

UNITED STATES MARINE CORPS
Utilities Instruction Company
Marine Corps Engineer School
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U-05D01
NOV 99

STUDENT HANDOUT

ELECTRICAL SAFETY

LEARNING OBJECTIVE:

a. TERMINAL LEARNING OBJECTIVE:

(1) Provided an operation order and a field electrical power generation and distribution system plan, with the aid of references, identify the safety requirements that pertain to the installation and operation of the electrical distribution system in accordance with FM 5-424 and the National Electric Code. (1169.04.19)

b. ENABLING LEARNING OBJECTIVES:

(1) Given definitions of safety warnings or safety precautions, identify each correct definition in accordance with FM 5-424 and the National Electric Code (1169.04.19a)

(2) Given a list of safe working practices, identify each practice to be used when working with electrical equipment in accordance with FM 5-424 and the National Electric Code. (1169.04.19b)

(3) Given descriptions of prohibited working practices, identify each practice to avoid when working with electrical equipment in accordance with FM 5-424 and the National Electric Code. (1169.04.19c)

(4) Given descriptions of rescue methods, identify the description that describes the proper method of rescuing a victim in contact with a downed power line in accordance with FM 5-424 and the National Electric Code. (1169.04.19d)

1. Safety Warnings, and Precautions:

a. Warning signs are necessary for notifying. Personnel or reminding them of a potential hazard. The National Electrical Code states the following concerning warning signs:

(1) In article 110-27(c) under warning signs: "Entrances to rooms and other guarded locations containing exposed live parts shall

be marked with conspicuous warning signs forbidding unqualified persons to enter".

(2) Using warning signs for operating voltage is required for transformer and structures. Article 450-8 states under Voltage Warning, "the operating voltage of exposed live parts of transformer installations shall be indicated by signs or visible marking on the equipment or structures". It may be wise to display a second set of safety signs in the native language of the country you are in.

b. There are other ways of warning personnel of hazards. Safety warnings can be established by tagging:

(1) Equipment with adequate instructions about the equipment and possible job hazards before leaving the work site for any reason.

(2) Breakers that are shut off to allow work or repairs on electrical circuits should be tagged and if possible locked in the off position.

c. Safety precautions are actions, which can help prevent mishaps from occurring. Some precautions are as follows:

(1) Rope off an area around the equipment being serviced to protect people who are involved in the operation.

(2) When running electric lines overhead the minimum height requirements are:

(a) Article 230-24(b) of the National Electric Code requires electrical power lines to be a minimum 18 feet over road ways and public alley ways. Consideration should be given to the height of some of the equipment such as cranes and trucks needing to pass under such lines.

(b) Article 230-24(b) of the NEC requires a minimum clearance of 12 feet over driveways not subject to truck traffic and where the voltage does not exceed 300 volts to ground.

(c) 10 feet over walk ways. Once again consideration should be given in the height of the type of equipment which may need to go under the lines if any i.e. trash trucks supply trucks etc.

(d) When gaining height is a problem or is questionable; tying strips of plastic bags or other nonconductive material is a good precaution in helping drivers and other operators see or take notice of the present height of the electrical lines. This does not fulfill the requirements by the NEC for height.

(3) Conduct safety briefs for utility personnel and all personnel being supported. Some of the topics, which should be covered, are:

(a) Limitations must be placed on electrical equipment, which may tax the electrical system due to high current draw. Also some equipment may be unsafe if not secured or shut off after use.

- 1 Irons
- 2 Hot plates
- 3 Coffee pots
- 4 Electric heaters

(b) It should be made clear that no extensions or alterations will be made to electrical systems unless approved and performed by authorized personnel. "Makeshift" electricians can cause major problems and safety hazards.

(c) Area's which should be placed off limits or brought to the attention of personnel due to the hazards.

1. Power lines throughout camp area
 - a. Conductors for distribution located under ground or on grade level.
 - b. Low overhead electrical power lines
2. Transformer pads or banks on grade level
3. Generator stations and utilities equipment
4. Fuel storage containers
5. Be alert for new electrical work that may be installed or in progress especially at night or in wooded areas.

(d) Personnel should be informed that carbon dioxide fire extinguishers are the only type of fire extinguishers used for electrical fires. Personnel should be instructed on the location and use of fire extinguishers.

1. Class A extinguishers - Class A fires include ordinary combustible material such as paper, wood, and textiles. Class A fire extinguishers are filled with water.

2. Class B extinguishers - Class B fires include flammable liquids such as oil or gasoline. Class B fire extinguishers are filled with a foam carbon-tetrachloride or carbon-dioxide; dry compound; or sand.

3. Class C extinguishers - Class C fires are in electrical equipment. Class C fire extinguishers are filled with carbon tetrachloride or carbon dioxide.

4. Class ABC extinguishers - Class ABC fire extinguishers can be used on all types of fires.

(NOTE: WHEN USING CLASS C OR ABC EXTINGUISHERS ENSURE AREA IS WELL VENTILATED. DO NOT BREATHE THE DANGEROUS VAPORS.)

2. SAFE WORKING PRACTICES WHEN WORKING WITH ELECTRICAL EQUIPMENT:

a. The following practices are for operators, electricians and maintenance personnel and intended to reduce the chance of accidents while working on electrical systems, operating, or repairing electrical equipment.

b. Use rubber mats or other insulating material to protect against shocks.

c. Stand or sit on a wooden platform or stool when working in damp or wet areas. Place a rubber mat or other nonconductive material on top of the wood.

d. Avoid horseplay, wrestling, scuffling, practical jokes, and unnecessary conversation during duty hours. Electrical work is not dangerous when you take proper care, but it may become dangerous if your attention is distracted.

e. One of the most common electrical operations is wire stripping. This should be done with an electrician's knife. When using the knife, ensure that the force of the cutting is directed away from your body and other personnel.

f. Ensure the exhaust gases from a generator operating within an enclosed area are piped outside.

g. Provide a metal-to-metal contact between the container and tank when refueling equipment. This prevents static discharge, which may spark as fuel flows across the metal.

h. Use test equipment to ensure power is off when working on power lines. Always assume the circuits are live until confirmed otherwise.

i. After shutting a circuit breaker off and tagging it, place a watch when ever possible to ensure the circuit is not reactivated until appropriate.

3. PROHIBITED WORK PRACTICES:

a. The following are normally prohibited work practices, which may be considered to be commonly violated.

b. Never work on a live circuit unless it is absolutely necessary. If you must work on a live circuit

(1) Never work without having some one present that is qualified in CPR.

(2) Never work with tools that are not properly insulated by either the manufacture or by using electrical tape.

c. Never work with jewelry and metal items that may come in contact with electrical equipment or power lines such as unsecured zippers or metal fasteners. Contact with metal objects can cause burns or electric shock.

d. Never operate generator sets without wearing hearing protection.

e. Never operate or activate electrical equipment or distribution systems, which are not properly grounded. Article 250 in the National Electric Code covers grounding.

f. Never replace a fuse or install a circuit breaker that is rated greater than the amperage demand of the system it is intended to protect. Never install an over current protection device unless it is equal to or less than the amperage demand. Article 240 of the National Electric Code covers over current protection.

g. Never smoke or use an open flame when servicing batteries because batteries generate hydrogen, a highly explosive gas.

4. RESCUE OF A VICTIM FROM A DOWNED POWER LINE:

a. Electric shock is life threatening and victims require immediate treatment. Operators and maintenance personnel must know how to rescue and treat an electric shock victim at a moment's notice.

b. Accidents involving electric shock sometimes result from lightning strikes, but most often result from contact with a live wire. The shock may cause the victim to stop breathing. Treatment is broken into two tasks:

(1) Rescue.

(2) Revive.

c. The following steps are rescue steps

(1) Turn the current off if the switch is nearby. Do not waste time looking for the switch if its location is unknown. Remember nearby means close to the accident scene.

(2) Use any of the following items to remove the victim from the wire.

(a) Wooden pole or length of dry wood can be used to move the wire.

(b) Throw a loop of dry rope or cloth around the victim and drag the individual off the wire.

(c) Any material that is dry and will not conduct electricity.

(3) Do not touch the wire or the victim with bare hands or you may also receive a shock.

REFERENCES: FM 5-424
NATIONAL ELECTRICAL CODE