

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL
AND FORT SAM HOUSTON
Fort Sam Houston, Texas 78234-5014

Memorandum
Number 385-7

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Safety
ELECTRICAL

1. Purpose.

- a. To provide Fort Sam Houston (FSH) and contractor personnel with guidance to prevent injury from electrical hazards that cannot be completely isolated by lockout/tagout (LO/TO).
- b. To establish the Electrical Safety Program.

2. Applicability.

- a. This memorandum applies to all military, civilian, and contractor personnel assigned or attached, to Fort Sam Houston (FSH) to include Camp Bullis and Canyon Lake (collectively referred to in this memorandum as FSH) who may be potentially exposed to electrical hazards in the workplace.
- b. It is primarily directed at work under 600 volts.

3. References.

- a. FSH Regulation 385-10, Occupational Safety and Health Program.
- b. FSH Memorandum 385-2, Lockout/Tagout Program.
- c. OSHA Standard 29 CFR §1910.331-335, Subpart S Electrical.
- d. OSHA Standard 29 CFR §1910.269, Electrical Power Generation, Transmission, and Distribution.
- e. FSH Memorandum 385-6, Confined Space Program.
- f. FSH Memorandum 385-9, Ladders.

4. Terminology. Definitions and specific terminology associated with electrical safety are contained in Appendix A.

5. Background.

a. Electricity is the most versatile and widely used energy form. All industrial operations, work places, stores, and homes require large amounts of this available power. However, when this power source is abused, the results may be property damage or personal injury.

b. Recent studies show that 31% of all reported fatal electrical accidents occur in the home, 34% in the work place, and the remaining in the production and distribution of power. This means that 65% of all fatalities are due to sources of electricity under 600 volts. This is the so-called low voltage source.

c. The severity of the shock and possible electrocution depend on:

- (1) Amount of current,
- (2) Path through the body,
- (3) Time of contact, and
- (4) Other items such as frequency, phase of the heart cycle, and general health of the individual.

d. In addition to shock and electrocution, the following causes and injuries can occur when contact is made with electricity.

- (1) Indirect -- Falling, Banging, Lacerations.
- (2) Burns -- Electrical, Arc, Contact.
- (3) Explosions -- Equipment, Body Parts.

6. Policies.

a. The first line of injury prevention from electrical hazard is lockout/tagout (See FSH Memo 385-2). However, when that is not possible, additional precaution shall be taken as described herein.

b. Only fiberglass (plastic) or wooden portable ladders will be used in association with electrical work, in accordance with FSH Memo 385-9. The use of metal ladders is prohibited.

c. Any work within 10 feet of exposed energized Power Transmission and Distribution equipment, or within the perimeter fence of high voltage substations, requires a qualified person or the direct supervision of a person so qualified.

7. Work Practices. The following work practices apply to all FSH and contractor personnel working on or near equipment that poses an electrical hazard. Additional requirements are contained in 29 CFR 1910.269 for power transmission and distribution (see Appendix B).

a. Before maintaining or repairing electrical equipment, disconnect from the power source and follow lockout/tagout procedures. After power disconnection, lock/tag appropriate switches or other devices in accordance with lockout/tagout procedures. If the circuit cannot be locked out, take a secondary step such as removing the fuse, in addition to tagging the switch. After de-energizing the circuit, verify the electricity is indeed disconnected through measurements, attempted activation of equipment, or other means.

b. Use only rated-load switches or circuit breakers to disconnect electric power and lighting circuits. Employees (other than electrical workers) may reset a tripped single-pole convenience outlet or lighting circuit breaker one time, provided it is not located in a designated emergency panel and when, based on their knowledge, it is safe to do so. If the circuit breaker trips again, contact supervision so an appropriate response can be authorized and initiated.

c. Do not use electrical cords to raise or lower equipment.

d. Do not use any equipment that has frayed cords or three wire cord ends that have had the grounding prong removed.

e. Use the proper power receptacle for each application. Do not bend cord-end prongs to fit the wrong receptacle.

f. Use only wood or fiberglass ladders, never metal, when working on or near live electrical equipment.

g. Do not wear wire/metal rimmed glasses, rings or other jewelry, or other conductive apparel when working on live electrical parts.

h. Avoid temporary wiring. Use appropriate ground fault circuit interrupters with any temporary wiring.

i. Unplug all portable electrical hand tools when not in use.

j. Use only double insulated extension cords.

k. Use ground fault circuit interrupters (GFCI) in wet or damp areas or if grounded by pipes, tanks, etc.

l. Inspect extension cords and cords on electrical equipment before each use. Do not use equipment or extension cords with damaged wiring or missing plug prongs until the damage is repaired to its original quality.

m. Do not endanger self or others by attempting to rescue shock victims. De-energize the circuit immediately if the victim is still in contact with electrical energy. If not possible to de-energize the circuit, only trained and qualified, knowledgeable employees should attempt to remove the victim. *NOTE:* All electrical shocks are medically serious regardless of the voltage. Even if the victim shows no apparent signs of injury, he/she shall be seen by a qualified health care professional.

8. Live Equipment.

a. Only qualified persons are allowed to work on or near live equipment. Work on or near live equipment is only permitted when it is impossible to shut off equipment or circuits or when de-energizing the equipment would introduce additional or increased hazards, or is infeasible due to equipment design or operational limitations.

b. Employees must remain alert at all times when working near exposed electrical parts or in situations where electrical hazards may exist. Employees must never reach blindly into areas that may contain live circuits. If alertness is recognizably impaired due to illness, fatigue, or other reasons, the employee shall not be permitted to work in areas containing electrical hazards.

c. Employees must not enter an area containing exposed electrical circuits unless adequate illumination is provided. When illumination or obstructions affect visibility and the

employee can contact the exposed circuits or equipment, the employee is not permitted to perform the task.

d. Employees shall not wear conductive apparel (e.g., watches, rings, bracelets, key chains, necklaces, metalized aprons, cloth with conductive thread, metal head gear), if contact with exposed circuits or equipment could occur. This includes wire or metal-rimmed eyeglasses.

e. Conductive material and equipment in contact with an employee's body must be handled carefully so that he/she does not come in contact with exposed conductors. Conductive material and equipment includes, but is not limited to ducts, pipes, tubes, conductive hoses or ropes, metal-lined rules and scales, and steel tapes or chains.

f. Suitably insulated tools and/or handling equipment shall be used when working near exposed energized conductors or circuit parts where it is possible for these items to make accidental contact with the conductors or parts. The insulating materials on these items must be protected during storage or transportation. When removing or installing fuses from an energized fuse terminal, use fuse handling equipment capable of withstanding the circuit voltage. GFCI protectors shall be used at all sites where employees use portable electric equipment. A GFCI must be located between the power source and the tool.

g. Protective shields, barriers, or insulating material must be used to protect employees from exposed energized parts which might be accidentally contacted or where dangerous electric heating or arcing is likely to occur.

h. Use of metal ladders or ladders which have metal longitudinal (top to bottom reinforcement is forbidden when working on or near exposed energized parts.

i. When work is performed in a confined or enclosed space such as a manhole or vault, precautions to avoid contact with the energized part are required and must be in accordance with FSH 385-6, Confined Space Program. An example of avoiding contact could be securing a swinging door to prevent being inadvertently knocked into energized circuits.

j. Employees must avoid contact with energized overhead lines, either with a body part, a conductive material, a tool, or a piece of equipment. If contact with energized overhead lines is possible, the lines shall be de-energized, guarded, or

insulated. These precautions must be taken before work in the area begins. If the lines cannot be de-energized or guarded, employees must maintain a safe distance from the conductors.

k. Housekeeping and custodial duties shall not be performed adjacent to energized parts where such parts present an electrical contact hazard. Cleaning materials such as water, steam, conductive cleaning fluids, steel wool, metalized cloth or silicon carbide shall not be used in the proximity of energized parts.

9. Extension Cords.

a. Because electrical accidents are often related to the use of faulty or incorrectly repaired extension cords, additional attention must be paid to their use. Oftentimes, the male end of the extension cord is often damaged or altered in some manner that renders the grounding path useless.

b. Repair work often results in the hot and ground (neutral) wires being interchanged. This can energize the metal case of tools or equipment. If used in this condition, fatal accidents can occur when the user supplies the path to the ground through their body.

c. New extension cords must also be tested because of potential reverse polarity. The following procedure will be used for testing extension cords:

(1) Prior to testing the cord, test the receptacle to which the cord will be inserted for polarity.

(2) Plug the extension cord into the power supply (receptacle) that was previously tested.

(3) Plug the circuit tester into the extension cord.

(4) The light code indicated on the circuit tester should be the same as when plugged into the power supply.

d. Extension cords used in the industrial setting will be inspected and tested upon purchase and after a repair has been made. Repairs can only be accomplished by a qualified person and the cord restored to its original condition.

10. Personal Protective Equipment (PPE).

a. Nonconductive head protection, consistent with the potential contact voltage hazard, must be worn where there is danger of head injury from electric shock, burns, or flying or falling objects resulting from an electrical explosion.

b. Safety glasses or face shields, which are rated for UV protection, must be worn where there is a danger of injury to the eyes or face from electrical arcs or flashes, or from flying or falling objects resulting from electrical explosion. (Do not wear metal frame eyeglasses when working on energized systems).

c. Insulating rubber gloves and glove protectors, sleeves, line hoses, blankets, hoods, and mats must be used, as required, to protect the hands and other parts of the body where there is a danger of injury from contacting energized parts.

d. Steel-toed safety shoes must be in good condition when worn in the vicinity of exposed energized circuits (i.e., no exposed steel on the shoes). Only safety shoes with fiber-reinforced toe protection should be worn when working on energized systems of 480 volts or greater.

11. Training.

a. All employees shall be trained in the safe work practices outlined in this memorandum on an annual basis.

b. Unqualified Persons will be:

(1) Trained in and familiar with any electrical safe practices.

(2) Trained in the safe distances from overhead lines when working near overhead lines.

c. Qualified Persons will be:

(1) Knowledgeable on local Lockout/Tagout procedures.

(2) Trained in the safe approach distances to exposed energized parts (see Appendix C).

(3) Trained in the safe approach distances for vehicles operating in the proximity of overhead power lines.

(4) Aware of the determination of proper illumination in work area.

(5) Knowledgeable on the hazards associated with confined spaces, and

(6) Trained on portable ladder safety.

d. All training will be documented on FSH Form 98-E, Employee Safety and Health Training Record.

12. Responsibilities.

a. Installation Safety Office will:

(1) Administer the Electrical Safety Program.

(2) Conduct an annual review of the program.

(3) Assist in training of employees that work on or near live electrical circuits.

(4) Ensure that employees receive the necessary training to perform their job safely.

(5) Ensure PPE complies with applicable standards.

b. Supervisors will:

(1) Ensure sufficient and proper PPE is available for employees.

(2) Ensure employees have been properly trained.

(3) Ensure employees follow all electrical safe work practices.

(4) Conduct spot checks and inspections to enforce electrical safety practices are being followed (See Appendix D).

c. Employees will:

(1) Attend and participate in all training classes.

(2) Follow safe work practices.

(3) Report unsafe work practices to supervision using the FSH Form 96-E, Accident/Incident/Near Miss Report.

(4) Perform only the task that you are trained for, knowledgeable of, equipped for, and authorized to do.

Appendix A Terms

Bonding - The permanent joining of metallic parts to form an electrically conductive path, which provides electrical continuity and the capacity to safely conduct current and complete a circuit.

Bonding Jumper - A reliable conductor that assures the required electrical conductivity between metal parts to be electrically conducted.

Grounded - A conductive body such as the earth that is used as a common return for an electrical circuit.

Ground Fault Circuit Interrupter (GFCI) - A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit. This is normally when a difference of 5 milliamperes, plus or minus 1 milliamperere, is detected between the two circuit conductors.

Labeled - An identifying mark or symbol attached or affixed to the equipment. The label or symbol distinguishes a nationally recognized testing laboratory, which makes periodic inspections of the production of such equipment and whose labeling indicates compliance with nationally recognized standards or performance in a specified manner.

Lockout/Tagout (LO/TO) - Use of designated locks and tags as a means of preventing equipment, machines or lines from becoming energized.

Qualified Person - One who is familiar with the construction and operation of the equipment and the hazards involved, and at a minimum shall be trained in and familiar with the following:

1. The skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment.
2. The skills and techniques necessary to determine the nominal voltage of exposed live parts.

3. The clearance distances specified in 29 CFR 1910.333(c) and the corresponding voltages to which a qualified person will be exposed.

4. Job-relevant National Electric Code training, as applicable.

Unqualified Person - An employee whose work exposes them to electrical hazards, which they are unfamiliar with in their usual duties. These employees shall be trained in safe work practices that pertain to their respective jobs if their work or the work of those they supervise bring them close enough to exposed parts of electric circuits operating at 50 volts to ground for a hazard to exist.

Appendix B
WARNING SIGNS AND MARKINGS

<p>Entrance to rooms or other guarded locations containing exposed live parts (600 volts nominal)</p>	<p>Post conspicuous warning sign forbidding unqualified persons from entering</p>
<p>Entrance to buildings, rooms or enclosures containing exposed live parts (over 600 volts nominal)</p>	<p>Post warning sign reading <i>Danger-High Voltage- Keep Out</i> or similar language. Entrance must remain locked.</p>
<p>All electrical equipment</p>	<p>Mark equipment with the manufacturer's name, trademark, or other marking indicating the organization responsible for the product. Additional requirements for marking voltage, current, wattage, or other ratings maybe specified by the National Electric Code (NEC).</p>
<p>Disconnection of power sources (including circuit breakers)</p>	<p>Mark each disconnection required for motors, appliances, and each service feeder or branch circuit at the point where it originates to indicate its purpose unless located and arranged so that the purpose is evident.</p>
<p>Circuit breakers or fuses applied in compliance with series combination ratings.</p>	<p>Mark equipment enclosure to indicate the equipment has been applied with series combination rating. Markings must state <i>caution-series rated system amps available - Identified replacement component required.</i></p>
<p>Transformers-Exposed live parts</p>	<p>Mark with operating voltage.</p>
<p>Fused cutouts not interlocked with the switch to prevent opening of cutouts under load.</p>	<p>Post conspicuous sign at the cut outs reading <i>Warning-Do Not Open Under Load</i></p>
<p>More than one switch is installed with interconnected load terminals to provide for alternate connection to different supply conductors</p>	<p>Post conspicuous sign reading <i>Warning- Switch may be Energized by Backfeed at each switch.</i></p>

Appendix C
SAFE APPROACH DISTANCES FOR QUALIFIED PERSONS
(ALTERNATING CURRENT)

300V and less	Avoid Contact
Over 300V, not over 750V	1 ft. 0 in.
Over 750V, not over 2kV	1 ft. 6 in.
Over 2kV, not over 15kV	2 ft. 0 in.
Over 15kV, not over 37kV	3 ft. 0 in.
Over 37kV, not over 87.5kV	3 ft. 6 in.
87.5kV, not over 121kV	4 ft. 0 in.
Over 121kV, not over 140kV	4 ft. 6 in.

MINIMUM SAFE DISTANCE FOR VEHICLES OPERATING IN PROXIMITY
OF OVERHEAD POWER LINES

50kV or below	10 ft.
Above 50kV	10 ft. plus 4 in. per 10kV greater than 50kV

**Appendix D
ELECTRICAL SAFETY CHECKLIST**

Employee _____ Date: _____

	Yes	No
Have exposed wires, frayed cords, and deteriorated insulation been replaced or repaired?		
Are junction boxes, outlets, switches, and fittings covered?		
Does equipment connected by cords and plugs have grounded connections?		
Are electrical appliances such as vacuums, blowers, and vending machines grounded?		
Are all portable electrical tools/equipment grounded unless double insulated?		
Are all breaker switches identified by their use?		
Are flexible cords and cables installed in appropriate places (not through holes in walls or ceilings, through doorways or windows, or attached to building surfaces)?		
Are flexible cords and cables free from splices or tape repairs and conduit connections intact?		
Are multiple plug adapters used? (not recommended).		
Is the electrical equipment in wet or damp locations properly protected, and if extension cords are required, are they GFCI protected?		
Are flexible cords and cables substituted for fixed hard wiring?		
Are lockout/tagout procedures used during work on equipment?		
Are all metal framework assemblies, including the motor on electrical machines, grounded?		
Do you have required personal protective equipment (PPE) necessary to do the job safely?		
Are you wearing recommended fiber-reinforced toe safety shoes? (steel-toed safety shoes should not be worn where 480 volts or greater is present.)		
Are GFCI's being utilized in wet or damp locations and for work outside		

NOTE: Any "No" must be brought to supervisor's immediate attention.

(MCCS-BPM-S)

FOR THE COMMANDER:

OFFICIAL:

/S/
LUCY S. PEREZ
Secretary of the General Staff

/S/
MICHAEL J. REDWINE
MAJ, AG
Adjutant General

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