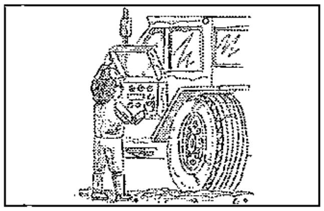


Electrical Safety—An Overview

Overview Of Topic

Electricity has long been recognized as a serious workplace hazard, exposing employees to such dangers as electric shock, electrocution, fires, and explosions.

The Occupational Safety and Health Administration (OSHA) has recognized the important role of the National Electric Code (NEC) in defining basic requirements for safety in electrical installations.

In 1986, OSHA updated the construction electrical regulations (29 CFR, Subpart K). OSHA pulled requirements from the 1984 NEC, that directly affect constuction employees, and placed them in the construction rules.

1926 Subpart K

The OSHA regulation for electrical work is divided into four major groups plus a general definitions section.

Part I—Safety requirements for installing and using equipment.

Sections 29 CFR 1926.402-.408 contain installation safety requirements for electrical equipment, and installations used to provide electric power and lights at jobsites.

These sections apply to installations, both temporary and permanent. They do not apply to existing permanent installations that were there before the construction started.

If an installation is in accordance with the 1984 NEC, it will be considered to be in compliance with the OSHA rules except for:

- .404(b)(1)—Ground-fault protection for employees.
- .405(a)(2)(ii)(E)—Protection of lamps on temporary wiring.
- .405(a)(2)(ii)(F)—Suspension of temporary lights by cords.
- .405(a)(2)(ii)(G)—Portable lights for wet or conductive areas.
- .405(a)(2)(ii)(J)—Extension cord sets and flexible cords.

What OSHA is saying is that in situations where the above rules apply, you must use the OSHA version, not the NEC's.

Part I contains requirements for: (1) approval of electrical components, (2) examination, installation, and use of electrical equipment, (3) guarding of electrical equipment, (4) overcurrent protection, and (5) grounding of equipment connected by cord and plug (extension cords).

Part I also has a "general duty clause" for construction electrical work. It is at §1926.403(b)(1)—The employer shall ensure that electrical equipment is free from recognized hazards that are likely to cause death or serious physical harm to employees. Safety of equipment shall be determined on the basis of the following considerations . . . (text goes on to list seven considerations that will be used to determine the condition of your electrical equipment and installations).

This "catch all" general duty clause can be used when there are no safety rules to cover a particular electrical hazard.

Part II—Safety related work practices *is critical for: (1) protection of employees, (2) passageways and open spaces, and (3) lockout and tagging of circuits.*

Part III—Safety related maintenance and environmental considerations *covers the protection of wiring components and the environmental deterioration of equipment.*

Part IV—Safety requirements for special equipment *covers batteries and battery charging, personal protective equipment, and emergency eyewash stations.*

Employee Training

No specific training requirements are mentioned in the electrical standard. However, you must always "instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury."

Training Tips

In your training on electrical safety, review your company's electrical safety requirements and any site-specific electrical safety issues.

Where To Go For More Information

29 CFR, Subpart K—Electrical.

National Electrical Code, National Fire Protection Association.

29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility.

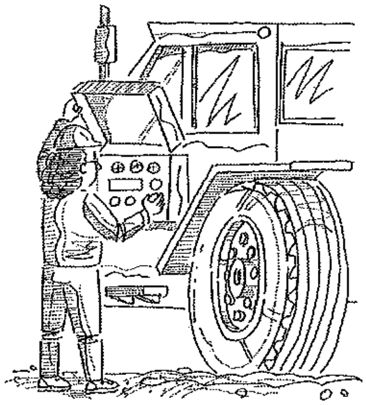
KELLER'S CONSTRUCTION TOOLBOX TALKS

Electrical Safety—An Overview

Exposed junction box wiring, damaged extension cords, and temporary set-ups are just some of the electrical hazards construction workers face daily. And electricity can be deadly, exposing you to such dangers as shock, electrocution, fires, and explosions.

According to the Bureau of Labor (BLS) statistics, 486 workers died in 1995 from electrocution. Contact with electrical current killed 347 employees while contact with overhead power lines killed 139 more. Approximately eighty-three of these deaths were construction workers.

The Occupational Safety and Health Administration (OSHA) has recognized the important role of the National Electric Code (NEC) in defining basic requirements for safety in electrical installations.



In 1986 OSHA updated the construction electrical regulations (29 CFR Subpart K), by pulling requirements from the 1984 NEC that directly affect employees in construction workplaces, and placing them in construction rules.

Your employer is required to provide you with training in safe electrical work practices, and has a duty to provide hazard-free equipment and work situations.

The OSHA electrical regulations for construction are located in Subpart K of 29 CFR 1926. The rules are divided into four major groups:

***Part I**—Safety requirements for installing and using equipment.*

Sections 29 CFR 1926.402-.408 contain installation safety requirements for electrical equipment, and installations used to provide electric power and lights at jobsites.

These sections apply to installations, both temporary and permanent. They do not apply to existing permanent installations that were there before the construction started.

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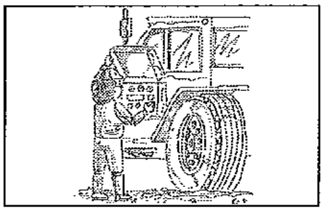
***Part III—Safety related maintenance and environmental considerations** covers the protection of wiring components and the environmental deterioration of equipment.*

***Part IV—Safety requirements for special equipment** covers batteries and battery charging, personal protective equipment, and emergency eyewash stations.*

Safety should be foremost in your mind when working with electrical equipment. You face hazards from jobsite conditions, your tools, and the electricity that powers them.

Published by J. J. Keller & Associates, Inc.
Neenah, WI 54957-0368



Electrical Safety—An Overview Sign-Off Sheet

This sign-off sheet documents the names of employees who attended this training session on Electrical Safety—An Overview at ______________________________ .
(company name)

The session covered:

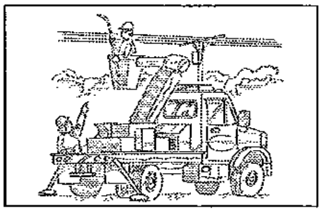
- OSHA's electrical regulations and how the National Electric Code influences them.
- Overview of the contents of Subpart K—Electrical.
- Brief review of each part of Subpart K—Electrical.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: ____________________ **Job Location:** ____________________

Employee Signature	**Print Name Here**

____
Supervisor's Signature



Electrical Safety — Accident Prevention

Overview Of Topic

Electrical accidents are caused by one or more of the following reasons:

- Unsafe equipment and/or installation.
- Unsafe workplaces caused by environmental factors.
- Unsafe work practices.

Protection from electrical hazards is one way to prevent accidents. Protective methods include insulation, electrical protective devices, guarding, grounding, personal protective equipment (PPE), and safe work practices.

Circuit protective devices

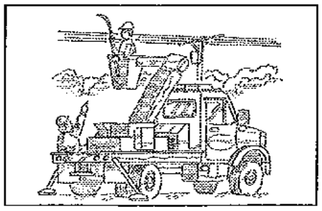
At construction sites, the most common electrical hazard is the ground fault electrical shock. The OSHA electrical rules require employers to provide either: (1) ground fault circuit interrupters (GFCIs) for receptacle outlets, or (2) an assured equipment grounding conductor program. Either method can eliminate ground fault electric shock hazards.

Circuit protective devices, such as fuses, circuit breakers, and GFCIs, automatically limit or shut off current flow in the event of a ground-fault, overload, or short circuit in a wiring system.

Fuses and circuit breakers protect conductors and equipment. They prevent overheating of wires and components that could create hazards for workers. They also open the circuit under certain hazardous ground-fault conditions.

Insulation

Employees should be trained to check their equipment daily for insulation breakdown. They should check for such things as broken or exposed wires, and scuffed insulation on extension cords. Electrical conductor insulation must be suitable for the voltage and conditions under which the item will be used. Employees can also wear insulated non-conductive gloves and shoes. Non-conducting coatings on tool handles also aid in insulating from electrical shock.



Electrical Safety — Accident Prevention

Guarding

Any "live" parts of electrical equipment operating at 50 volts or more must be guarded to avoid accidental contact. Entrances to areas with "live" electrical parts must be marked with warning signs. The signs should forbid entrance except by qualified persons.

Grounding

Grounding is required to protect employees from electrical shock, safeguard against fire, and protect against damage to electrical equipment. There are two kinds of grounding: (1) service or system ground—where one wire, the neutral conductor, is grounded. This type of ground is designed to protect machines, tools, and insulation; (2) equipment ground—provides a path for current from a tool or machine to ground. This safeguards the operator in the event of a malfunction.

Personal protective equipment

If your employees work where there is potential electrical hazards, you must provide them with electrical protective equipment. You must use equipment appropriate for the body parts needing protection, and the work being done.

Employee Training

No specific training requirements is mentioned in the electrical standard. However, you must always "instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury."

Training Tips

Have a supply of circuit breakers, fuses, GFCIs, etc., on hand to explain their functions for protecting workers. Promote the fact that these are only mechanical devices and subject to failure. The best accident preventive methods are still correct installation of temporary wiring and safe work places and practices.

Where To Go For More Information

Regulatory text: 29 CFR 1926.400-.449

National Electrical Code, National Fire Protection Association

Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility

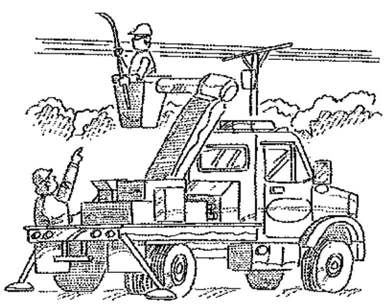
KELLER'S CONSTRUCTION TOOLBOX TALKS

Electrical Safety — Accident Prevention

Electrical accidents on construction sites are almost always caused by unsafe equipment and/or installations, unsafe workplaces caused by environmental factors, or unsafe work practices. Protection from electrical hazards is one way to prevent accidents. According to OSHA, protective methods that may be employed on your jobsite include insulation, electrical protective devices, guarding, grounding, personal protective equipment (PPE), and safe work practices.

Circuit protective devices

At construction sites, the most common electrical hazard is the ground fault electrical shock. The OSHA electrical rules require your company to provide either: ground fault circuit interrupters (GFCIs) for receptacle outlets, or an assured equipment grounding conductor program. Either method can eliminate ground fault electric shock hazards.



Circuit protective devices, such as fuses, circuit breakers, and GFCIs, automatically limit or shut off current flow during a ground-fault, overload, or short circuit in a wiring system. Fuses and circuit breakers protect conductors and equipment. They prevent overheating of wires and components that could create hazards. They also open the circuit under certain hazardous ground-fault conditions.

Insulation

You should check your equipment daily for insulation breakdown. You should check for such things as broken or exposed wires, and scuffed insulation on extension cords. You can also wear insulated non-conductive gloves and shoes. Non-conducting coatings on tool handles also aid in insulating from electrical shock.

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Any live parts of electrical equipment operating at 50 volts or more must be guarded to avoid accidental contact. Entrances to areas with live electrical parts must be marked with warning signs. The signs should forbid entrance except by qualified persons.

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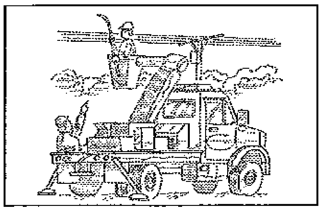
Personal protective equipment

If you work where there are electrical hazards, your employer must provide you with electrical protective equipment. You must use equipment appropriate for the body parts needing protection, and the work being done.



Electrical Safety — Accident Prevention Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Electrical Safety — Accident Prevention at ______________________________.
(company name)

The session covered the following:

- The three primary causes of electrical accidents.
- Methods of protection from electrical hazards.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: **Job Location:**

Employee Signature	**Print Name Here**

Electrical Safety—Arc Flash & Blast

Overview Of Topic

Working around electrical equipment can expose employees to many hazards. One of most dangerous hazards is the arc burn which results from an electric arc flash and the accompanying arc blast.

Arc flashes are caused by an electrical equipment failure (like a short circuit) or human error (such as holding a metal object too close to energized equipment). If you have two energized points which are not contacting each other solidly, the current can jump from one point to the other. This is called an electric arc or arc flash.

One-second duration

Unlike a flash fire, an electric arc can begin and end in less than a second. Bystanders see a flash and hear an extremely loud boom and it is over.

Electric arc

A person can be severely injured or killed by the huge amount of heat generated by this arc. Temperature of the arc can range from 15,000 to 35,000 degrees F. You can imagine what this heat can do to the human body. (Heat in excess of 122 degrees F. can cause third degree burns, which do not heal.)

Flying molten metal

The arc also immediately turns the electrical conductors into molten metal droplets that fly away from the source at near the speed of sound. These projectiles can travel quite a distance, starting clothing and other materials on fire.

Arc blast

Not only does the electric arc generate an excessive amount of heat, this heat causes a intense pressure wave that usually throws the employees working nearby away from the arc. This wave is so strong it can break ear drums and cause concussions and broken bones.

Explosions and/or fire

The heat from electric arcs can ignite combustible or flammable vapors in the air causing an explosion. Materials stored nearby can also start on fire.

Personal Protective Equipment (PPE)

Whenever electrical workers have the chance to be exposed to an electric arc they must wear clothing resistant to the flash. Part II, Chapter 3 of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces covers the standards for PPE.

Cost of an electric arc accident

The monetary cost of an electric arc accident can run into the hundreds of thousands of dollars. Damage to equipment and facility, lost production time, increased insurance expense, medical bills, worker's compensation, and legal costs can all be the result of one electric arc accident.

Employee Training

As the employer, you must instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury.

OSHA state-plan-states: Remember that certain states have more stringent regulations that go above and beyond the OSHA standards.

Training Tips

Ask your trainees if they know of anyone injured by an electric arc accident. Discuss possible scenarios where a worker could be exposed to arc flash (working near overhead power lines, working near exposed electrical equipment). Discuss any company specific training that your employees need to know.

Where To Go For More Information

29 CFR 1926.21—Safety training and education.

NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

29 CFR 1926.416—General requirements.

KELLER'S CONSTRUCTION TOOLBOX TALKS

Electrical Safety—Arc Flash & Blast

Arc flashes are caused by an electrical equipment failure (like a short circuit) or human error (such as holding a metal object too close to energized equipment). If you have two energized points which are not contacting each other solidly, the current can jump from one point to the other. This is called an electric arc or arc flash.

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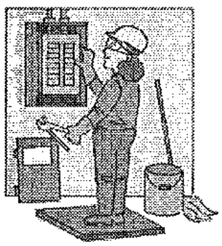
Electric arc



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The heat from electric arcs can ignite combustible or flammable vapors in the air causing an explosion. Materials stored nearby can also start on fire.

Personal Protective Equipment (PPE)

Whenever electrical workers have the chance to be exposed to an electric arc they must wear clothing and eye protection resistant to the flash. Make sure your employer provides you with the necessary PPE. (Part II, Chapter 3 of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces covers the standards for PPE.)

Cost of an electric arc accident

The monetary cost of an electric arc accident can run into the hundreds of thousands of dollars. Damage to equipment and facility, lost production time, increased insurance expense, medical bills, worker's compensation, and legal costs can all be the result of one electric arc accident.

Questions?

Talk to your supervisor if you have any questions or concerns about working around energized electrical equipment.

Electrical Safety—Arc Flash & Blast Sign-Off Sheet

This sign-off sheet documents the employees at this company, ______________________, who have taken part in a training session on Electrical Safety—Arc Flash & Blast. The session covered:

- The causes of electric arc accidents.
- The physical effects of an arc flash and blast.
- The proper use of personal protective equipment.

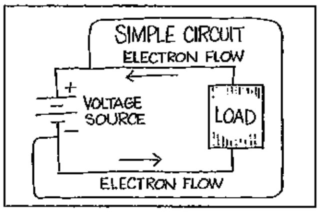
The space below is for employees to "sign-off" that they were in attendance.

Date of Training: ____________________ **Job Location:** ______________________

Employee Signature	**Print Name Here**

____
Supervisor's Signature

Sign-off sheets may be copied and distributed to workers for use during your training session. Please refer to HOW TO USE THIS MANUAL for restrictions.



Electrical Safety — Basics

Overview Of Topic

To handle electricity safely and to communicate hazards and how to avoid them you need to understand how electricity works, how it can be directed, the hazards it presents, and how those hazards can be controlled.

How does electricity work?

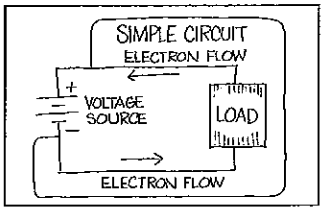
When someone turns on a circular saw or throws a circuit breaker, they allow current to flow from the generating source (battery, portable generator, or electric utility), through conductors (wiring), to the area of demand or load (equipment or lighting). A complete circuit is necessary for the flow of electricity through conductor. Interrupting that circuit through a break in a conductor or load, i.e., a burned out filament in a light bulb, will not allow current to flow. Opening a circuit breaker is interrupting the circuit.

Volts = Current X Resistance (or V=IR)

Volts = Current X Resistance is an equation known as Ohm's Law. The equation shows the relationship between three factors: volts, current, and resistance. This relationship makes it possible to change the qualities of an electrical current but keep an equivalent amount of power.

A force or pressure must be present before water will flow through a pipeline. Similarly, electrons flow through a conductor because an electromotive force (EMF) is exerted. The unit of measure for EMF is the volt. For electrons to move in a particular direction, a potential difference must exist between two points of the EMF source. The continuous movement of electrons past a given point is known as current. It is measured in amperes.

The movement of electrons along a conductor meets with some opposition. This opposition is known as resistance. Resistance to the flow of electricity is measured in ohms. The resistance is determined by three factors: the nature, length and cross-sectional area (size), and the temperature of the substance. The amount of resistance provided by different materials varies widely.



Electrical Safety — Basics

Some substances, such as metals, offer very little resistance to the flow of electric current and are called conductors. Other substances, such as Bakelite, porcelain, pottery, and dry wood, offer such a high resistance that they can be used to prevent the flow of electric current and are called insulators.

These "basics" of electricity are important for employees to know so they know what to do when things go wrong. When insulation on a conductor breaks down; when an end terminal or splice breaks; or when a screw comes loose and leaves a wire dangling; injury and death can strike. If electrical conductors become exposed, there is a danger of shocks, burns, or fire. When a cord connector is wet, hazardous leakage can occur to the equipment grounding conductor. If a worker picks up that connector he could provide a path to ground, which could be fatal.

Remember—electricity travels in closed circuits, and its normal route is through a conductor. Shock occurs when the body becomes a part of the electric circuit. The severity of the shock received is affected by three primary factors: the amount of current, the path of the current, and the length of time the body is in the circuit.

Employee Training

No specific training requirements is mentioned in the electrical standard. However, you must always "instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury."

Training Tips

In your overview of electrical safety basics, you may want to review the above-mentioned basic information on electricity.

Where To Go For More Information

Regulatory text: 29 CFR 1926.400-.449

National Electrical Code, National Fire Protection Association

Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility

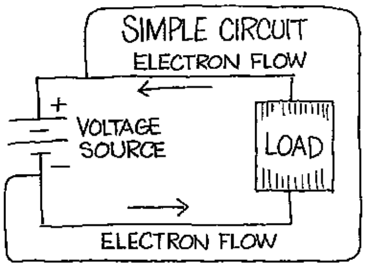
KELLER'S CONSTRUCTION TOOLBOX TALKS

Electrical Safety — The Basics

To handle electricity safely, recognize hazards, and know how to avoid them, you need to understand how it acts, how it can be directed, the hazards it presents, and how those hazards can be controlled.

How does electricity work?

When you turn on a circular saw or throw a circuit breaker, you allow current to flow from the generating source (battery, portable generator, or electric utility), through conductors (wiring), to the area of demand or load (equipment or lighting). A complete circuit is necessary for the flow of electricity through a conductor. Interrupting that circuit through a break in a conductor or load, i.e., a burned out filament in a light bulb, will not allow current to flow. Opening a circuit breaker is interrupting the circuit.



Volts = Current X Resistance is an equation known as Ohm's Law. The equation shows the relationship between three factors: volts, current, and resistance. This relationship makes it possible to change the qualities of an electrical current but keep an equivalent amount of power.

A force or pressure must be present before water will flow through a pipeline. Similarly, electrons flow through a conductor because an electromotive force (EMF) is exerted. The unit of measure for EMF is the volt.

For electrons to move in a particular direction, a potential difference must exist between two points of the EMF source. The continuous movement of electrons past a given point is known as current. It is measured in amperes.

The movement of electrons along a conductor meets with some opposition. This opposition is known as resistance. Resistance to the flow of electricity is measured in ohms. The resistance is determined by three factors: the nature, length, and cross-sectional area (size), and the temperature of the substance. The amount of resistance provided by different materials varies widely. Some substances, such as metals, offer very little resistance to the flow of electric current and are called conductors. Other substances, such as Bakelite, porcelain, pottery, and dry wood, offer such a high resistance that they can be used to prevent the flow of electric current and are called insulators.

These "basics" of electricity are important to know so you understand what happens when things go wrong. When insulation on a conductor breaks down; when an end terminal or splice breaks; or when a screw comes loose and leaves a wire dangling; injury and death can strike. If electrical conductors become exposed, there is a danger of shocks, burns, or fire. When a cord connector is wet, hazardous leakage can occur to the equipment grounding conductor. If a worker picks up that connector he could provide a path to ground. This could be fatal.

Remember—electricity travels in closed circuits, and its normal route is through a conductor. Shock occurs when the body becomes a part of the electric circuit. The severity of the shock received is affected by three primary factors: the amount of current, the path of the current, and the length of time the body is in the circuit.

Never forget that your body is an excellent conductor of electricity.

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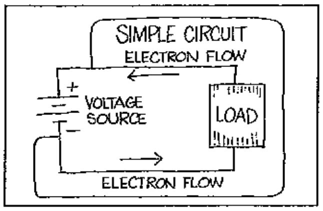


Electrical Safety — Basics Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Electrical Safety — Basics of Electricity at ______________________________.
(company name)

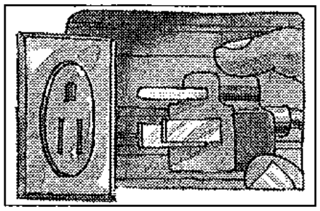
The session covered the following:

- Basic information on how electricity works.
- How to avoid being a human conductor of electricity.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: **Job Location:**

Employee Signature	**Print Name Here**



Electrical Safety—Extension Cords

Overview Of Topic

Extension cords are common on jobsites. They are also one of most misused pieces of electrical equipment.

A large majority of the citations under this standard are issued because ground prongs are missing from cord and plug connected equipment or extension cords. Sometimes ground prongs are intentionally removed from tools and extension cords because "it makes them easier and quicker to plug into and remove."

When the third prong is removed from a 3-prong connector the cord is in violation of 29 CFR 1926.404(f)(6), which indicates that "The path to ground from circuits, equipment, and enclosures shall be permanent and continuous."

Using Electrical Tape to Repair Extension Cords

OSHA allows the use of electrical tape to cover "superficial damage" to cord jackets. There is no prohibition against putting electrical tape over these kinds of abrasions and nicks when there is (1) no damage beyond the jacket, (2) the conductors have not been scraped or exposed, and (3) the insulation inside the jacket has not been displaced or compressed.

While taping these incidental abrasions and cuts does not violate any OSHA standard, OSHA does not recommend it for two reasons:

- Applying electrical tape that is too thick or applying too much of it could change the cord's original flexibility and lead to internal damage.
- The depth of the abrasions and cuts cannot be monitored to see if they get worse without removing the tape.

Hard or Extra Hard Extension Cords

Extension cords are rated for use and only Hard or Extra Hard Service extension cords can be used on construction jobsites. Examples of Hard Service types include: S, ST, SO, STO, SJ, SJO, SJT, and SJTO. Extension cords must be durably marked with one of the Hard or Extra Hard Service designation letters, size, and number of conductors.

Strain Relief for Extension Cords

29 CFR 1926.405(g)(2)(iv) requires extension cords to have "devices or fittings so that strain relief is provided which will prevent pull from being transmitted to joints or terminal screws."

One of the weak points of cord assembly is the plug area. When devices or fittings designed to relieve cord strain are not used, insulation tends to pull back and expose conductors.

Employee Training

Instruct your employees to:

- Visually inspect all electrical equipment prior to use. Any defects such as frayed cords, missing ground prongs, etc., should be corrected by taking the tool out-of-service.
- Frequently inspect electrical systems to insure the path to ground is continuous.
- Continually audit extension cords at your jobsite. Any cords found not to be Hard or Extra Hard must be taken out-of-service immediately.
- Use only cords that are equipped with strain relief.
- Remove cords from receptacles by pulling on the plug, not the cord.

Training Tips

Have a supply of extension cords that include Hard and Extra Hard Service designations. Explain where the strain relief device is located.

Where To Go For More Information

Regulatory text: 29 CFR 1926.405.

National Electric Code, National Fire Protection Association.

Regulatory text: 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility.

KELLER'S CONSTRUCTION TOOLBOX TALKS

Electrical Safety—Extension Cords

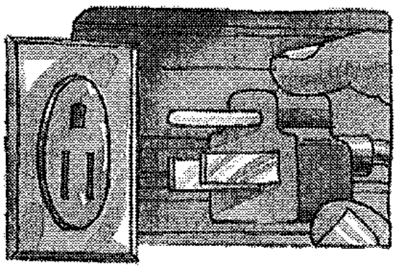
Extension cords are one of the most misused pieces of electrical equipment. When exposed to "normal" construction use, extension cords can experience rapid deterioration. When you subject the cord to additional misuse, such as removing the ability to ground the cord, the cord can be a ticket to the emergency room or even the morgue.

3-prong connectors

One of the most common tricks to get extension cords to work faster is to remove the third prong from a 3-prong connector. Removing this third prong can result in electrocution because the path to ground is now lost.

Repairing extension cords with electrical tape

Another common mistake is to use electrical tape to repair extension cords. OSHA doesn't recommend it for a couple reasons: If the tape is applied too thickly if could change the cord's original flexibility and lead to internal damage: also, the depth of the abrasions and cuts cannot be monitored to see if they get worse (unless of course you remove the tape).



Hard or Extra Hard Service cords

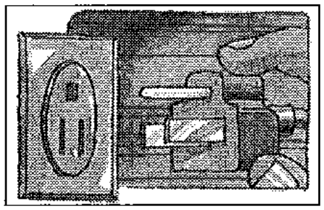
OSHA often cites construction companies because they fail to use extension cords that are rated correctly. For instance, a two wire ribbon type cord is not designed for hard usage. OSHA requires that construction extension cords must be either Hard or Extra Hard Service cords. Hard Service or Extra Hard Service cords are marked with one of the following designations: S, ST, SO, STO, SJ, SJO, SJT, and SJTO.

Strain relief

Another common citation OSHA issues deals with the lack of strain relief on extension cords. The plug area of an extension cord is one of the weakest areas of the cord. When devices or fittings designed to relieve cord strain are not used, insulation tends to pull back and expose conductors.

What you can do to prevent accidents when using extension cords

- Visually inspect all electrical equipment prior to use. Any defects such as frayed cords, missing ground prongs, etc., should be corrected by taking the tool out-of-service.
- Frequently inspect electrical systems to insure the path to ground is continuous. Continually audit extension cords at your jobsite. Take any cords that are not Hard or Extra Hard out-of-service immediately.
- Use only cords that are equipped with strain relief.
- Remove cords from receptacles by pulling on the plug, not the cord.



Electrical Safety—Extension Cords Sign-Off Sheet

This sign-off sheet documents the employees at this company, ______________________, who have taken part in a training session on Electrical Safety—Extension Cords. The session covered:

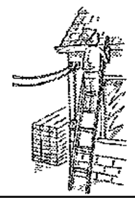
- Use of 3-prong extension cords.
- When it's OK to use electrical tape to repair extension cords.
- Use of Hard or Extra Hard Service extension cords.
- Use of extension cords with proper strain devices.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: ______________ **Job Location:** ______________

Employee Signature	**Print Name Here**

____
Supervisor's Signature



Electrical Safety—Hazards Of Electricity

Overview of Topic

Electricity travels in closed circuits; its normal route is through a conductor and load. Employers get shocks when some part of their body becomes part of the circuit. An electric current enters their body at one point and exits at another.

Shock normally occurs in one of three ways. When a person: (1) touches both wires of an electric circuit, (2) one wire of an energized circuit and ground, or (3) a metallic part that is "hot" because it is contacting an energized wire and the person is in contact with the ground. The severity of the shock depends on three factors: (1) how much current flows through the body (measured in amperes), (2) what path the electric current takes through the body, and (3) how long the body is part of the electric circuit.

Other factors that make a difference are the frequency of the current, the phase of the heart cycle when shock occurs, and the general health of the person prior to shock.

The effects of electric current in the human body

The below examples give the general relationship between the degree of injury and amount of amperage for a 60-cycle hand-to-foot path of one second's duration of shock.

The effects of an electric shock on the body can range from: (1) 1 milliamp—a faint tingle; (2) 5 milliamps—slight shock, not painful but disturbing, strong involuntary reactions that can lead to injuries; (3) 6-25 milliamps for men, 9-30 milliamps for women—painful shock, muscular control is lost, this is the freezing or "let go" range; (4) 50-150 milliamps—extreme pain, respiratory arrest, severe muscular contractions, individual cannot let go; (5) 1,000-4,000 milliamps—ventricular fibrillation (the rhythmic pumping of the heart ceases), muscular contraction, and nerve damage occurs, death is most likely; (6) 10,000 milliamps—cardiac arrest, severe burns and probable death.

A severe shock can also cause considerably more damage to the body than is visible. A person can suffer internal bleeding and destruction of tissues, muscles, nerves, and internal organs. In addition, shock is often only the beginning in a chain of events. The final injury may be from a fall, cuts, burns, or broken bones. The most common shock-related injury is a burn. Burns suffered are electrical burns, arc burns, and thermal contact burns.

Electrical burns—are the result of current flowing through tissue or bone, generating heat, and causing injury. They are serious and should be given immediate attention.

Arc or flash burns—are the result of high temperatures near the body and are produced by an electric arc or explosion.

Thermal contact burns—are those experienced when the skin contacts hot surfaces of overheated electric conductors, conduits, or other energized equipment. Additionally, clothing may be ignited in an electrical accident and a thermal burn will result.

Other injuries—of an indirect or secondary nature, caused by involuntary muscle reaction from the shock, can result in bruises, bone fractures, and even death resulting from collisions or falls.

Fire, explosion, and flying metal—hazards are created from resulting arcs when a short circuit occurs. If high current is involved, arcs can cause injury or start a fire. Extremely high-energy arcs can damage equipment, causing fragmented metal to fly in all directions. Even low-energy arcs can cause violent explosions around flammable gases, vapors, or combustible dusts.

Employee Training

No specific training requirements are mentioned in the electrical standards. However, you must always "instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury."

Training Tips

Make sure to get across the results of an electric shock, and how it only takes one to hurt or even kill an employee.

Where To Go For More Information

Regulatory text: 29 CFR 1926.400-.449.

National Electrical Code, National Fire Protection Association.

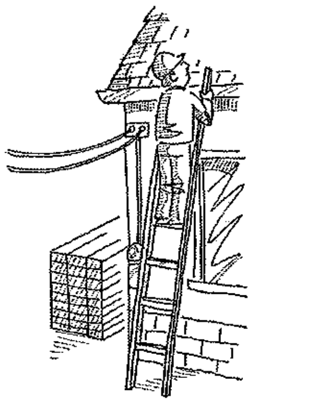
Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility.

KELLER'S CONSTRUCTION TOOLBOX TALKS

Electrical Safety—Hazards of Electricity

Electricity is necessary to get work done at construction sites. However, with its benefits come deadly hazards you should be aware of and guard against when working with electrically-powered equipment or wiring. Primary hazards are shock and possible electrocution, burns, arc-blasts, explosions, and fires. Electricity travels in closed circuits; its normal route is through a conductor and load. You can get a shock when some part of your body becomes part of the circuit. An electric current enters your body at one point and exits at another.

Shock normally occurs when you touch: (1) both wires of an electric circuit, or (2) one wire of an energized circuit and ground, or (3) a metallic part that is "hot" because it is contacting an energized wire and you are in contact with the ground. The severity of the shock depends on three factors: (1) how much current flows through your body (measured in amperes), (2) what path the electric current takes through your body, and (3) how long your body is part of the electric circuit. The effects of an electric shock on your body can range from: a faint tingle at 1 milliamp, to cardiac arrest, severe burns, and probable death, at 10,000 milliamps.



A severe shock can also cause considerably more damage to your body than is visible. You can suffer internal bleeding and destruction of tissues, muscles, nerves, and internal organs. In addition, shock is often only the beginning in a chain of events. The final injury may be from a fall, cuts, burns, or broken bones. The most common shock-related injury is a burn. Burns suffered in electrical accidents are of three types: electrical burns, arc burns, and thermal contact burns.

Electrical burns—are the result of current flowing through tissue or bone, generating heat, and causing injury. They are serious injuries and should be given immediate attention.

Arc or flash burns—are the result of high temperatures near the body. They are produced by an electric arc or explosion.

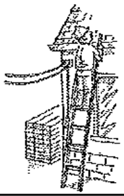
Thermal contact burns—are those experienced when the skin contacts hot surfaces of overheated electric conductors, conduits, or other energized equipment. Additionally, clothing may be ignited in an electrical accident and a thermal burn will result.

Other injuries—of an indirect or secondary nature, caused by involuntary muscle reaction from the shock, can result in bruises, bone fractures, and even death resulting from collisions or falls.

Fire, explosion, and flying metal—hazards are created from resulting arcs when a short circuit occurs. If high current is involved, arcs can cause injury or start a fire. Extremely high-energy arcs can damage equipment, causing fragmented metal to fly in all directions. Even low-energy arcs can cause violent explosions in atmospheres that contain flammable gases, vapors, or combustible dusts.

Construction workers can't do their job without electricity. However, constant activity at a construction site makes it a particularly hazardous environment. Extension cords, temporary wiring panels, water hoses, materials laying around, and constant use of electric tools, make it extremely important that you are careful around electricity. Your life may depend on it.

Published by J. J. Keller & Associates, Inc.
Neenah, WI 54957-0368



Electrical Safety—Hazards Of Electricity, Sign-Off Sheet

This sign-off sheet documents the names of employees who attended this training session on Electrical Safety—Hazards of Electricity at ______________________________.
(company name)

The session covered:

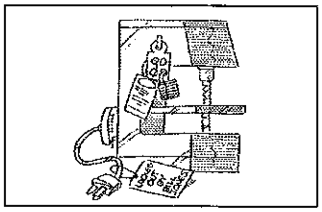
- The effects of electricity on the human body.
- The effects of shock—the shock itself and secondary problems.
- Burns, fire, explosion, and flying metal.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: ____________________ **Job Location:** ____________________

Employee Signature	**Print Name Here**

____
Supervisor's Signature



Electrical Safety — Lockout/Tagout

Overview Of Topic

The accidental release of hazardous energy can cause accidents. Lockout/tagout procedures protect your employees from accidental exposure to energized equipment or circuits.

What is lockout/tagout?

Lockout is turning off and locking out the flow of electricity from a power source to a piece of equipment or circuit.

Lockout is accomplished by installing a lockout device at the power source so that equipment cannot be operated. A lockout device is a lock, block, or chain that keeps a switch, valve, or lever in the off position.

Tagout is the placing of a tag on a power source. The tag acts as a warning not to restore energy—it is not a physical restraint. Tags must clearly state: **Do not operate or remove this tag** or the like, and must be applied by hand.

What must be locked or tagged out

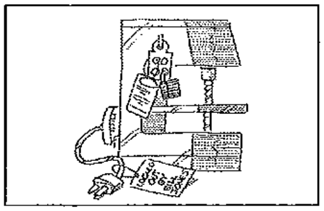
A lock and a tag must be placed on each handle, circuit breaker, push-button, or similar device used to deenergize electric equipment when repairs or maintenance is being done.

Lockout/tagout procedures

Anytime electrical equipment is deactivated for repair, or circuits are shut off, the equipment must be locked out and tagged at the point where it can be energized. This is done to warn others that maintenance work is being done. Only the person that locked and tagged the equipment can turn it back on.

Before equipment is reenergized a qualified person must conduct tests and visual inspections to verify that all tools, and electrical jumpers, are removed.

Each lock and tag must be removed by the employee who applied it (or under their supervision). If the employee is absent, his or her lock or tag may be removed by a qualified person provided: (1) the employer ensures that the employee who applied the lock or tag is not available at the workplace; and (2) it must be visually determined that all employees are clear of the circuits and equipment.



Electrical Safety — Lockout/Tagout

Personnel changes

In general, if a piece of equipment is locked out at a personnel change, the person beginning the job must apply his lock before the employee who is leaving the job can remove his. This procedure is done to make sure the lockout/tagout protection is kept.

Power sources that cannot be locked out

If a power source cannot be locked out employees must discuss the situation with their supervisor. There are some situations where tagout alone is allowed.

Employees should always: (1) follow lockout/tagout procedures during servicing or maintenance of equipment, and (2) lock and tag out power sources and switches when they service or repair electrically-energized equipment They should never ignore or remove the locks or tags of other employees when they come across them in the workplace.

Attention to, and respect for the company lockout/tagout program will make the workplace safer for all employees.

Employee Training

No specific training requirements is mentioned in the electrical standard. However, you must always "instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury."

Training Tips

Go over your lockout/tagout program by bringing in examples of locks and tags that are used frequently in your company.

Where To Go For More Information

Regulatory text: 29 CFR 1926.400-.449

National Electrical Code, National Fire Protection Association

Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility

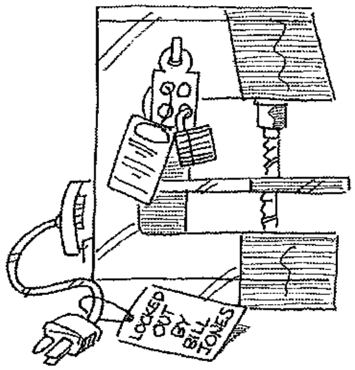
KELLER'S CONSTRUCTION TOOLBOX TALKS

Electrical Safety — Lockout/Tagout

The accidental release of hazardous electrical energy can cause accidents. OSHA-required lockout/tagout procedures protect you from accidental exposure to energized equipment or circuits on the job site.

What is lockout/tagout?

Lockout is turning off and locking out the flow of electricity from a power source to a piece of equipment or circuit. Lockout is accomplished by installing a lockout device at the power source so that equipment cannot be operated. A lockout device is a lock, block, or chain that keeps a switch, valve, or lever in the off position.



Tagout is the placing of a tag on a power source. The tag acts as a warning not to restore energy—it is not a physical restraint. Tags must clearly state: **Do not operate or remove this tag** or the like, and must be applied by hand.

What must be locked or tagged out

A lock and a tag must be placed on each handle, circuit breaker, push-button, or similar device used to deenergize electric equipment when repairs or maintenance is being done.

Lockout/tagout procedures

Anytime electrical equipment is deactivated for repair, or circuits are shut off, the equipment must be locked out and tagged at the point where it can be energized. This is done to warn others that maintenance work is being done. Only the person that locked and tagged the equipment can turn it back on. Before equipment is reenergized a qualified person must conduct tests and visual inspections to verify that all tools and electrical jumpers are removed. Each lock and tag must be removed by the employee who applied it (or under their supervision). If the employee is absent, their lock or tag may be removed by a qualified person provided: (1) the employer ensures that the employee who applied the lock or tag is not available at the workplace; and (2) it must be visually determined that all employees are clear of the circuits and equipment.

Power sources that cannot be locked out

If a power source cannot be locked out discuss the situation with your supervisor. Find out if tagout alone may be used safely. There are some situations where tagout alone is allowed.

Always: (1) follow lockout/tagout procedures during servicing or maintenance of equipment, and (2) lock and tag out power sources and switches when you service or repair electrically-energized equipment. Never ignore or remove the locks or tags of other employees when you come across them in the workplace.

Your attention to, and respect for, your company's lockout/tagout program will make your workplace safer for both you and your coworkers.

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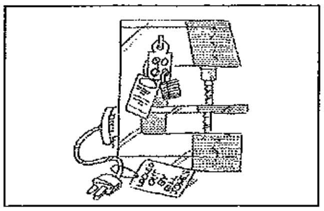


Electrical Safety — Lockout/Tagout Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Electrical Safety — Lockout/Tagout at ____.
(company name)

The session covered the following:

- The definitions of lockout and tagout.
- What must be locked/tagged out.
- Lockout/tagout procedures.
- Lockout/tagout safety rules.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: **Job Location:**

Employee Signature	**Print Name Here**

Electrical Safety—Overhead Power Line Safety

Overview Of Topic

Working near overhead power lines is a very dangerous job. The following safety tips can help you protect your employees.

Before you begin

- Survey the site for overhead power lines. Look up!
- Consider all overhead lines as energized until the electric utility indicates otherwise, or an electrician verifies that the line is not energized and has been grounded.
- If overhead lines are present, call the utility company and find out what voltage is on the lines. Ask if the utility company can shut off the lines while you are working near them.
- If overhead lines cannot be shut down, ask the utility company if they can install insulation over the lines during the time you will be working near them.

Working with tools and equipment

If the lines cannot be shut down and/or insulation applied:

- A minimum safe distance of 10 feet must be established.
- Have a brief jobsite meeting to discuss the planned work as it relates to the power lines. Discuss topics such as the use of long-handled tools, and equipment (raised dump trucks, back hoes, etc.) that could come in contact with the lines.
- Consider the need for a designated person to monitor activities around the lines.
- Only use nonconductive ladders when working on or near overhead power lines.
- Do not permit employees to approach or carry any conductive object closer than 10 feet to an energized line. The only exception is for trained and qualified employees using insulated tools designed for high voltage lines.

Operating cranes near power lines

If using a crane/equipment near lines rated at 50,000 volts (50 kv) or less, the minimum distance between the energized lines and any part of the crane (boom, load line) must be at least 10 feet.

If using a crane/equipment near energized lines rated at 50,000 volts (50 kv) or more, the minimum distance between the energized lines and any part of the crane must be at least 10 feet plus 0.4 inch for each 1,000 volts over 50,000 volts.

Where it is difficult for the operator to maintain the desired clearance by visible means, an employee must be designated to observe the distance between the crane/equipment and the line so as to give timely warning to the operator. This should be the ONLY job the monitor is performing when this hazardous condition is present.

Employee Training

No specific training requirements are mentioned in the electrical standard. However, you must always "instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury."

OSHA state-plan-states: Certain states have more stringent regulations than Federal OSHA. If you operate in a state-plan-state, check with your local OSHA office to determine if there are regulations that go above and beyond Federal OSHA.

Training Tips

Pass out the names and telephone numbers of local utility companies. Discuss who should be responsible to contact those utility companies when needed. Talk about when a designated person should monitor the site around power lines. Mention some of the other jobs you've been involved with that entailed working around power lines.

Where To Go For More Information

29 CFR 1926.400-.449—Electrical General

29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility

National Electric Code (NEC)

KELLER'S CONSTRUCTION TOOLBOX TALKS

Electrical Safety—Overhead Power Line Safety

Working near overhead power lines is a very dangerous job. The following are some safety tips to help protect your employees.

Before you begin

- Survey the site for overhead power lines. Look up!

- Consider all overhead lines as energized until the electric utility indicates otherwise, or an electrician verifies that the line is not energized and has been grounded.
- If overhead lines are present, call the utility company and find out what voltage is on the lines. Ask if the utility company can shut off the lines while you are working near them.
- If overhead lines cannot be shut down, ask the utility company if they can install insulation over the lines during the time you will be working near them.

Working with tools and equipment

If the lines cannot be shut down and/or insulation applied:

- A minimum safe distance of 10 feet must be established.
- Have a brief jobsite meeting to discuss the planned work as it relates to the power lines. Discuss topics such as the use of long-handled tools, and equipment (raised dump trucks, back hoes, etc.) that could come in contact with the lines.
- Have a designated person monitor activities around the lines.
- Use only nonconductive ladders when working on or near overhead power lines.
- Do not approach or carry any conductive object closer than 10 feet to an energized line. The only exception is for trained and qualified employees using insulated tools designed for high voltage lines.

Operating cranes near power lines

- If using a crane/equipment near lines rated at 50,000 volts (50 kv) or less, minimum distance between the energized lines and any part of the crane (boom, load line) must be at least 10 feet.
- If using a crane/equipment near energized lines rated at 50,000 volts (50 kv) or more, minimum distance between the energized lines and any part of the crane must be at least 10 feet plus 0.4 inch for each 1,000 volts over 50,000 volts.
- Where it is difficult for the operator to maintain the desired clearance by visible means, an employee shall be designated to observe the distance between the crane/equipment and the line so as to give timely warning to the operator. This should be the ONLY job the monitor is performing when this hazardous condition is present.

Construction workers need to be alert and aware of their surroundings at all times. However, when working around electric power lines, you must be extremely sensitive to the electrical hazards you could be exposed to.

Electrical Safety—Overhead Power Line Safety Sign-Off Sheet

This sign-off sheet documents the employees at this company, ______________________, who have taken part in a training session on Electrical Safety—Overhead Power Line Safety. The session covered:

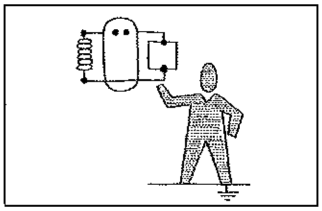
- What to do before beginning work near overhead power lines.
- How to work safely with tools and equipment near overhead power lines.
- How to safely operate cranes near overhead power lines.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: ____________________ **Job Location:** ______________________

Employee Signature	**Print Name Here**

____
Supervisor's Signature



Electrical Safety — Protection (GFCIs & Assured Equipment Grounding Conductor Program)

Overview Of Topic

At construction sites the most common electrical hazard is the ground fault electrical shock. A ground fault occurs when a "hot" electrical wire contacts a grounded enclosure. In most situations, the fault will trip a circuit breaker or blow a fuse. However, if a break in the ground wire occurs, the worker would no longer be protected unless a secondary safety measure is available.

The use off a ground-fault circuit interrupter (GFCI) is one method to overcome ground and insulation deficiencies. The GFCI is a fast-acting circuit breaker which senses small imbalances in the circuit caused by current leakage to ground and in a fraction of a second shuts off the electricity. The GFCI will not protect employees from line-to-line contact hazards, but it does provide protection against fires, overheating, and destruction of wiring insulation.

OSHA's requires you to provide either a ground-fault circuit interrupters, or a scheduled and recorded assured equipment grounding conductor program.

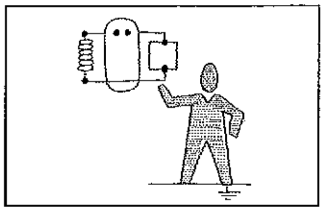
Ground-fault circuit interrupters (GFCIs)

You are required to provide approved ground-fault circuit interrupters for all 120-volt, single-phase, 15- and 20-ampere receptacle outlets on construction sites not a part of the permanent wiring of the structure and which are in use by employees. Receptacles on the ends of extension cords are not part of the permanent wiring and must be protected by GFCIs.

GFCIs monitor the current-to-the-load for leakage to ground. When this leakage exceeds 5mA +/- 1 mA, the GFCI interrupts the current. They are rated to trip quickly enough to prevent electrocution.

Assured equipment grounding conductor program

The assured equipment grounding conductor program covers all cord sets, receptacles which are not a part of the permanent wiring of the structure, and equipment connected by cord and plug.



Electrical Safety — Protection (GFCIs & Assured Equipment Grounding Conductor Program)

OSHA requires:

- A written description of your program to be kept at your jobsite outlining your specific procedures for the required inspections, tests, and test schedule.
- That required tests be recorded, and the record kept until replaced by a more current record.
- That you designate one or more competent persons to implement the program.
- Electrical equipment noted in the program must be visually inspected before each day's use. Any damaged or defective equipment must not be used by employees until repaired.

Two tests are required by OSHA. They are:

- A continuity test to ensure the grounding conductor is electrically continuous.
- A test to ensure that the grounding conductor is connected to its proper terminal.

These tests are required before first use, after any repairs, after damage is suspected to have occurred, and at 3-month intervals. Any equipment failing the required tests cannot be made available or used by employees.

Employee Training

No specific training requirements is mentioned in the electrical standard. However, you must always "instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury."

Training Tips

Go over the program used to protect your employees against the dangers of ground fault electrical shock.

Where To Go For More Information

Regulatory text: 29 CFR 1926.404(b)(1)(ii) and (iii)

National Electrical Code, National Fire Protection Association

Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility

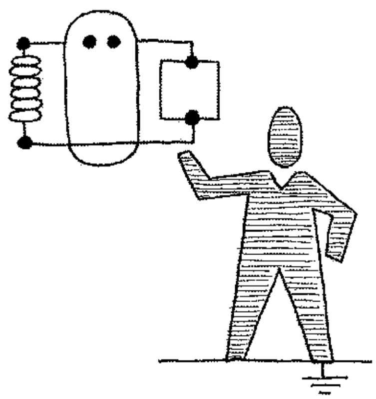
KELLER'S CONSTRUCTION TOOLBOX TALKS

Electrical Safety — Protection
(GFCIs & Assured Equipment Grounding Conductor Program)

When working with electricity, accidents and injuries are caused by one or a combination of the following factors: (1) unsafe equipment and/or installation, (2) unsafe workplaces caused by environmental factors, (3) unsafe work practices.

Preventing electrical accidents

Protection from electrical hazards is one way to prevent accidents caused by electric current. Protective methods to control electrical hazards include insulation, electrical protective devices, guarding, grounding, personal protective equipment (PPE), and safe work practices.



At construction sites, the most common electrical hazard is the ground fault electrical shock.

Ground fault circuit interrupters (GFCIs) or an assured equipment grounding conductor program can eliminate the hazards associated with ground fault electric shock.

The OSHA electrical standard requires your employer to provide either: (1) GFCIs for receptacle outlets in use and not part of the permanent wiring of the structure; or (2) an assured equipment grounding conductor program covering all cord sets, receptacles that are not part of the permanent wiring of the structure, and equipment connected by cord and plug that are for use by employees.

Ground fault circuit interrupters

Although most portable electric tools have an equipment grounding conductor and many are double insulated, these methods are not foolproof. A grounding wire could break or a cord could become defective. Using a GFCI overcomes these insulation problems.

A GFCI is a fast-acting circuit breaker that senses small imbalances in a circuit caused by current leakage to ground. In a fraction of a second the GFCI shuts off the electricity.

Assured equipment grounding conductor program

The assured equipment grounding conductor program is an inspection program covering: (1) all cord sets (extension cords), (2) receptacles that are not a part of the permanent wiring of the structure, and (3) equipment connected by cord and plug that is available for use or is used by employees.

This inspection program includes electrical equipment that must be visually inspected for damage or defects before each day's use. Any damaged or defective equipment must not be used until repaired.

Under this program, OSHA requires the following two tests to be performed before the first use of new equipment, after suspected damage to equipment, and at three month intervals:

- A continuity test to ensure that the equipment grounding conductor is electrically continuous.
- A test to ensure that the equipment grounding conductor is connected to its proper terminal.

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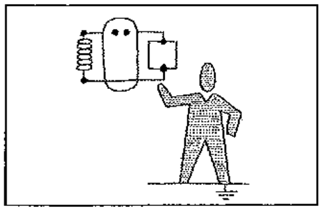
Neenah, WI 54957-0368



Electrical Safety — Protection (GFCIs & Assured Equipment Grounding Conductor Program) Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Electrical Safety — Protection (GFCIs & Assured Equipment Grounding Conductor Program) at

____.

(company name)

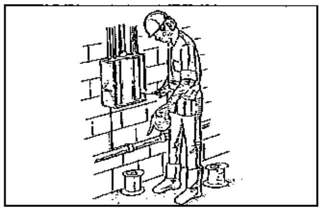
The session covered the following:

- The ground fault electrical shock.
- The requirements for ground-fault circuit interrupters.
- The requirements for an assured equipment grounding conductor program.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: **Job Location:**

Employee Signature	**Print Name Here**



Electrical Safety—Safe Work Practices

Overview Of Topic

You need to instill in your employees a healthy respect for electricity and its power. Safe work practices are essential. Training can ensure your employees recognize electrical hazards and use safe work practices to control or eliminate those hazards.

Safe work practices include: (1) deenergizing electric power circuits and/or equipment before working near, inspecting, or making repairs, (2) using electric tools, extension cords, and other equipment, that is in good repair, (3) using good judgment when working near energized lines (including underground and overhead lines), and (4) using appropriate protective equipment.

Deenergizing electrical equipment

The accidental or unexpected starting of electrical equipment can cause severe injury or death. Employees must not work near any part of an electric power circuit that they could contact during their work, unless protected against shock by deenergizing the circuit and grounding it or by guarding it effectively.

Tags must be placed on controls that are to be deactivated during work on energized or deenergized equipment or circuits. Equipment or circuits that are deenergized must be rendered inoperative and have tags attached at all points where such equipment or circuits can be energized. Employees must:

- Respect warning signs, fences, cages or other barriers for special electrical hazards.
- Repair only those items they are authorized to repair.

Tools

To maximize their safety, employees should always use tools that work properly. Employees must:

- Maintain electrical equipment according to manufacturer and company standards.
- Regularly inspect tools, cords, grounds, and accessories.
- Use safety features like three-prong plugs, double-insulated tools, and safety switches. Keep machine guards in place and follow proper procedures.

- Extension cords are more vulnerable to damage; use and maintain them properly. Never use worn or frayed extension cords.

Underground and overhead lines

Where the exact location of underground lines are unknown, employees using jackhammers or hand tools that may contact a line must be provided with insulated protective gloves. If work is to be done near overhead power lines, the lines must be deenergized and grounded or other protective measures must be provided before work is started. Unqualified employees and mechanical equipment must stay at least 10 feet away from overhead power lines. For voltages over 50,000 volts, the clearance should be increased by four inches for each additional 10,000 volts.

Protective equipment

Employees who are required to work with electricity must use the personal protective equipment required for the job they perform. The equipment may consist of rubber insulating gloves, hoods, sleeves, matting, blankets, line hose, and protective helmets.

Employee Training

No specific training requirements is mentioned in the electrical standard. However, you must always "instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury."

OSHA state-plan-states: Remember that certain states have more stringent regulations that go above and beyond the OSHA standards.

Training Tips

Demonstrate methods for insulating overhead lines and ensuring underground utilities are marked before digging.

Where To Go For More Information

Regulatory text: 29 CFR 1926.400-.449.

National Electrical Code, National Fire Protection Association.

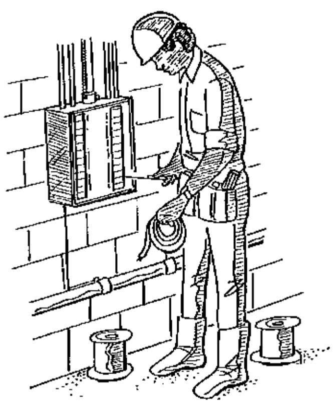
Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility.

KELLER'S CONSTRUCTION TOOLBOX TALKS

Electrical Safety — Safe Work Practices

Have a healthy respect for electricity and its power, it can hurt or even kill. This Toolbox Talk will help you recognize electrical hazards and use OSHA-required safe work practices to control or eliminate those hazards. Safe work practices include: (1) deenergizing electric power circuits and/or equipment before working near, inspecting, or making repairs, (2) using electric tools, extension cords, and other equipment, that is in good repair, (3) using good judgement when working near energized lines (including underground and overhead lines), and (4) using appropriate protective equipment.

Deenergizing electrical equipment



The accidental or unexpected starting of electrical equipment can cause injury or death. Don't work near any part of an electric power circuit that you could contact during your work, unless protected against shock by deenergizing the circuit and grounding it or by guarding it effectively by insulation or other means.

Place tags on controls that are to be deactivated during work on energized or deenergized equipment or circuits. Equipment or circuits that are deenergized must be rendered inoperative and have tags attached at all points where such equipment or circuits can be energized. Respect warning signs, fences, and other barriers, and repair only items you are authorized to.

Tools & PPE

To maximize your safety, you should always use tools that work properly. Tools that are used to handle energized conductors must be designed and constructed to withstand the voltages and stresses to which they are exposed. You must:

- Regularly inspect tools, cords, grounds, and accessories.
- Use safety features like three-prong plugs, double-insulated tools, and safety switches. Keep machine guards in place and follow proper procedures.
- Never use worn or frayed extension cords.

In addition, when you work with electricity, you must use the personal protective equipment required for the job. The equipment may consist of rubber insulating gloves, hoods, sleeves, matting, blankets, line hose, and protective helmets.

Underground and overhead lines

If you are to work near overhead power lines, the lines must be deenergized and grounded or other protective measures must be provided before work is started. Unqualified employees and mechanical equipment must stay at least 10 feet away from overhead power lines. For voltages over 50,000 volts, the clearance should be increased by four inches for each additional 10,000 volts.

Good work habits soon become second nature. Treat electricity with the respect it deserves and it will serve you efficiently and safely.

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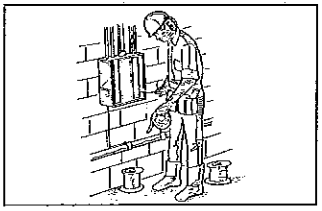


Electrical Safety — Safe Work Practices
Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Electrical Safety — Safe Work Practices at ______________________________.
(company name)

The session covered the following:

- The requirement for deenergizing electric power circuits and/or equipment before working near, inspecting, or making repairs.
- Requirement for using electric tools, extension cords, and other equipment.
- Methods for overhead and underground lines.
- Using appropriate protective equipment.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: **Job Location:**

Employee Signature	**Print Name Here**

Electrical Safety—OSHA's Top 5 Electrical Violations

Overview of Topic

OSHA regulates electrical equipment and systems as used in construction under 29 CFR 1926, Subpart K—Electrical. Accidents involving electricity are one of the top four killers at construction sites. Each year approximately 17% of all construction fatalities are a result of electrical hazard accidents.

This Toolbox Talk highlights the current top five electrical safety violations. This is a good place to start when instructing your employees in electrical safety.

You also need to remember that in §1926.403(b) it says: *The employer shall ensure that electrical equipment is free from recognized hazards that are likely to cause death or serious physical harm to employees. Safety of equipment shall be determined on the basis of the following considerations...* .This is known as the General Duty Clause for electrical safety. It is a catch all regulation for electrical hazards at your jobsite.

#1

Ground fault protection—Employers must use either ground fault circuit interrupters or an assured equipment grounding conductor program to protect employees on construction sites. (§1926.404(b)(1))

Ground fault electrical shocks are the most common electrical jobsite hazard. This rule is designed to take away that hazard. For details on the requirements see the above OSHA reference.

This rule is currently the 5th most cited OSHA regulation.

#2

Temporary wiring—Temporary electrical power and lighting wiring methods may be of a class less than would be required for a permanent installation. Except as specifically modified in paragraph §1926.405(a)(2) of the construction regulations, all wiring must meet the requirements for permanent wiring. Temporary wiring must be removed immediately upon completion of construction or the purpose for which the wiring was installed. (§1926.405(a)(2))

This rule is currently the 14th most cited OSHA regulation.

#3 **Path to ground**—The path to ground from circuits, equipment, and enclosures must be permanent and continuous. (§1926.404(f)(6))

Temporary wiring and extension cords are a major part of the construction jobsite. Interrupted equipment grounds are an invitiation to disaster.

This is currently the 22nd most violated construction regulation.

#4 **Flexible cords and cables—Identification, splices, and terminations**—§1926.405(g)(2)) covers the requirements for flexible cords and cables. This is OSHA's term for extension cords. Covered here is requirements for: (1) identifying the grounded conductor (usually green), (2) flexible cord marking requirements (i.e., SJO, STO, etc.), (3) requirements for splicing/repairing extension cords, and (4) strain relief requirements.

#5 **Installation and use of equipment**—Listed, labeled, or certified equipment must be installed and used in accordance with instructions included in the listing, labeling, or certification. (§1926.403(b)(2))

At times, electrical equipment is installed or used in a manner for which it was not designed. A good example is the multi-receptacle outlet box. It is designed to be mounted but is sometimes fitted with a power cord and placed on the floor to provide power for various tools.

Employee Training

No specific training requirements are mentioned in the electrical standard. However, you must always instruct employees in the recognition and avoidance of unsafe conditions and the regulations applicable to their work environment to control or eliminate any hazards or other exposure to illness or injury.

Training Tips

Pick any one or two of the five stated rules. Discuss how that rule applies to your jobsites. Do you have equipment that is not up to standard? Maybe you have some examples of jury-rigged junction boxes or defective extension cords to share.

Where To Go For More Information

Construction regulatory text: §1926, Subpart K—Electrical

General industry regulatory text: §1910, Subpart S—Electrical

National Electric Code, NFPA 70

KELLER'S CONSTRUCTION TOOLBOX TALKS

Electrical Safety—OSHA's Top 5 Electrical Violations

Accidents involving electricity are one of the top four killers at construction sites. Each year, approximately 17% of all construction fatalities are a result of an electrical accident.

This Toolbox Talk highlights the current top five electrical safety violations. This is a good place to start when working with electricity and the problems found at typical jobsites.

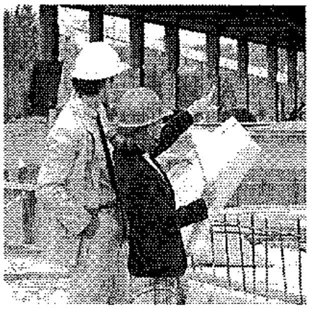
#1 Ground fault protection

Electrical circuits and equipment must be protected by either ground fault circuit interrupters or an assured equipment grounding conductor program to protect employees on construction sites.

Ground fault electrical shocks are the most common electrical jobsite hazard. This rule is designed to take away that hazard.

#2 Temporary wiring

Temporary electrical power and lighting wiring methods may be of a class less than would be required for a permanent installation. Except as specifically modified in §1926.405(a)(2) of the construction regulations, all wiring must meet the requirements for permanent wiring. Temporary wiring must be removed immediately upon completion of construction or the purpose for which the wiring was installed.



#3 Path to ground

The path to ground from circuits, equipment, and enclosures must be permanent and continuous.

Temporary wiring and extension cords are a major part of the construction jobsite. Interrupted equipment grounds are an invitation to disaster.

#4 Flexible cords and cables—Identification, splices, and terminations

The OSHA regulations cover the requirements for flexible cords and cables. This is OSHA's term for extension cords. Covered is requirements for: (1) identifying the grounded conductor (usually green), (2) flexible cord marking requirements (i.e., SJO, STO, etc.) (3) requirements for splicing/repairing extension cords, and (4) strain relief requirements.

#5 Installation and use of equipment

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

At times, electrical equipment is installed or used in a manner for which it was not designed. A good example is the multi-receptacle outlet box. It is designed to be mounted but is some times fitted with a power cord and placed on the floor to provide power for various tools.

When not installed, tested, inspected, and used properly, electrical equipment can be deadly. Do not use electrical equipment that is obviously bad.

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Electrical Safety—OSHA's Top 5 Electrical Violations Sign-Off Sheet

This sign-off sheet documents the names of employees who attended this training session on OSHA's Top 5 Electrical Violations at ______________________________.
(company name)

The session covered:

- Ground fault protection.
- Temporary wiring.
- Path to ground.
- Flexible cords and cables.
- Installation and use of equipment.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: ____________________ **Job Location:** ____________________

Employee Signature	**Print Name Here**

____
Supervisor's Signature