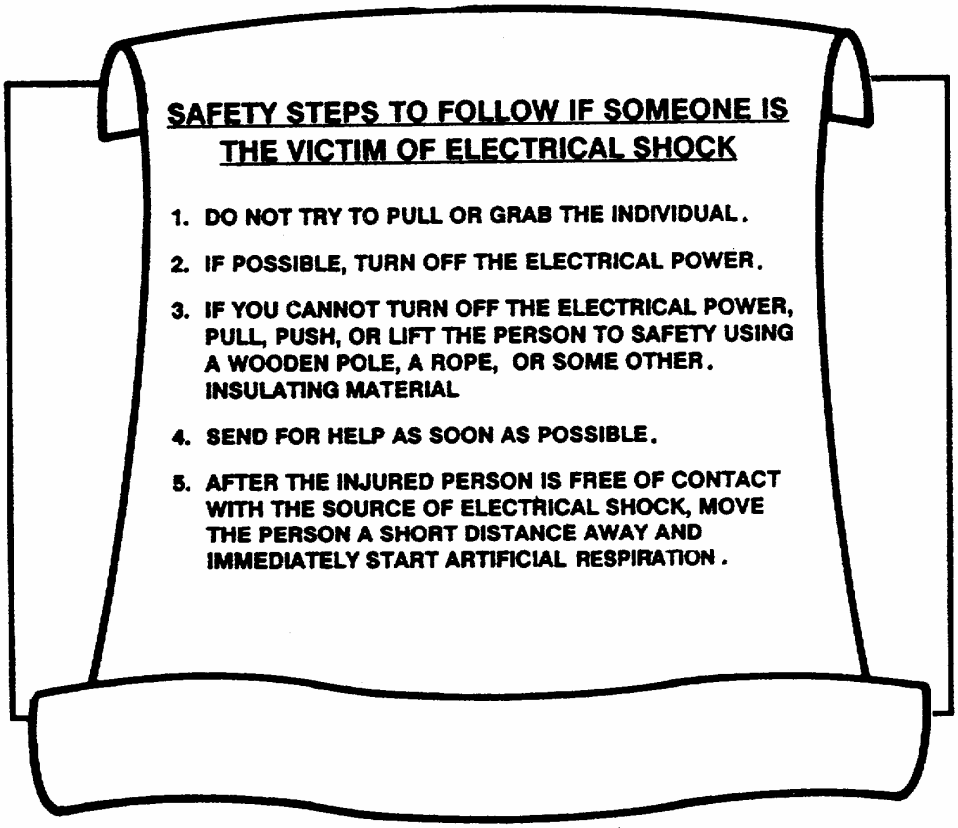
SUBCOURSE
SS0713

EDITION
7

US ARMY FIELD ARTILLERY SCHOOL

ELECTRICAL/ELECTRONIC SAFETY



THE ARMY INSTITUTE FOR PROFESSIONAL DEVELOPMENT

ARMY CORRESPONDENCE COURSE PROGRAM

A I P D

READINESS / PROFESSIONALISM

THRU GROWTH

UNIT-LEVEL COMMUNICATIONS MAINTAINER

MOS 31V SKILL LEVEL

ELECTRICAL/ELECTRONIC SAFETY
SUBCOURSE SS 0713

US Army Field Artillery School

Fort Sill, Oklahoma

One Credit Hour

GENERAL

This subcourse is designed to train skills in electrical/electronic safety necessary to perform tasks related to the unit-level communications maintainer duties. This subcourse is presented in one lesson.

TASK NO: None

TASK: Identify safety precautions and procedures associated with electrical/electronic equipment.

CONDITIONS: This task is performed when an unsafe electrical/electronic situation is observed in the unit maintenance facility or when equipment is in use in a field location.

STANDARDS: Demonstrate competency by correctly eliminating all safety hazards.

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GRADING AND CERTIFICATION INSTRUCTIONS

Instructions to student. This subcourse has a written examination consisting of 20 questions. You must score a minimum of 80 percent to meet the objective of this subcourse.

Credit hours. One credit hour will be awarded for the completion of this subcourse.

***** IMPORTANT NOTICE *****

THE PASSING SCORE FOR ALL ACCP MATERIAL IS NOW 70%.

PLEASE DISREGARD ALL REFERENCES TO THE 75% REQUIREMENT.

ELECTRICAL/ELECTRONIC SAFETY

OBJECTIVE

Upon completion of this lesson, the unit-level communications maintainer will be able to correctly identify electrical/electronic hazards and take necessary actions to prevent damage to personnel and equipment.

1. INTRODUCTION.

a. This subcourse introduces you to electrical/electronic hazards and the minimum safety precautions with which you, as a unit-level communications maintainer, should be familiar.

b. This subcourse presents minimum safety precautions for all the electrical/electronic hazards associated with electrical/electronic equipment. It is not the intention of this subcourse to supersede or delete cautions, warnings, and safety instructions in technical manuals (TMs), technical bulletins (TBs), or standing operating procedures (SOP).

2. GENERAL INFORMATION.

a. Responsibility. Overall safety is a command responsibility; however, application of safety principles and practices rests with the supervisor and ultimately with the individual. By observing the cautions, warnings, and safety instructions in TMs, TBs, and your SOP, you will be able to prevent personal injury and damage to equipment.

b. Training. As a unit-level communications maintainer involved with electrical equipment, circuits, or transmission (wire) lines, you should be provided local training from qualified personnel in safety procedures and proper first aid for electrical/electronic hazards. You may need to tell your commander of the need for annual training for all personnel who work around and directly with electrical equipment. This training should include, as a minimum, instructions in pertinent aspects of safety and lifesaving techniques; for example, cardiopulmonary resuscitation (CPR).

c. Standing operating procedures. The supervisor (which may be you) should develop and post the SOP for all hazardous operations that are performed often. The supervisor should review these procedures annually for possible changes in the situations and/or work areas.

3. ELECTRICAL/ELECTRONIC HAZARDS.

a. Electrical shock is probably the most common electronic hazard caused by electronic equipment. As the result of improper grounding of and/or defective equipment, a person's body becomes a conductor for current to pass through.

(1) Causes. Electrical shock is the result of voltage and current acting upon a person in contact with an electrical circuit.

(a) Voltage (not just high voltage). High voltage is voltage over 500 volts. However, any voltage is dangerous. Voltage alone does not cause injury; it is the force that pushes current through a circuit or a person's body.

(b) Current (the killer in electricity). The effects of current have been charted as follows:

- 5 milliamperes may cause an unpleasant sensation.
- 15 milliamperes flowing through any part of the body is considered shock potential.
- 70 milliamperes flowing through the heart region may cause death.

NOTE: The degree of shock depends on such things as dampness of the work area and the general health of the victim.

(2) Effects. The effects of electrical shock are in direct proportion to the amount of current that flows through the body. These effects may show up immediately or may be delayed. Some of the delayed effects may appear days or even months later.

(a) Immediate effects:

- Muscle paralysis.
- Cardiac arrest (heart failure).
- Ventricular fibrillation (discoordinated heart action).

(b) Delayed effects:

- Loss of muscle coordination.
- Deterioration of muscle and/or brain tissue.
- Physiological problems.

b. Radio frequency (RF) is produced inside a radio transmitter, amplified, and then sent out into the air through an antenna system connected to the transmitter. These radio frequencies can cause what are known as RF burns. You do not always have to be in contact with the antenna; radio frequency energy has been known to jump as far as 2 inches from the antenna. You should always use caution when working around antennas, especially when the transmitter is keyed. Observe the warnings in the TM pertaining to the equipment to determine the safe distance from antenna, antenna jacks, and cables.

c. Fuses are devices used to protect equipment and personnel from damage. When you must replace a fuse, turn the power off, correct the problem that caused the fuse to blow, replace the fuse, and turn the power on. When replacing a fuse, always ensure that it is of the same amperage and type (for example, standard or slow blow).

d. Improper grounding may be detected by a slight tingle when you touch the equipment or by an electrical shock. If either occurs, check for tightness of ground strap and proper ground strap (WD-1 is not a proper ground strap). Use only an approved ground strap.

e. Work areas are often electrical hazards because of improper housekeeping techniques. Work areas should always be kept dry and clean to prevent damage to equipment and/or personnel. However, when you must work in a tactical environment, use common sense and be safety-conscious at all times. If your work area is inside a building, you must have a safety board that is centrally located. The safety board will have necessary equipment and instructions for rescuing personnel that are being electrically

shocked. The design of the safety board will be IAW TB 385-4.

4. ELECTRICAL/ELECTRONIC EQUIPMENT. We have just discussed some electrical hazards. Next, let's look at some of the electrical/electronic equipment for which you, as a unit-level communications maintainer, are responsible and possible problems with each.

a. Radio transmitters.

(1) RF burns can occur when you come in contact with or are too close to the antenna system when the receiver-transmitter (RT) is keyed.

(2) Because the radio transmitter must have power applied, you must always ensure proper grounding of equipment to prevent electrical shock. When radios are mounted in vehicles, you must check all ground straps--those on the equipment and the ones that ground the equipment to the vehicle (for example, the proper star washer).

b. Antennas. There are many different sizes and shapes of antennas, but the safety rules apply to all.

(1) Siting is not only important for communication but also for safety. Before erecting an antenna, check the area for power lines with which your antenna could come in contact. Some safety rules to follow are:

(a) Never erect an antenna any closer to a power line than twice the antenna length.

(b) Never erect or move an antenna during an electrical storm.

(c) Always mark guy wires and the area around the antenna to keep personnel and vehicles from running into your antenna.

(2) Tactical mobile antennas usually are connected to the vehicle by a matching unit. The ground wire on the matching unit should be of the right type and connected to a ground in accordance with the appropriate TM for the radio set.

(a) The antenna should be tied down whenever the vehicle moves. This keeps the antenna from accidentally coming in contact with an electrical power line. Check the appropriate TM for proper tie-down procedures.

(b) When the antenna is tied down, you, as the unit-level communications maintainer, are responsible to ensure the antenna tip cap is in place.

c. Switchboards and wire lines.

(1) Switchboards must always be grounded regardless of where they are mounted. Grounding must be IAW the appropriate TM for the equipment.

(2) Switchboards and wire lines should never be operated, set up, or taken down in an electrical storm unless the mission requires it.

(3) It is a must to use the proper type of fuse in automatic switchboards. (For example, never replace a standard fuse with a slow-blow fuse.)

d. Vehicles. If electrical/electronic equipment is mounted on a vehicle, two things must be considered:

(1) Batteries should be considered--both the vehicle batteries and the batteries that are used to operate the electrical/electronic equipment.

(a) Caution should be used to prevent arcing while batteries are being tested or handled. Tools should be placed or stored in such a way as to not accidentally come in contact with the battery binding posts.

(b) Charging batteries should be done only in a well-ventilated area and IAW local SOP. Caution should be taken because of the possibility of acid fumes and burns

(2) Shelters should be well grounded with appropriate ground rods and ground straps. No short cut, such as using WD-1 as a ground strap, should ever be used in grounding procedures.

5. TROUBLESHOOTING. Observe the following safety precautions before and during troubleshooting.

a. Remove all jewelry (including "dog tags") when working on electrical/electronic equipment.

b. Inspect all interlock safety switches, fuses, and grounds to ensure they are in good condition and serviceable. Interlocks, fuses, and circuit breakers should not be bypassed unless removal is essential for performance as provided in appropriate manuals or SOP. Be extremely careful working on equipment when the safety devices are removed and power is applied.

c. Always disconnect or connect cables by grasping end connectors.

d. When troubleshooting electrical/electronic equipment, you should not place one hand on an energized component and the other hand on an electrical ground (for example, chassis of equipment). A suggested method of working on such equipment is to use only one hand for probing while keeping the other hand in your pocket or behind your back. Sometimes you must perform tests using both hands (for example, when making voltage measurements with a multimeter). Both insulated leads should be firmly held and placed on test points or connected to the test points by using insulated clips. Then turn the power on.

e. Make sure that a safety board containing rescue equipment is available and in a central point for easy access.

f. Ensure that two persons are in the immediate work area at all times while work is being performed on exposed circuits carrying over 30 volts. This is to ensure that one person is available to render assistance in case of accident.

g. Do not handle equipment with power applied when hands, feet, or body is wet or the floor is wet.

6. FIRST AID.

a. This subcourse does not deal with training for first aid. This is the responsibility of the local commander and the supervisor. It is the individual's responsibility to be familiar with FM 21-11.

b. There are five safety steps to follow when encountering an individual experiencing electrical shock. All personnel working with electrical/electronic equipment should know them.

(1) Do not try to grab or pull the individual away from the equipment.

(2) If possible, turn off the electrical power.

(3) If you cannot turn off the electrical power, pull, push, or lift the person to safety by using a wooden pole, a rope or some other insulating material.

(4) Send for help as soon possible.

(5) After the injured person is free of contact with the source of electrical shock, move the person a short distance away and immediately start artificial respiration, if required.

7. SUMMARY.

a. As a unit-level communications maintainer, you must be able to identify unsafe electrical/electronic situations and use correct safety procedures to eliminate these unsafe situations. Most electrical/electronic accidents are caused by human error, not because of equipment failure. Therefore, the unit-level communications maintainer must use common sense and proper safety procedures. For example, he must not use, or allow to be used, WD-1 as ground traps, improper fuse ratings (amp ratings and slow-or fat-blow fuses), and so forth. One of the most effective tools to prevent electrical/electronic hazards is proper and current training. This responsibility lies as much with the individual as with the commander.

b. If you, as the unit-level communications maintainer, apply the electrical/electronic safety procedures and rules in this course, you will have a safe work area. Most important, you will be able to keep electrical/electronic safety hazards to a minimum. This will afford you maximum use of personnel and equipment to accomplish the mission.