

UNITED STATES MARINE CORPS
Utilities Instruction Company
Marine Corps Engineer School
PSC BOX 20069
Camp Lejeune, North Carolina 28542-0069

U-07F05
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STUDENT HANDOUT

REPAIR ELECTRICAL DISTRIBUTION SYSTEM

a. **Terminal Learning Objective:** Provided an installed field electrical power generation and distribution system with faults, an amp probe, and a multi-meter, repair all faults so the system operates properly and safely. (1141.03.07)

b. **Enabling Learning Objectives:**

1. Provided a multi-meter, an amp probe, lineman's tools, and a power distribution system with a short circuit, without the aid of reference, diagnose the short circuit, in accordance with FM 5-424 and MCI 11.43. (1141.03.07a)

2. Provided a multi-meter, an amp probe, lineman's tools, and a power distribution system with an open circuit, without the aid of reference, diagnose the open circuit, in accordance with FM 5-424, and MCI 11.43. (1141.03.07b)

3. Provided a multi-meter, an amp probe, lineman's tools and a power distribution system with an open circuit, without the aid of reference, repair the short circuit, in accordance with FM 5-424, and MCI 11.43. (1141.03.07c)

4. Provided a multi-meter, an amp probe, lineman's tools and a power distribution system with an open circuit, without the aid of reference, repair the open circuit, in accordance with FM 5-424, and MCI 11.43. (1141.03.07c)

1. **Diagnose a short circuit:**

a. The definition of a short circuit is two bare conductors of different potential coming in contact with each other. An example of this would be a hot connected to a ground, two hots connected together, or a hot and a neutral connected.

(1) When the hot wire comes into contact with the ground, a short circuit can occur. This problem, however, is often called 'grounded'

instead of a short circuit. One good example of this would be when the hot wire comes into contact with a metallic part of a wiring system, such as the motor frame or conduit.

(2) When two hots are connected together, the insulation on two hot wires breaks down and the two conductors come in contact with each other. This type of short is rare in 115-volt systems, but it happens more often in 220-volt systems.

(3) A short circuit involving a hot to a neutral occurs when, for example, mounting Romex with staples and the staple penetrates the insulation and touches the conductors.

b. Giving prime consideration to the portable equipment can reduce troubleshooting time for short circuits. Most of the short circuits in the interior wiring system occurs in motors of the flexible cord supplying the fixtures or electrical devices. Physical checks of the flexible cord will indicate the trouble area. Short circuit malfunctions, however are almost always due to abuse of the electrical system itself. Look for signs of damage to the wire, boxes, and other parts, such as loose or partially dismantled receptacle boxes.

2. Diagnose an open circuit:

a. When one or more conductors in the circuit are broken, burned out or otherwise separated, an open circuit has occurred. An open circuit is determined by the failure to operate part or all of an electrical circuit during operation. This can occur even though the fuses, if any are blown out or circuit breakers are not tripped.

b. A visual check should be made for a broken or loose connection in the circuit in order to troubleshoot. If the problem is not found by a visual check, then use a test lamp or multimeter to see if the circuit is hot or operating up to the point of the outlet. If there are no problems there, then the outlet could be defective. If the outlet is not hot, check the wiring next. There may be broken or damaged wires causing the problem.

3. Repairing the short circuit:

a. Before performing any repairs to an electrical system or circuit, always ensure that the power to the affected area is disconnected or turned off. This factor is crucial to the overall safety to the mission. Failure to do so can result in serious bodily harm.

b. Repairing a short in the system is relatively simple. Uninsulated wire can be reinsulated with electrical tape. If this method would not be effective, the affected wire should be replaced.

c. Even though repair short circuits is simple, they can in some cases be prevented, especially when installing wire. Ensure that your wiring is properly connected and that wiring is not damaged when installing, for example when stapling Romex to a wooden surface.

4. **Repairing the open circuit:**

a. After performing a visual check on the affected area, you can then determine how to repair the open circuit.

(1) If there is a loose connection, tighten or repair it accordingly.

(2) If there is a broken wire or connection, the wire can either be restripped and reconnected or the entire wire must be replaced.

(3) If you discover that you have a defective component, replace the defective component with another one.

(4) If necessary, a junction box can be installed and a new wire may be spliced into the circuit at the defective point.

REFERENCE: FM 5-424

MCI 11.43

LIST OF SUPPORTING PAPERS

1. Student Outline

LIST OF MEDIA/TRAINING AIDS

1. MEDIA TYPE (S) AND LOCATION:

a. Lesson plan - located in BB-50 Electrical section instructor area.

b. Student handouts - located in, BB-14 Academic sections back office. Student handouts are located in locker labeled Basic Electrician Course U-07.

c. Student Exams - located in, BB-14 Academic sections back office. Student exams are located in locker labeled Basic Electrician Course Exam U-07.

d. Computers - located in, BB-50, Electrical sections classrooms.

e. Computer aided graphics - located on computers in, BB-50, Electrical section classrooms under c/BE Courseware/. Each presentation is saved under its lesson designator.

f. Publications - located in, BB-50, Electrical section instructor area.

2. TRAINING AIDS (S) AND LOCATION:

a. Actual Items - located at electrical section training area (BB-50).

b. Training aids - located in and around BB-50.

c. Tools - located in cage at BB-50.