# Electrical Safety Policy

## Summary

This policy establishes the requirements for the identification and training of employees who work on or **near** exposed energized and de-energized parts of electrical equipment. The electrical safety-related work practices contained within this policy apply to all groups uniformly within BT.

- This policy covers all employees who face a risk of electrical shock, direct or indirect, that is not reduced to a safe level by Siemens general policy or proper electrical installation requirements listed in the National Electrical Code (NEC), National Electric Safety Code (NESC), and the Occupational Safety and Health Administration (OSHA) standards.
- The degree of exposure to electricity and the hazards it poses varies among Siemens employees, depending on their job assignment and work area. Personnel involved in engineering, installation, maintenance, modifications, and electrical calibration/testing are considered to have direct exposure to electrical hazards. Other employees who may be expected to face risk of injury due to electrical shock or other electrical hazards are also covered by this policy.

- Employees who are not expected to be at risk to electrical hazards due to the nature of their work, such as office personnel (excluding sales personnel tasked with electrical sales proposal data gathering), are exempt from this policy as long as they do not work near or come in contact with electrically-powered equipment.
- Contractors are required to coordinate electrical-related activities with a Siemens' representative. A contractor's lock-out/tag-out and other electrical safety-related work practices are subject to review and approval prior to beginning work.

## 1.1 Safe Work Practices

### *1.1.1 Selection and Use of Work Practices*

Safety-related work practices are employed to prevent electrical shock or other injuries resulting from direct or indirect electrical contacts, when work is performed near or on equipment or circuits which may be energized.

Live parts which may expose an employee to more than 50 volts are de-energized before the employee works on or near them.

If exposed live parts are not locked or tagged out, they are treated as energized parts, and other safety-related work practices are used to protect employees who may be exposed to the electrical hazards involved.

When working around exposed high voltage (greater than 600 volts) electrical parts, an authorized Safety Observer

is assigned to be in close proximity to the work location. This Safety Observer understands the hazards of the work to be performed and is knowledgeable of the safe work practices required. **The Safety Observer must not be involved in the work performed and is trained in rescue procedures including CPR and First-Aid techniques.**

Only qualified persons work on live exposed parts. Qualified persons are persons that meet both OSHA and NFPA 70E training and experience requirements.

**In California,** persons qualified to perform work within minimum clearance distances when there are live high voltage (greater than 600 volts) exposed parts, must have at least 2 years of combined training and experience working with high voltage. Employees in training are allowed to work within such areas under the direct supervision of a qualified person.

**Note:** It is BT general policy that **NO** work will be performed on any equipment, conductors, and/or exposed parts at 50 volts and above while they are energized, unless the specific "limited," "restricted," and "prohibited" approach boundary requirements defined by the NFPA 70E are met, and an Energized Work Permit is completed for non-routine work or test activities (which may be deemed as infeasible for de-energization as per OSHA 29 CFR 1910.333 (a)(1). These exception requirements are delineated in the BT Electrical Live Work Policy, and under certain circumstances may require the explicit approval of a responsible BT Manager or BT Safety Manager. This is

further extended to include operation of customer-owned electrical equipment.

### *1.1.2 Primary Rule*

Electrical equipment and lines must be considered energized until isolated, tested, locked out and/or tagged out, and grounded. **Until appropriate grounds are firmly placed, these devices are to be considered energized!**

### *1.1.3 Verification of De-Energized Condition*

A qualified person verifies the equipment is properly isolated, locked out, and cannot be restarted or energized (tryout). They use appropriate test equipment to test circuit elements and electrical parts of equipment to which workers may be exposed, and verify that all elements and parts are de-energized. A qualified person installs appropriate grounding.

The qualified person determines whether the potential for any induced voltage or unrelated voltage back-feed exists (even though specific parts of the circuit have been de-energized).

Test equipment is checked for proper operation with a known live source immediately before and immediately after the test.

### *1.1.4 Safe Work Zone*

Occasionally establishing protection boundaries is necessary. Identify and barricade work areas containing electrical hazards not normally encountered during routine

operation of the equipment and/or conductors located therein.

This happens normally during maintenance, renovations to existing installations, or additions to installations where high-voltage equipment and/or conductors are located and exposed. Appropriate identification warns workers of the hazards in their work areas.

### *1.1.5 Protection Boundary*

Area access is restricted to qualified workers only. Unqualified workers may access the area if escorted by a qualified worker.

A flash hazard analysis is done before a person approaches an exposed electrical conductor or circuit part not placed in an electrically safe work condition. This analysis establishes a Flash Protection Boundary used to define the level of PPE necessary to perform work safely.

If the work exposes energized or moving parts normally protected, danger signs are displayed. Suitable barricades are erected to restrict other personnel from entering the area.

When working in a restricted section that adjoins other sections, a qualified worker marks the work area and places barriers to prevent accidental contact with energized parts in adjacent sections.

A qualified person determines the size of the safe zone. The voltage applied and the available fault at the work location of exposed energized conductors is considered.

The dimension is established by the use of the “ten foot rule.” The calculation of the Flash Protection Boundary made in the Flash Hazard Analysis is compared with “ten foot rule” to identify which is greater and usable as the perimeter of the protection boundary.

### *1.1.6 Areas Accessible to Vehicular and Pedestrian Traffic*

When vehicles and non-qualified pedestrian traffic pass adjacent to exposed energized electrical equipment under maintenance, operating, or where construction activity could compromise the safety of these vehicles and pedestrians, appropriate warning signs and/or barricades are used.

### *1.1.7 Use of Electrical Hazard Barricade Tape/Rope*

Electrical hazard barricade tape/rope is intended as a temporary hazard warning. Temporary is defined as the duration of any work assignment where there is an active effort to complete a permanent installation and worker safety is not compromised.

The recommended color is red. It is recommended the red tape be imprinted with wording such as "Danger - Electrical Shock Hazard."

### *1.1.8 Job Briefings*

Before an electrical work operation begins entry into the protection boundary, personnel are briefed on the safety concerns, energy source controls, required personal protective equipment, and precautions regarding their

assignments. The BT Pre-Work Safety Log is used for this purpose.

Whenever work conditions or methods change in a way that could potentially compromise personnel safety, additional briefings are held.

The job briefings are conducted by the task supervisor or person-in-charge.

If the work or operations during the day are repetitive, at least one job briefing is conducted before the start of the first job of the day. Additional job briefings are held if changes affecting the safety of workers occur during the course of the work. Workers reporting to the job site after the work has begun receive a full job briefing before they begin work.

A job briefing is a brief discussion if the work task is routine and familiar to the workers. If the task is more complicated or particularly hazardous, or if workers may not recognize the hazards involved, a more extensive discussion is conducted.

Personnel working alone are required to plan their respective work and utilize the BT Pre-Work Safety Log.

## 1.2 Lock-Out/Tag-Out

### *1.2.1 General*

This section establishes the basic minimum requirements for the lock-out and/or tag-out of energy isolating devices and systems. This procedure covers the servicing and

maintenance of machines and equipment for which the unexpected startup or the release of stored energy may cause injury. The energy sources to be isolated and controlled include electrical and all other energy forms found in the work place.

BT management ensures all BT employees at facilities as well as field jobsites understand and comply with customer and/or other contractor procedures which may affect BT operations.

## Responsibility

BT management must:

- Assure all employees comply with the program
- Assure affected employees are trained
- Identify the types of hazardous energy that must be locked or tagged out
- Ensure machines and equipment are rendered inoperative before any employee is allowed to perform servicing or maintenance where the unexpected energizing, start up, or release of stored energy could occur and cause injury
- Provide the necessary locks, tags, and padlocks to comply with the program
- Review areas where lock-out/tag-out is required to assure compliance with the program

## Lock-Out/Tag-Out

- If an energy isolating device is not capable of being locked out, the site must tag out the system.
- If an energy isolating device is capable of being locked out, it is preferred that the system be locked out. If the customer does not permit lock-out of the system, the site uses a tag-out system to provide employee protection.
- New machines or equipment are designed to accept lock-out devices on energy isolating devices. During replacement, repair, renovation, or modification of existing equipment or machines, energy isolating devices are modified to accept lock-out devices.

## Full Employee Protection

- When a tag-out device is used on an energy isolating device without a lock-out device but is capable of being locked out, the tag-out device is attached at the same location that the lock-out device would have been attached, and the tag-out procedure provides the same level of safety as using a lock-out procedure.
- Removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle may be necessary to demonstrate the level of safety with a tag-out–only procedure, which is equivalent to a lock-out procedure.

## 1.3 Energy Control Procedure

### *1.3.1 Preparation for Lock-Out/Tag-Out*

Before an authorized or affected employee turns off a machine or equipment, the authorized employee should have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the methods or means to control the energy. Site maintenance procedures are reviewed to identify complete isolation requirements.

The authorized person determines whether lock-out or tag-out, or both will be used on the piece of equipment, and follows the respective procedure. A tag is always used in conjunction with a lock to identify the ownership of the lock and the affected system.

### *1.3.2 Sequential Lock-Out Procedure*

The authorized employee performing the servicing or maintenance during which a lock-out is required must:

1. Notify all affected employees the equipment is going to be locked out and the reason for the lock-out.
2. If permitted to do so, shut down the equipment by the normal stopping procedure. Otherwise, have it shut down by someone who is permitted to do so.
3. Operate the isolating device(s) so the equipment is isolated from its energy source(s) and is in the “safe” or “off” position (electric circuit breaker, air valve, chemical valve, gas valve, etc.).

4. Lock out the energy isolating device(s) by securing the assigned individual locks and tags on them.
5. Test the lock-out to ensure it is securely attached and locked.
6. Test the energy isolating device(s) to ensure they cannot be energized with the lock-out in place.
7. After making sure that no personnel are exposed, operate the push-button or other operating controls to make certain the equipment does not operate, and verify isolation and de-energization of the machine or equipment.
8. Following the application of lock-out or tag-out devices to energy isolating devices, all potentially hazardous stored or residual energy is relieved, disconnected, restrained, and otherwise rendered safe and in the ZERO ENERGY STATE (a term for no potential energy, as described in 6.4.3 below).
9. If there is a possibility of re-accumulation of stored energy to a hazardous level, verification of isolation is continued until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists. This is documented on the tag under "Remarks." The equipment is now locked out.
10. Complete the service or maintenance. If the activities take more than one shift or if new personnel begin to work on the equipment, verify the source is in ZERO ENERGY STATE prior to beginning work on the equipment and repeat steps 6 through 9 above.

### *1.3.3 Zero Energy State*

When a lock-out or tag-out is applied, there still is danger of injury from stored energy sources such as machine parts which could rotate or create an electrical hazard, hydraulic pressure, spring loading, etc.

All such stored energy sources must be placed in the Zero Energy State before the work is begun. This work is done by:

1. Blocking, releasing, or otherwise safely securing any parts or mechanisms which can still move or rotate due to gravity, springs, pressure, or other means.
2. Safely releasing any stored electrical, hydraulic, pneumatic, steam, or other types of energy pressure.
3. Safely removing any chemicals and/or pressure trapped in piping, process, or storage systems.
4. Safely releasing pressurized lines or vessels by fully opening bleed off (or relief) valve. When pressure appears to be dissipated (released), double check this by opening a second vent.

If there is a possibility that the dissipated stored energy can re-accumulate to a hazardous level, continue to check it until the service/maintenance is complete or until this possibility of re-accumulation no longer exists and either:

a. Again place it in the Zero Energy State, *or*
b. Make certain it is isolated and is not a potential energy source.

### *1.3.4 Tag-Out Sequential Procedure*

Whenever a lock-out cannot be used because the equipment does not have a lock-out capability, a tag-out is used.

The tag-out procedure is the same as the lock-out procedure, with the following exceptions:

1. If the tag(s) cannot be secured directly to the energy isolating device(s), they are located as close as safely possible to the energy isolating device(s), in a position immediately obvious to anyone attempting to operate the device(s).
2. The tag-out must provide a level of safety equivalent to a lock-out. Tag-out devices should be affixed in such a manner that clearly indicate the operation or movement of energy isolating devices from the "Safe" or "Off" position is prohibited. Additional ways of making certain that employees are fully protected must be included in the tag-out, such as:
   a. Removal of an isolating circuit element
   b. Blocking of a controlling switch
   c. Opening of an extra disconnecting device
   d. Removal of a valve handle
   e. Any additional methods are applied as required, in order to reduce the possibility of inadvertent or accidental energization of the equipment.

### *1.3.5 Release from Lock-Out or Tag-Out*

Before lock-out or tag-out devices are removed and energy is restored to the machine or equipment, procedures are followed and actions taken in the following sequence by authorized employee(s) ensuring the following:

1. The work area is inspected to ensure non-essential items, tools, and equipment have been removed and the machine or equipment components are operationally intact. Special considerations are made to assure that all grounds, both personal and static, are removed and accounted for.
2. All guards, covers, safety devices, etc., have been reinstalled and properly secured, activated, etc.
3. The work area is checked to ensure all employees have been safely positioned or removed. Before devices are removed and before machines and equipment are energized, affected employees are notified the lock-out or tag-out devices have been removed.
4. Each lock-out or tag-out device is removed from the energy isolating device by the employee who applied the device. <u>If the employee is not available</u>, a specific procedure addressing the methods for safe removal of the device must be in place at the jobsite. The procedure must be included in the training program and consists of the following elements:
    a. The Project Manager or Operations Supervisor verifies the authorized employee who applied the device is not at the facility or jobsite. This is

accomplished in the presence of at least one witness and is documented on the BT Pre-Work Safety Log.

b. All reasonable efforts are made to contact the authorized employee who applied the device to inform them that their lock-out or tag-out device is being removed.

c. The authorized employee who applied the device must have knowledge of the removal of their lock or tag before they resume work at the facility or jobsite. The removed lock or tag is presented to the employee upon return, and the Project Manager or Operations Supervisor requires the returning employee to sign a document acknowledging receipt of their compromised device.

5. Operate the energy isolating device(s) to restore energy to the equipment.
6. Notify those permitted to start up the equipment it is ready for start-up.

### *1.3.6 Protective Materials and Hardware*

Locks, tags, chains, wedges, key blocks, adapter pins, pipe blanks, self-locking fasteners, or other hardware are provided for isolating, securing, or blocking of machines or equipment from energy sources.

Lock-out devices and tag-out devices are identified, used as the only device for controlling energy, and not used for any other purposes. They are required to be:

1. Durable

- Capable of withstanding the environment to which they are exposed for the maximum period of time exposure is expected.
- Constructed and printed so exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.
- Tags do not deteriorate when used in corrosive environments where acid and alkali chemicals are handled or stored.

2. Standardized
    - Standardized within the facility by either color, shape, or size. In the case of tag-out devices, the print and format should be standardized.
3. Substantial
    - Lock-out devices must be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as bolt cutters or other metal cutting tools.
    - Tag-out devices and their means of attachment are substantial enough to prevent inadvertent or accidental removal. Tag-out device attachment means are of a non-reusable type, attachable by hand, self-locking, and a minimum unlocking strength of no less than 50 pounds. Nylon cable ties are suggested.
4. Identifiable
    - Fully identify the employee applying the device.

- Tag-out devices warn against hazardous conditions if the machine or equipment could become energized, and includes a legend such as "Do Not Start," "Do Not Open," Do Not Close," "Do Not Energize," or "Do Not Operate."

### *1.3.7 Periodic Inspection*

An inspection is conducted at least once per the duration of the job and not less than once per year to ensure the lock-out/tag-out procedures are followed. The inspection includes the following:

- Performed by an authorized employee other than the employees who utilize the procedure
- Designed to correct any deviations or inadequacies observed
- A periodic review with the inspector and the employees using the procedure to identify the employee responsibilities when using the procedure
- Certification of inspection identifying the machine included in the inspection, and the person performing the inspection

### *1.3.8 Training and Communication*

Training is provided to those employees who use the lock-out/tag-out procedure and includes:

- Recognition of hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control.

- Each affected employee is instructed in the purpose and use of the lock-out/tag-out procedure.
- Other employees, whose work may be in area where lock-out/tag-out procedures are used, are made aware of the procedure and restrictions on restarting or energizing machines or equipment locked out or tagged out. This includes subcontractors hired by BT under the scope of the job.
- Employees shall be trained on the limitations of tags as described below.
- Retraining is conducted whenever there is a change in job assignments, machines, equipment, or processes where a new hazard may be present. The retraining re-establishes employee proficiency and introduces new or revised control methods and procedures as necessary.
- Certification of training is kept, including the employee's name and dates of training.
- Training is conducted on the specific methods for safe removal of the device at the jobsite, should the employee who applied the lock not be available.

### *1.3.9 Notification of Employees*

Affected employees are notified during lock-out/tag-out procedures. Notification is given before the controls are applied and after they are removed from the machine or equipment.

## 1.4 Additional Requirements and Restrictions

### *1.4.1 Temporary Removal of Lock-Out or Tag-Out*

In situations where lock-out or tag-out devices must be temporarily removed from the energy isolating device and the machine or equipment is energized to test or position the machine, equipment, or component, the following sequence is followed:

1. Clear the machine or equipment of tools and materials.
2. Remove employees from the machine or equipment.
3. Remove the lock-out or tag-out devices.
4. Energize and proceed with testing or positioning.
5. De-energize all systems and reapply energy control measures.

Whenever outside servicing personnel are engaged in activities covered by the scope and application of this policy, the Project Manager or Operations Supervisor informs the servicing personnel of this policy and determines if other procedures may apply.

The Project Manager or Operations Supervisor ensures BT employees at the jobsite understand and comply with restrictions and prohibitions of other lock-out/tag-out procedures, which may affect BT operations at the jobsite.

### *1.4.2 Group Lock-Out or Tag-Out*

When servicing and/or maintenance is performed by a crew, force, department, or other group, they utilize a procedure which affords the affected employees a level of

protection equivalent to that provided by the implementation of a personal lock-out or tag-out device.

Group lock-out or tag-out devices are used in accordance with this policy, including the following specific requirements:

- Primary responsibility is vested in one authorized employee (the “Person-in-Charge”) for a set number of employees working under the protection of a group lock-out or tag-out device.
- Provisions are made for the employee with primary responsibility (“Person-in-Charge”) to ascertain the exposure status of individual group members with regard to the lock-out or tag-out of machines or equipment.
- When more than one crew, force, department, etc. is involved, assignment of overall job-associated lock-out or tag-out control is given to one authorized employee (“Person-in-Charge”) to coordinate affected work forces and ensure continuity of protection.
- Each authorized employee affixes a personal lock-out or tag-out device to the group lock-out device, group lock box, or comparable mechanism when they begin work, and removes those devices when they stop working on the machine or equipment being serviced or maintained.

### *1.4.3 Shift or Personnel Changes*

Special procedures are utilized during shift or personnel changes to ensure the continuity of lock-out or tag-out

protection, including provision for the orderly transfer of lock-out or tag-out devices between incoming and outgoing employees, and to minimize exposure to hazards from the unexpected energization, startup of equipment, or release of stored energy. An incoming shift involved in group lock-out or tag-out procedures, must place incoming shift lock-out or tag-out devices on the equipment **before** outgoing shift devices are removed.

### *1.4.4 Limitations of Tag-Out*

- Tags are a warning attached to an energy isolating device. They do not provide the same amount of protection against energization of the equipment that a lock-out provides.
- Never remove a tag-out placed by someone else. Never bypass or ignore a tag-out.
- Tags must be legible and understandable.
- Tags and their attachment device must be able to withstand the conditions of their environment.
- Tags may create a false sense of security. Their meaning must be clearly understood.
- Tags must be securely attached to energy isolating devices so that they cannot be accidentally or inadvertently detached during use.

## 1.5 Grounding

This section applies to the grounding of all generation, transmission, distribution, and utilization lines and equipment.

For workers to work on lines or equipment designated as de-energized, equipment isolation must occur, a lock-out/tag-out must be accomplished, and appropriate grounds installed.

Before any grounding equipment is installed, the lines or equipment are tested for absence of voltage unless a previously installed ground is present. The regimen of this test is followed. Before installation of the grounds, the grounding equipment is visually inspected to confirm the equipment's integrity.

Temporary protective grounding equipment is placed at the work location.

If installation of grounds at the work location is not feasible, grounds are installed on each side of the work location as close as possible.

Single-point grounding is an acceptable means of grounding, provided equal potential grounding principals are followed. Everything a worker can touch, reach, or stand upon must be tied to the same ground point.

Protective grounding equipment is capable of conducting the maximum ground-fault current that could flow for the time necessary to clear the fault. This equipment has an amp capacity greater than or equal to number 2 AWG stranded copper. A larger conductor such as 2/0 AWG stranded copper is recommended.

Protective grounds must have an impedance to ground low enough to guarantee prompt operation of protective

devices in case of accidental energization of the lines or equipment.

Before grounding any previously energized part, the worker connects one end of the grounding device to an effective ground. Grounding is accomplished with the use of HV gloves, live-line tools, appropriate clothing, and other necessary personal protective equipment (electrocution-related PPE and arc-flash-related PPE).

After necessary equipment is gathered and set up, a test of the previously energized parts is performed for voltage level using the regimen as detailed in this section. If the parts are free from voltage, the grounding is completed. The grounding device is brought into contact with the previously energized part using live-line tools and securely attached.

**If the test indicates the parts are not free from voltage, the grounds must not be attached to the part.**

Determine the source of the voltage to ensure that the presence of voltage does not prohibit completion of the grounding.

When removing grounds, first remove the grounding devices from the de-energized parts, using live-line tools. Then remove the connection to the ground. **Take extreme caution.** Never remove the connection to the ground prior to removing the connection to the de-energized part. Electric shock and injury may result.

Approved clothing, rubber insulating gloves with protectors, hard hat and eye protection, and necessary

arc-flash-related PPE are worn when testing for voltage and placing/removing grounding devices.

Static capacitors are grounded (discharged for 5 minutes) before work is done on them. A five-minute waiting period is required between isolating the capacitor and applying the grounds to ensure total discharge.

If the employer can demonstrate that the installation of grounds is impractical or presents a greater hazard, the lines or equipment may be worked on but must be considered energized. BT personnel are not allowed to make direct contact with energized circuits. This is considered “live-line work.”

Grounds may be removed temporarily for testing. During the test procedure, the previously grounded lines and equipment must be considered to be energized.

### *1.5.1 Equipotential Grounding*

Equipotential groundings are techniques used in generation, transmission, and distribution lines and equipment. These temporary protective grounds are placed and arranged to prevent each employee from being exposed to hazardous differences in electrical potential. Everything a worker can touch, reach, or stand upon is tied to the same ground point. The following are the different methods:

**Single-point grounding** for pole top is where the worker has connected all three phases together with jumpers to a cluster bar attached to the pole below the worker's feet. A jumper to the neutral, if available,

connects the cluster bar. For all other applications, the conductors and everything a worker can touch, reach, or stand upon is tied to the same ground point. If a ground fault should occur, the worker is at the same voltage as the lines and current does not flow through their body.

**Double-point grounding** is necessary if work at the pole or non-pole location involves breaking the circuit. It is necessary to ground faults that may come from either direction. On both sides of the worker (an "equi-potential zone" is established), the phases are connected to each other, to the cluster bar below the worker's feet, and to the neutral for pole top activities. For non-pole top everything a worker can touch, reach, or stand upon is tied to the same ground point.

**Remote double-point grounding** allows the worker more movement between the jumper sets, but offers less protection than other methods. The grounds are connected to structures such as towers on each side of the work location. Fault current would flow through the towers into the earth. With this method, it is still possible to have potentially fatal current flow into the worker's body. The conductors are treated as energized requiring appropriate PPE.

These grounding techniques require much skill. Hands-on training and qualification is required before practicing these methods.

### *1.5.2 Mobile Equipment Grounding*

To establish an equipment ground on a vehicle trailer or other portable equipment, a connection is made from a suitable ground plate or stud to the best ground available in the immediate work area. Examples of such equipment include cranes, line trucks, and aerial lifts.

On distribution circuits, the common neutral or ground grid system is used as the ground source. A driven ground rod is used only as a last alternative. Workers are instructed to stay clear of the driven ground location. Other protective measures such as barricades are used as necessary.

High-voltage rubber gloves are worn during the attaching and removal of the ground lead at the vehicle. The correct sequence calls for the lead to be attached to the best available ground source first and then to the vehicle. When removing grounds, detach the ground lead first from the vehicle and then from the ground source.

Grounding is done prior to raising a crane, derrick boom, or similar equipment.

The ground device is not removed until after the crane, derrick boom, or similar parts of the equipment have been returned to their cradle and lashed.

Only qualified personnel trained in the proper grounding technique and hazards associated with working around energized or potentially energized circuits are permitted to operate mechanical equipment where these hazards are present. The “10-foot rule” is followed at all times.

### *1.5.3 Grounding Equipment and Material*

Safety ground leads are applied to mobile equipment as described in the previous subsection. It is required that safety ground leads are not less than 2/0 flexible stranded copper rubber-covered cable.

Ground leads are visually inspected for any type of damage or wear before first use of the day.

## 1.6 Operator Training

Mobile equipment operators are qualified in electrical work (29 CFR 1910.269) and have had live-line training if their equipment has the potential for coming closer than the "10-foot rule" to energized lines or equipment. Few, if any, BT employees will fit this description.

**Potential Additional Training Requirements:** Training in the potential electrical shock hazards associated with mobile equipment operation under these conditions is necessary.

### *1.6.1 Notification*

Any mobile equipment operators who notice that operation of their equipment may place that equipment within the "10-foot rule" of energized or potentially energized lines or parts of electrical equipment must notify the appropriate location management, and wait for further safety instructions.

Before the mobile equipment is moved to the job site, responsible engineering/location personnel must notify

contractors and location workers of potential electrical hazards regarding mobile equipment operation (where this potential exposure can be reasonably anticipated before the job assignment starts).

### *1.6.2 Insulated Armored High-Voltage Cable*

The “10-foot rule” does not apply to armored, insulated, high-voltage cable. Work activities can be performed adjacent to this type of cable while it is energized; however, this type of cable must not be disturbed or moved while it is energized.

### *1.6.3 Insulated Non-Armored High-Voltage Cable*

In some cases the “10-foot rule” does not apply to insulated non-armored high-voltage cable.

Because the integrity of this insulation is considered, a review by qualified persons is required before work activities are performed adjacent to this type of cable while it is energized. This type of cable must not be disturbed or moved while it is energized.

### *1.6.4 Enclosed Spaces*

These requirements apply only to enclosed spaces, which are electrical in nature, such as manholes, un-vented vaults, tunnels, etc. that can be entered by workers. OSHA 29 CFR 1910.146 covers all other confined spaces. Refer to the BT Confined Space Policy.

The employer ensures the worker uses safe work practices for entry into and work within enclosed spaces, and for rescue of workers from such places.

If hazards remain after the precautions taken for enclosed space are exercised or if the escape procedures cannot be met, the entry into enclosed spaces must meet the requirements of permit-space or confined space requirements of the BT Permit-Required Confined Space Procedure.

### *1.6.5 Underground Electrical Facilities*

The following are additional requirements for work on underground electrical installations in manholes and/or vaults:

- Ladders or other climbing devices are used to enter or exit manholes or subsurface vaults exceeding four feet (122 cm) in depth. Workers must not use cables or hangers as steps to climb in or out of manholes and vaults.
- Equipment used to lower materials and tools are capable of supporting the weight and are checked for defects before use. Workers working in manholes and vaults must stand clear of the area directly underneath openings while tools or materials are being lowered or raised.
- While work is being performed in a manhole containing energized electrical equipment, a worker capable of rendering emergency assistance is on duty in the immediate vicinity of the manhole opening. This worker must have received CPR/First Aid training and cannot enter the manhole.

- When working in a manhole or vault with energized cable or equipment, all workers are in constant communication. This can consist of visual, voice, or signal-line communication.
- An energized cable is moved only under direct supervision of a qualified worker. It is first inspected for defects.
- When multiple cables are present, exact identification is required by electric means unless identification is obvious. All other cables not being worked on are protected against damage.

Cables may be defective when any of the following abnormalities are observed:

- Oil or compound leaking from cable or joint
- Broken cable sheaths
- Broken joint sleeves
- Hot surface temperatures
- Joints swollen beyond normal tolerances

Sheath continuity is maintained while work is performed on buried cable or in cables in manholes, or the sheath is treated as energized.

### *1.6.6 Trenches and Excavation*

All trenching and excavation is preceded by notification to all utilities and others having underground installations in the affected location. This notice is given 24 hours prior to

starting work unless local or state law requires a longer period.

Normal trenches or excavations less than five (5) feet (1.52 m) deep do not require a protection system, if a Competent Person determines there is no cave-in potential.

All trenching and excavation operations must comply with 29 CFR 1926.650, 1926.651, and 1926.652.

### *1.6.7 Infrared Testing*

Workers performing infrared testing on open high voltage systems located in or on structures wear approved Class E hard hats, leather gloves (min 0.7mm thick), safety glasses with side shields, approved clothing, and leather safety shoes, and should define the arc-flash hazard boundary. If infrared testing brings the worker within the defined arc-flash boundary, the appropriate arc-flash-related PPE is worn.

When performing infrared testing on metal-clad, enclosed switchgear requiring the enclosure to be opened (exposing energized high or low voltage parts), workers must wear, in addition to the personal protective equipment listed above, leather gloves, a face shield, balaclava (sock-hood), and an Arc-rated coverall covering the torso to the feet, with leather work shoes.

While infrared testing is going on, no equipment, tools, or body parts should enter the Minimum Approach Distance