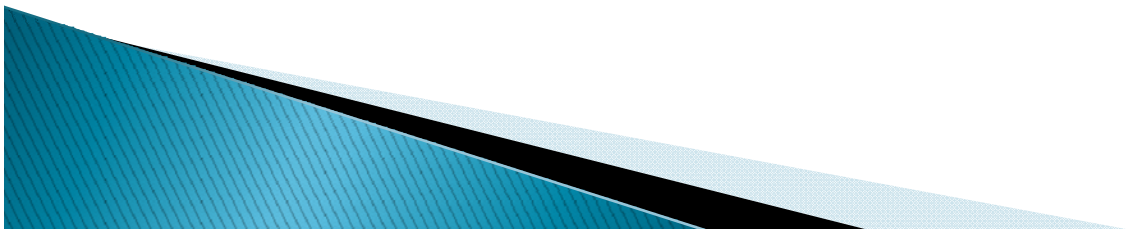
Three Step Procedure:

- 1) Supervisor performs the lockout of each energy source.
- 2) Supervisor and employees attempt to restart the equipment.
- 3) Keys used on the devices are placed in a lockbox and each employee places a lock on the box.



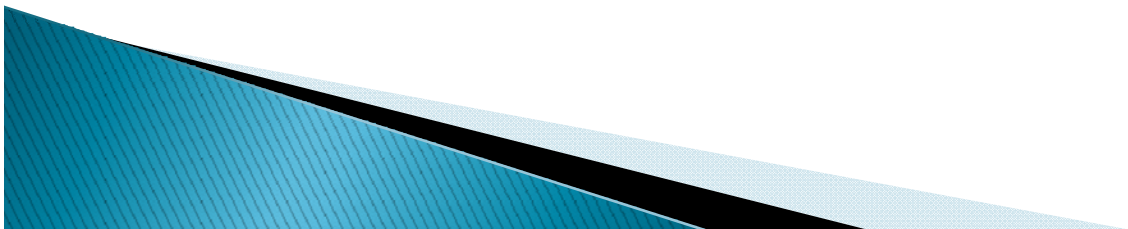
Periodic Inspection

- A common item missed by many is failure to conduct a periodic inspection of lockout procedures to ensure the process is being done correctly.
- Each authorized employee must be 'field tested' on each type of energy he/she is authorized to lockout.
- Done at least annually.



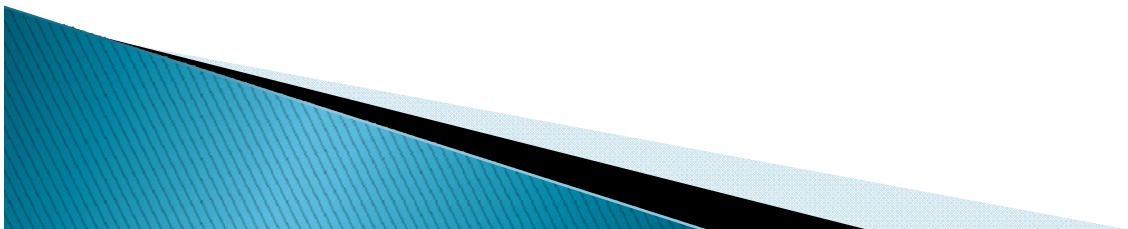
Periodic Inspection

- ▶ Identify and correct any deviations or inadequacies of program.
- ▶ Includes:
 - The procedure is being followed
 - Employee knows responsibilities
 - Procedure is adequate
 - Record equipment, date, employees and inspector
- ▶ OSHA will ask if you have certified your worker's lockout.



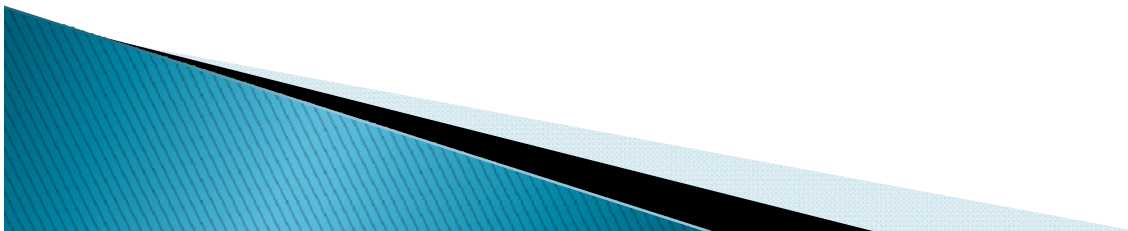
Lockout Tagout Tidbits

- ⬇ Locks and keys are provided by the company.
- ⬇ Locks must be standardized for color, shape or size.
- ⬇ Locks or tags must identify the employee applying the device.
- ⬇ Only keyed locks are permitted.
- ⬇ Tags must have an unlocking strength of no less than 50 pounds.



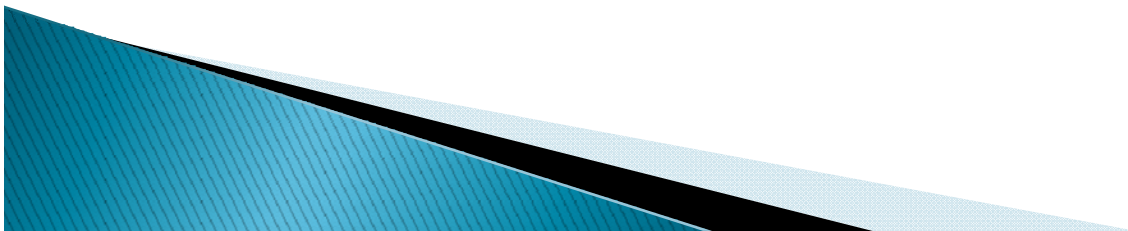
Common Questions

- ▶ We have over 100 components at our facility that have hazardous energy. Do I need 100 separate written lockout procedures?



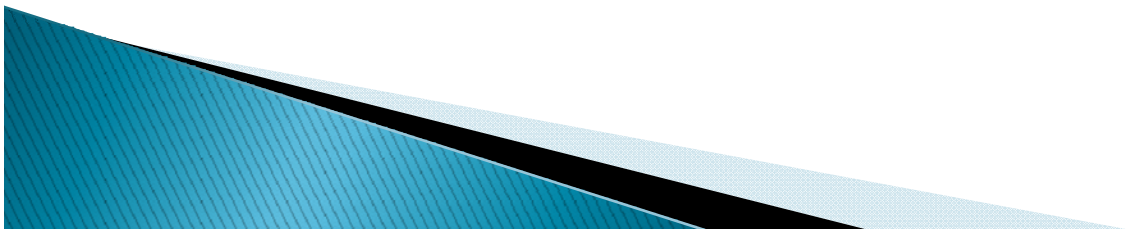
Answer

- ▶ One energy control procedure may be used for similar machines and /or equipment if the procedure adequately addresses the unexpected energization hazards related to each machine.
- ▶ Method of identification for machines and lockout locations needed.
- ▶ Use supplemental pages if needed.



Common Questions

- ▶ What training do employees need?
- ▶ What about retraining?
- ▶ What about documentation?



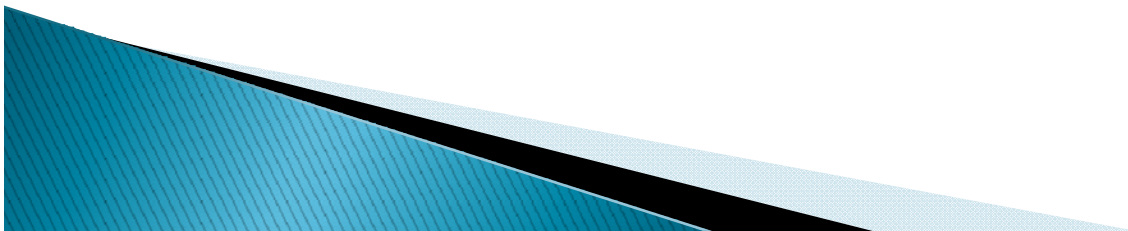
Answers

- ▶ Initial training to understand and follow the applicable provisions of the hazardous energy control procedures. Must cover the written program, elements of the employee's duties, and the various requirements of the standard.
 1. How to find and recognize hazardous energy sources.
 2. Types and magnitudes of energy used in the workplace.
 3. How to isolate energy sources.
- ▶ Retraining after changes in equipment, job assignments, or when an audit (periodic inspection) shows deficiencies.
- ▶ Written documentation needed of periodic inspections, initial training, and retraining.



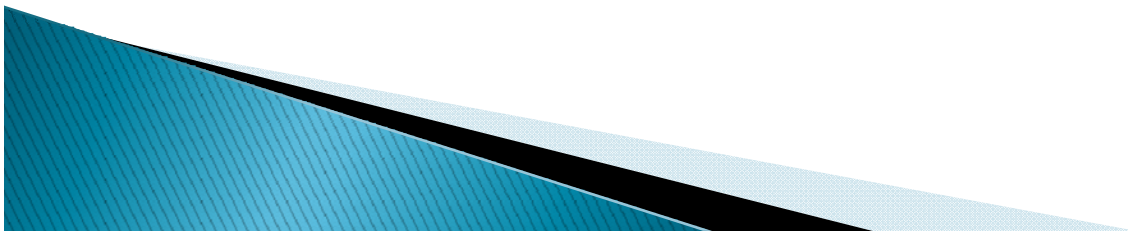
Common Questions

- ▶ Does each authorized employee need to be trained on each piece of equipment he is authorized to lockout?



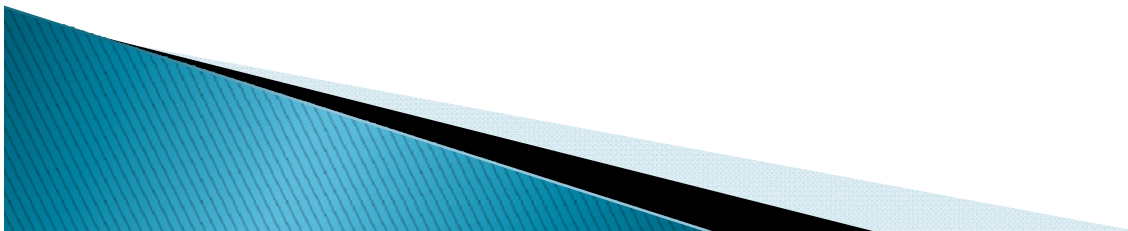
Answer

- ▶ No. The authorized employee must be familiar with a sampling of all of the different necessary techniques and skills that would be necessary.



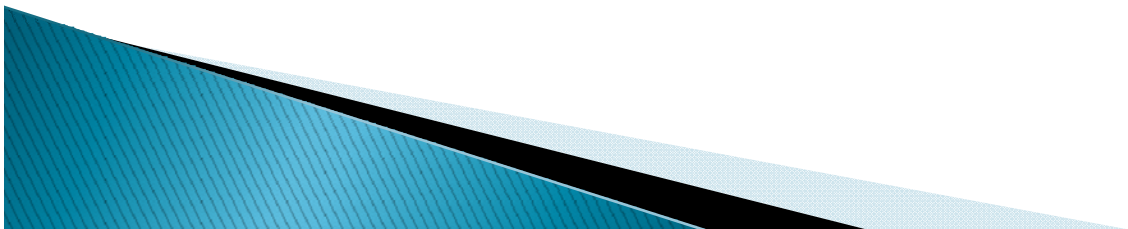
Common Questions

- ▶ What if the operator is standing directly in front of the disconnect. Does it need a lock?



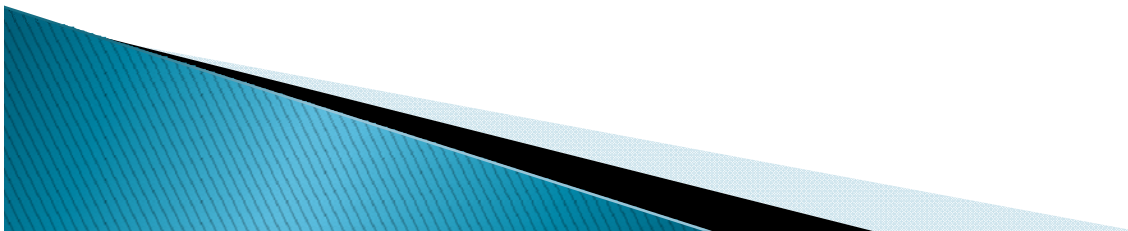
Answer

- ▶ The standard does not apply to work on cord and plug connected electrically powered equipment if the plug is under the exclusive control of the employee performing the maintenance.
- ▶ Minor tool changes or routine adjustments which take place during normal operation provided the work is performed using alternative measures which provide effective protection.
- ▶ Other than these two: “Yes”



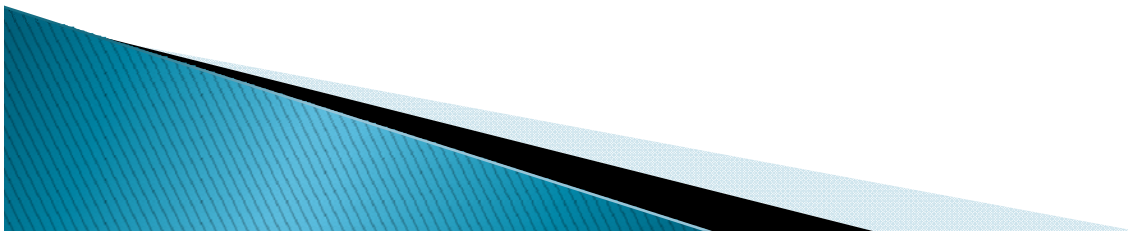
Common Question

- ▶ Can annual refresher training take the place of an annual periodic inspection?



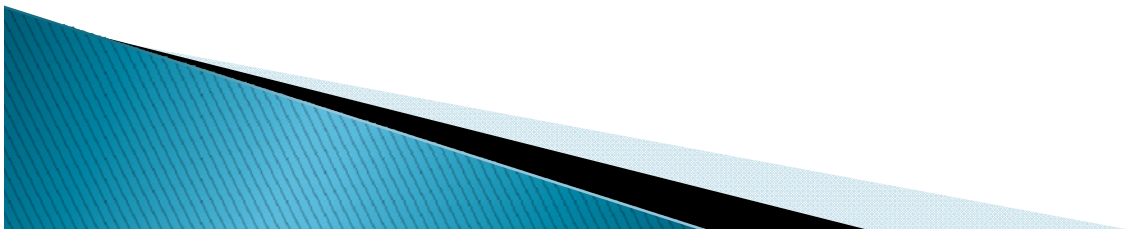
Answer

- ▶ No. Certain benefits expected to be derived from the talks with individual employees may not be addressed in refresher training.



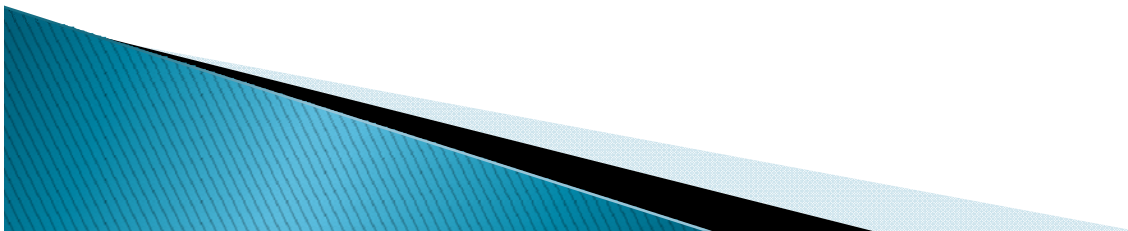
Common Question

- ▶ What should I do if a co-worker is not following proper lockout procedure?



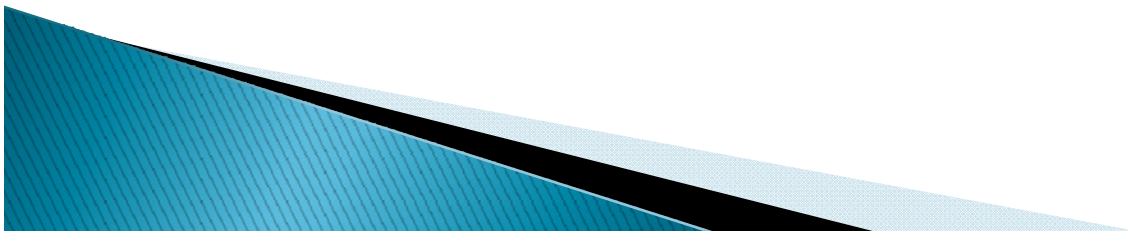
Answer

- ▶ Take it as your responsibility to make sure the employee has not put himself into danger and notify your supervisor immediately.
- ▶ Any questions regarding lockout/tagout, contact your supervisor or safety coordinator.

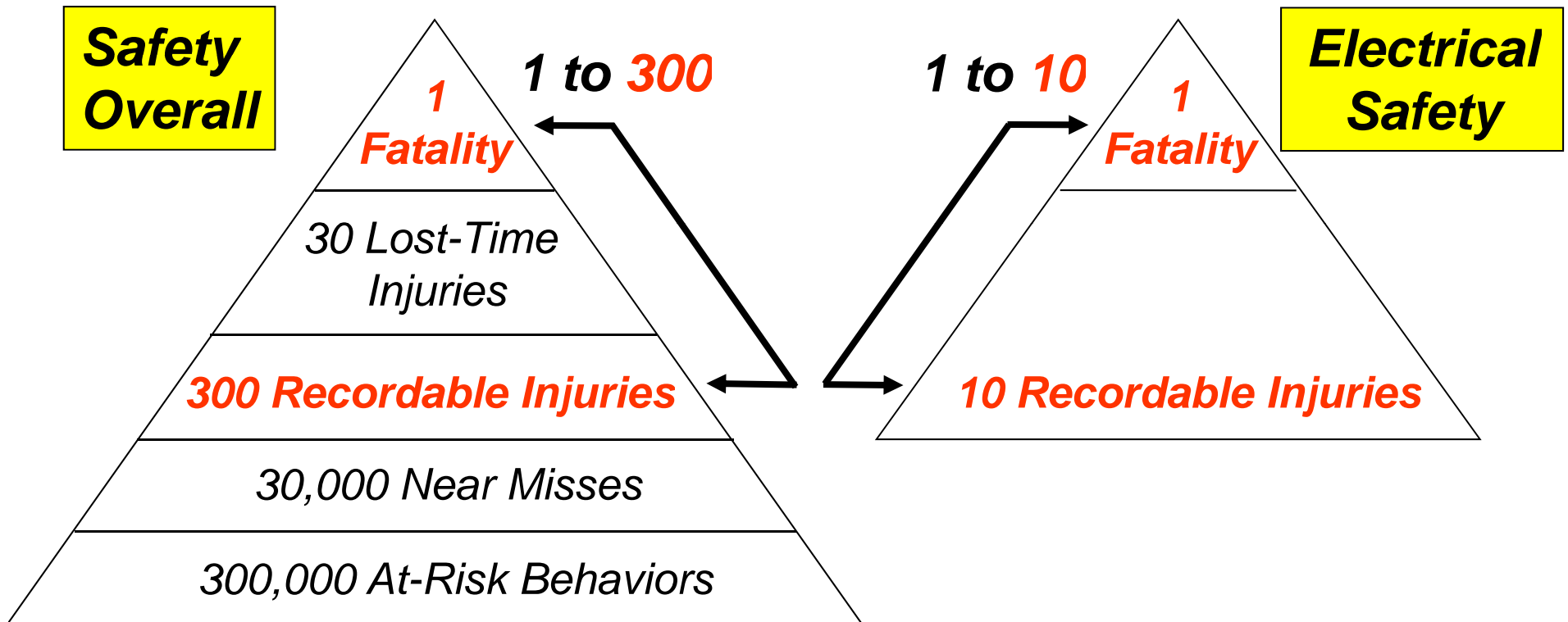


Basic Electrical Safety

Subpart S 1910.301–399



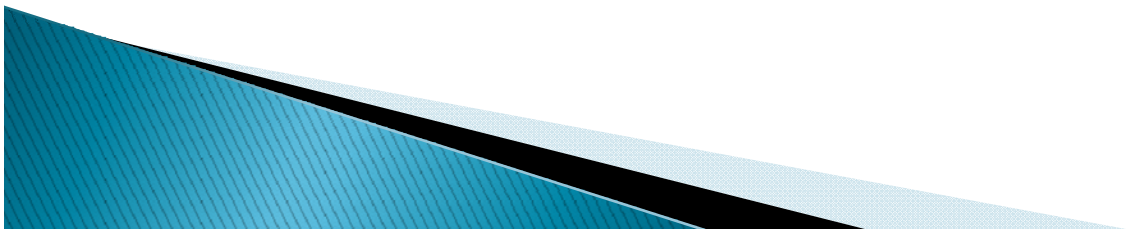
Why Electrical Safety?



Everyday, electrical incidents cause 13 injuries that require days-away-from-work and 1 fatality.

Too Many Workers Get Seriously Injured

- ▶ Electrical injuries impose significantly high personal and family tolls.
- ▶ Long stays in hospital common.
- ▶ Too often, permanently alters workers' life.
- ▶ Multiple operations common.
- ▶ Some never make it home.



Electrical Hazards



- ▶ **Electric Shock**
 - Currents less than 100mA can result in injury or death.
- ▶ **Arc Blast**
 - During an arc-blast a fire ball is generated with minimum temperatures of 10,000 °F. Noise levels can reach 150 dBA. Intense light will damage eyes.
- ▶ **Fires and Explosions**
 - Explosions can occur when electricity is the source of ignition in an explosive atmosphere.
- ▶ **Falls and other hazards**
 - Human reaction can result in falls from ladders or scaffolds, or movement into operating machinery

What OSHA Standards Apply?

1910.301 – Introduction

ELECTRICAL SYSTEMS

1910.302 – Electrical Utilization Systems

1910.303 – General Requirements

1910.304 – Wiring Design and Protection

1910.305 – Wiring Methods, Components & Equipment for General Uses

1910.306 – Specific Purpose Equipment and Installations

1910.307 – Hazardous (Classified) Locations

1910.308 – Special Systems

1910.331 – Qualified and Unqualified Persons

SAFE WORK PRACTICES

1910.332 – Training

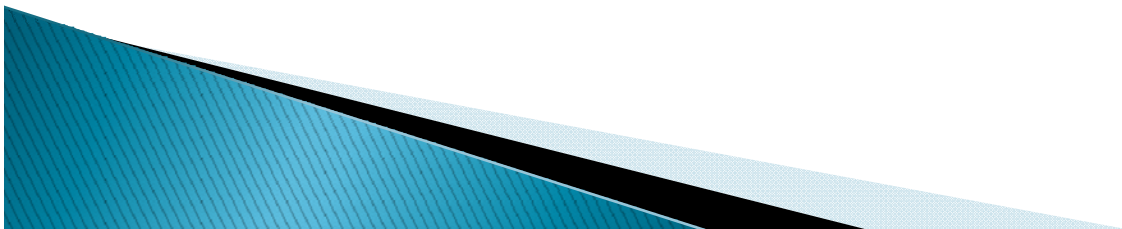
1910.333 – Selection and Use of Work Practices

1910.334 – Use of Equipment

1910.335 – Safeguards for Personnel Protection

1910.399 – Electrical Definitions

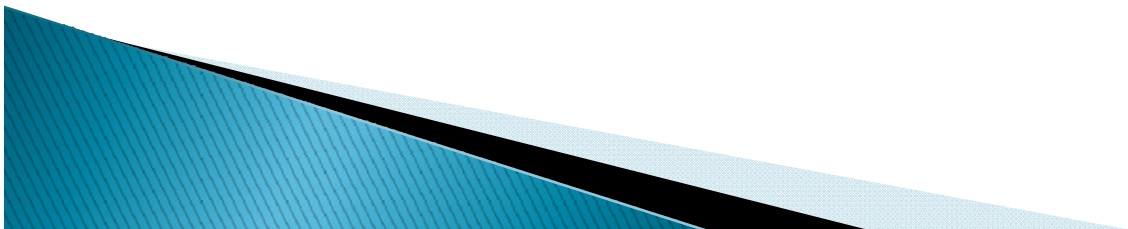
App B, C & D – Reference Documents, Explanatory Data, Tables, Notes



OSHA Citations and Emphasis

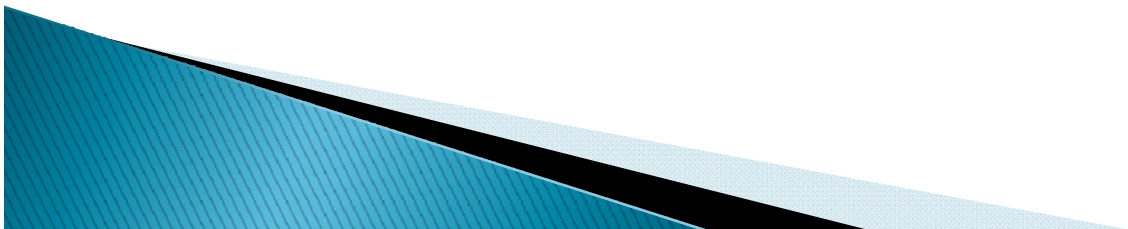
Local Emphasis Programs

1. 1910.272 – Grain handling facilities
2. 1910.219 – Mechanical power–transmission apparatus
3. 1910.023 – Guarding floor and wall openings and holes
4. 1910.146 – Permit–required confined spaces
5. **1910.305 – Electrical wiring methods and components**
6. 1910.1200 – Hazard Communication
7. 1910.134 – Respiratory Protection
8. 1910.147 – Lockout/Tagout of equipment
9. 1910.027 – Fixed Ladders
10. **1910.303 – Electrical, General Requirements**



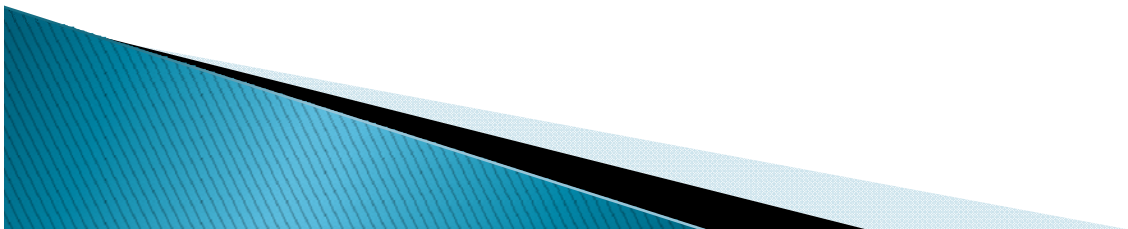
Electrical, General Requirements

- ▶ “Electrical equipment shall be free from recognized hazards that are likely to cause death or serious physical harm to employees”.
- ▶ Many items including:
 - Marking.
 - Working space around equipment.
 - Enclosures for electrical equipment.
 - Electrical guarding.



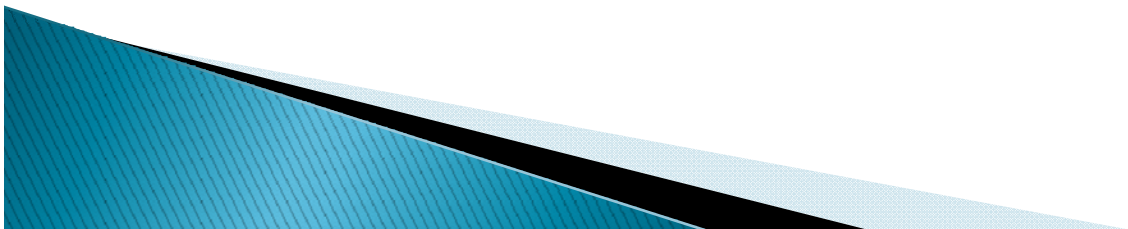
Wiring methods, components, and equipment for general use

- ▶ Temporary wiring.
 - Flexible cords
 - Strain relief
- ▶ Protection of lamps from accidental breakage.
- ▶ Electrical boxes, open wiring on insulators, switches, grounding, GFCI requirements on temporary wiring (6 months).



National Fire Protection Association and OSHA Codes

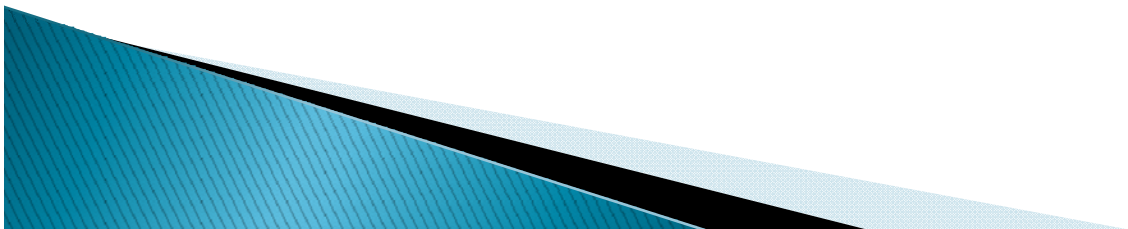
- ▶ OSHA regulations are law and mainly performance based.
 - Regulations on what must be done.
 - The “Shall”.
 - Not how to do it.
- ▶ OSHA references Nationally Recognized Standards in §1910.399 for the “How”. These include selected NFPA codes.



What is a recognized standard?

(Non-mandatory references in 1910.399*)

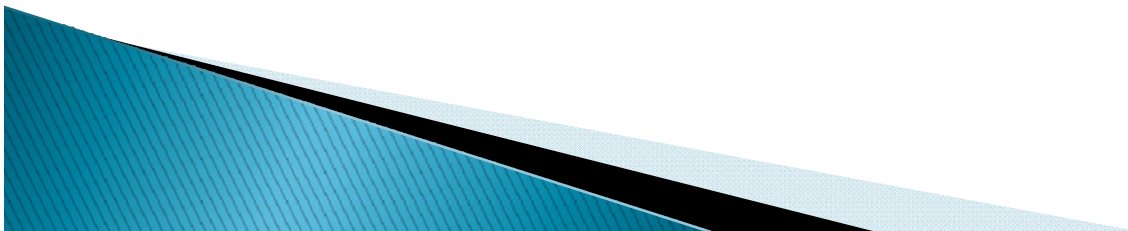
- ▶ **NFPA 70** is the **National Electric Code***
- ▶ **NFPA 70E** Standard for Electrical Safety in the Workplace*
- ▶ **NFPA 499** Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations



OSHA Interpretation, 7/25/2003

Industry consensus standards, such as NFPA 70E, can be used by employers as guides in making the assessments and equipment selections required by the standard.

In OSHA enforcement actions, they can be used as evidence of whether the employer acted reasonably to correct the hazard.



Class II Application

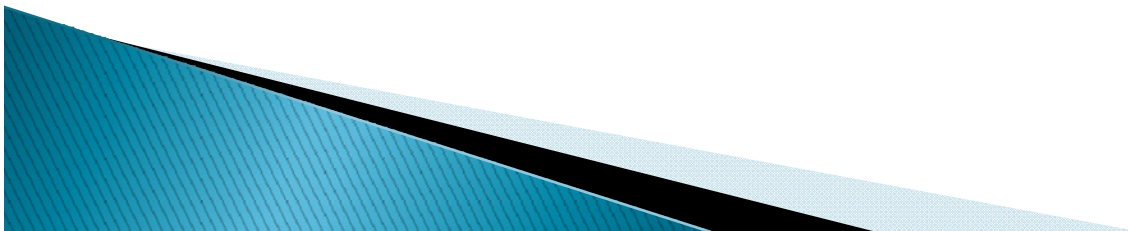
1910.307 Hazardous (Classified) Locations

- ▶ Those areas of a facility made hazardous by the presence of combustible dust:
 - Grain elevators;
 - Flour and feed mills;
 - Producers of starch or candies;
 - Spice-grinding plants, sugar plants, cocoa plants, and many others.



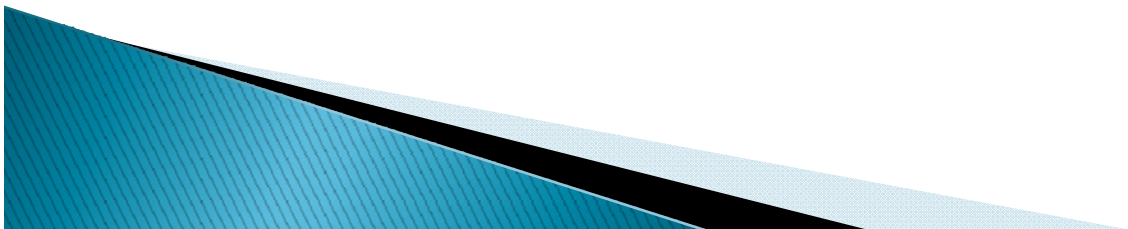
Electrical Classifications (OSHA and NFPA)

- ▶ Class II, Division 1
 - Dust under normal operation sufficient to produce explosion.
 - Hazardous concentrations of dust may be thrown into the air during periodic operation under normal conditions.
 - Abnormal operation or catastrophic failure of equipment would cause hazardous concentrations to become suspended – at the same time cause electrical failure causing sparks or arcs.



Class II, Division 1

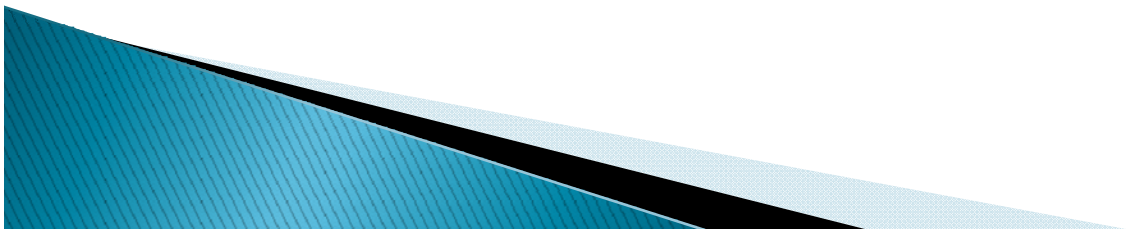
- ▶ May apply to:
 - Enclosed receiving areas.
 - Head houses.
 - Bin floors (top of bins with open conveyors).
 - Open transfer points.
 - Tunnels with open conveyors.
 - Milling operations with dust normally in air, such as grinding areas.



Electrical Classifications

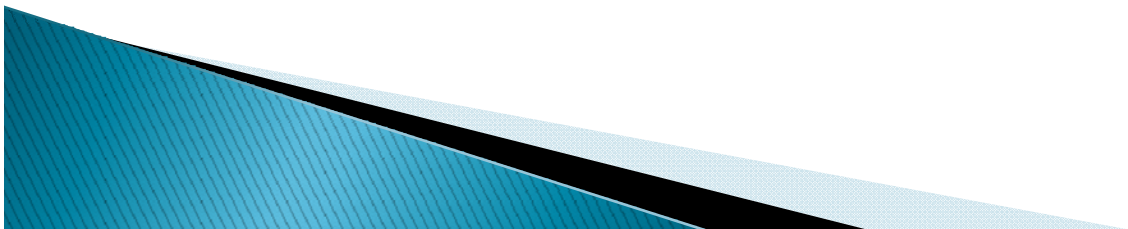
Class II, Division 2

- Dust under normal operation not sufficient to produce explosion.
- Infrequent malfunctions may produce higher levels of dust in suspension or to settle on equipment (example hole in spout) and an electrical failure would have to occur where equipment surface temp reaches 120 degrees F.
- May apply to:
 - Totally enclosed conveyor areas.
 - Milling equipment that is totally enclosed.
 - Areas with good exhaust ventilation and dust control.
 - Areas adjacent to Class II, Division 1 areas.



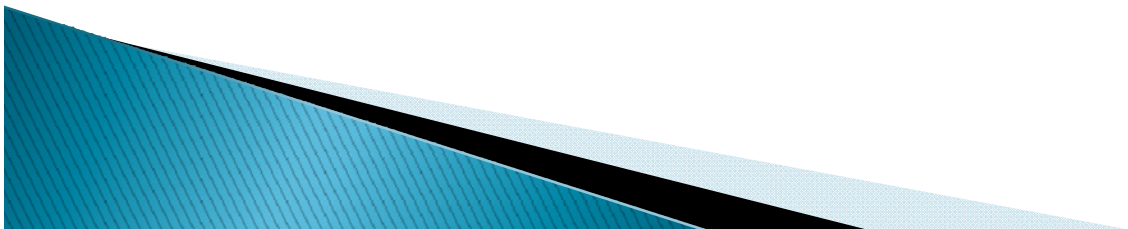
Electrical Area Classification

- ▶ Non-hazardous Classifications:
 - Warehouse (with separation from mill tower)
 - MCCs
 - Boiler Room
 - Control Room
 - Offices
- ▶ Area classification does not extend beyond a wall, provided it is effective in preventing the passage of dust in suspension or layer form.
- ▶ Documentation for all area classifications:
 - Areas with changes after August 2007.
 - Mark areas or have a plot plan.

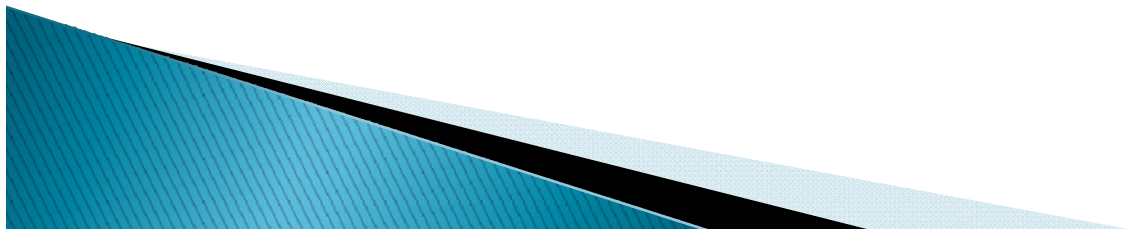


Final Consideration

- ▶ Electrical Equipment should be rated for “Group G” (Flour, starch, grain, combustible plastic or chemical dust (explosive))
- ▶ Therefore equipment should be rated as:
 - Class II, Division 1, Group G – normally dusty areas
 - Class II, Division 2, Group G – not normally dusty areas



Use properly rated electrical equipment for the area.





Citation and Notification of Penalty

Company Name:

Inspection Site:

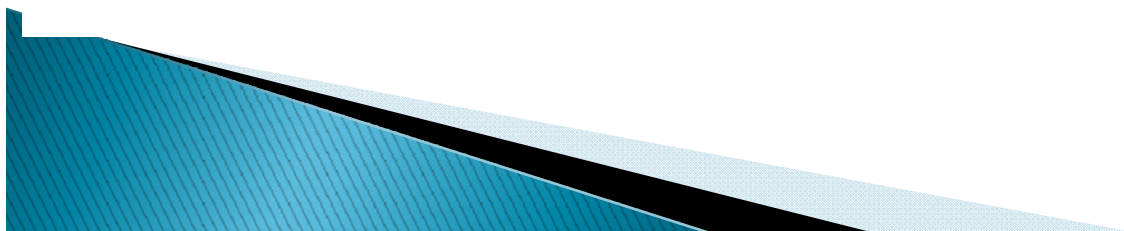
Citation 2 Item 2 Type of Violation: **Willful**

29 CFR 1910.307(c)(2)(i): Equipment was not approved not only for the class of location, but also for the ignitable of combustible properties of the specific gas, vapor, dust, or fiber that will be present:

- (a) On or about 10/06/11 - Feed Mill, electrical equipment, such as, but not limited to general purpose wiring, breaker panel boxes, disconnect switches, and receptacles were not approved for the class and location where combustible dust was present.

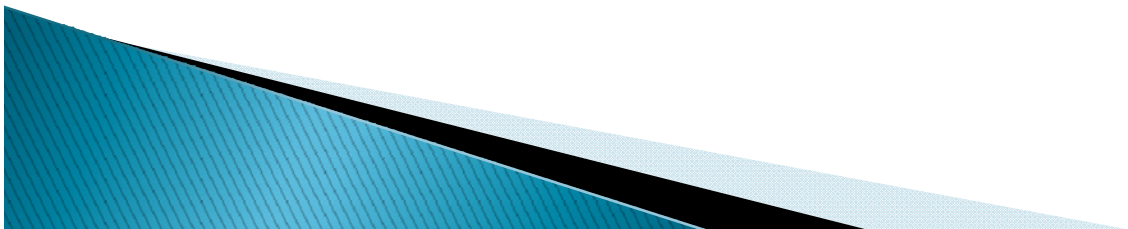
Abatement Documentation Required

| | |
|---|-------------|
| Date By Which Violation Must be Abated: | 05/09/2012 |
| Proposed Penalty: | \$ 63000.00 |



Ground Fault Circuit Interrupters

- ▶ GFCI's are not over current devices like fuses or breakers.
- ▶ GFCI's protect people from electrical shock.
- ▶ GFCI's sense an imbalance in current flow.
- ▶ GFCI will open the circuit if 5 mA or more of current returns to the service entrance by any path other than the intended grounded conductor.
 - Designed to open in 1 / 30 of a second or less.



2007 Requirement for GFCI's

For maintenance, repair work, or other temporary installations, all 125 volt, 15, 20, or 30 amp receptacle outlets that are not part of the permanent wiring of a building or structure must have a GFCI.

Temporary wiring must have a GFCI.

- Temporary wiring is generally less than 6 months.

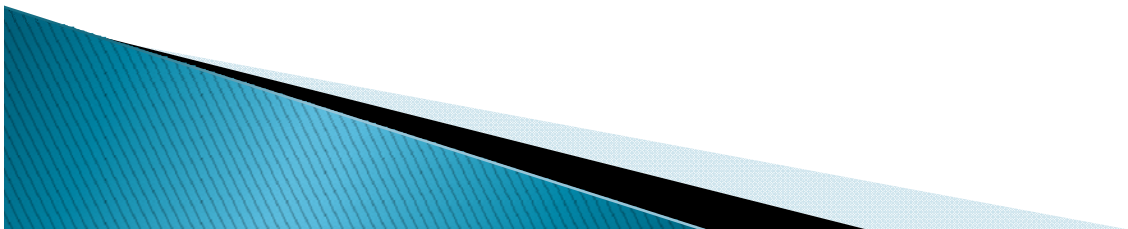


Portable GFCI.

OSHA Electrical Safety Training

OSHA requires training for employees who work with or around electricity in the workplace.

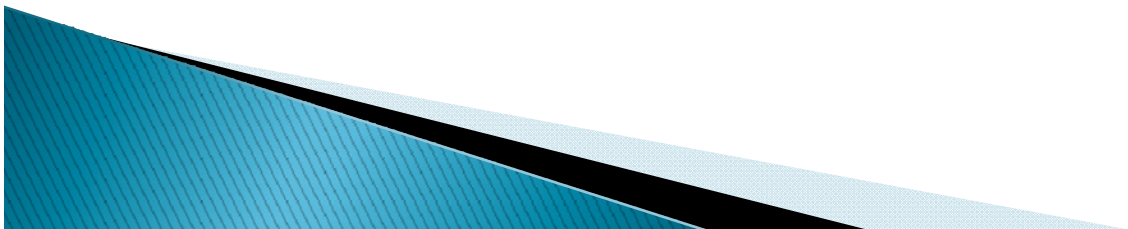
- ▶ Qualified Employee - Has training in avoiding the electrical hazards of working on or near exposed energized parts.
 - Applies to maintenance employees, electricians, etc.
- ▶ Unqualified Employee - Is a person who has had little or no training in recognizing and avoiding the electrical hazards that may be present with respect to the equipment or work method.
 - Applies to production employees.



Train Qualified Employees

1910.332(a)(3) & NFPA 70E

- ▶ For Qualified Employee:
 - Usually 8 hours in duration.
 - Must cover:
 - Electrical hazards and how to avoid them.
 - How to distinguish “live” parts.
 - How to determine voltages.
 - Clearance distances.
 - Use of electrical PPE.
 - Once per period of employment – Unless employee demonstrates need for re-training.



Train Unqualified Employees

1910.332(a)(2)

- ▶ Unqualified electrical employees should be trained annually on:
 - What tasks they can and cannot perform.
 - How to recognize electrical hazards.
 - What to do in case of an emergency.
 - Follow all plant safety rules for electrical work restriction.
 - Observe all distance restrictions to energized circuits (barriers).
 - Follow all Lockout and Tagout rules.
- ▶ Unqualified workers may not:
 - Service or test exposed electrical parts greater than 50 volts.
 - Change fuses.
 - Perform electrical work on energized equipment.
 - Assist with the running of electrical wiring.
 - Assist in servicing equipment where they could be exposed to energized parts.



Many OSHA electrical citations are obvious.

Be on the look out for issues.

Examples:

- ▶ Junction box with no cover plate.
- ▶ Cover left off a conduit elbow.
- ▶ Disconnect boxes being left open and full of dust.
- ▶ Wires hanging out of junctions.
- ▶ Frayed wires.



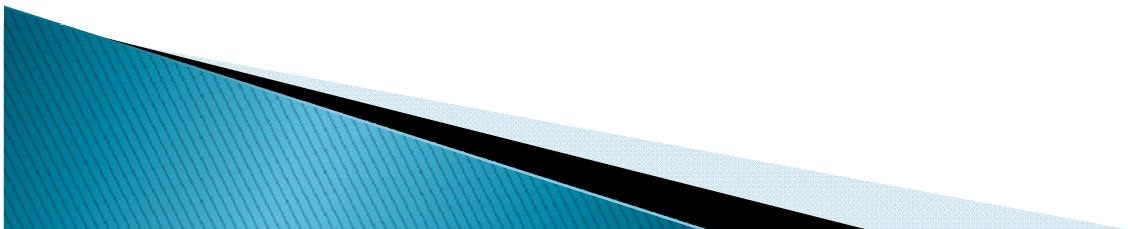
Many citations are obvious: Flexible Cords and Cables

- ▶ Improper use of flexible cores: Don't use:
 - As a substitute for fixed wiring of a structure.
 - Where run through holes in walls, ceilings or floors.
 - Where run through doorways, windows or similar openings.
 - Where attached to building surfaces.
 - Where concealed behind building walls, ceilings or floors.
- ▶ Shall be connected to devices and fittings so that strain relief is provided which will prevent pull from being directly transmitted to the joints or terminal screws.



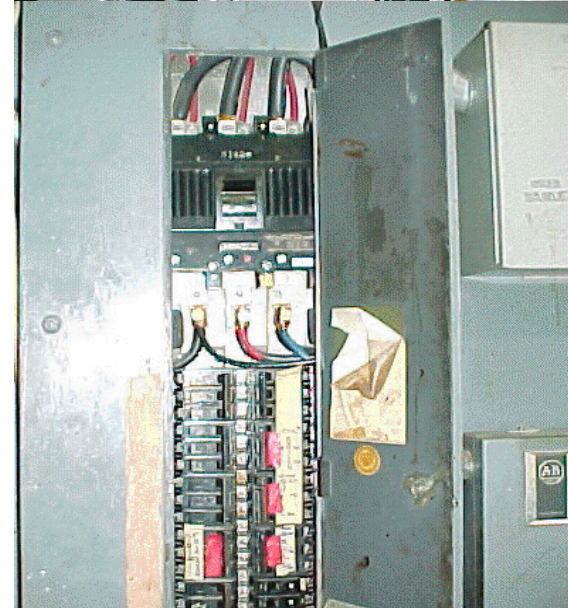
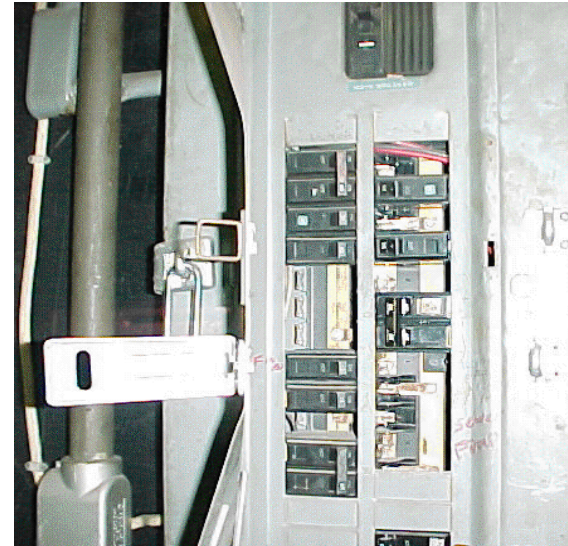
Many citations are obvious.

- ▶ Unapproved equipment brought in hazardous areas: radios, fans, heater, hot plates, CELL PHONES
- ▶ Grounding plugs cut off



Many citations are obvious.

- ▶ Knockout holes left open in an electrical box.
- ▶ Breakers are not marked.
- ▶ Exposed connection points inside of the panel.
- ▶ Other issues?



Many citations are obvious.

- ▶ Light bulbs with no globes or protection cage to help keep them from being hit when in low areas.
- ▶ Power tools with no guard or exposed wiring.

Be Proactive: Catch your own problems.

