AIR FORCE
QUALIFICATION TRAINING PACKAGE (AFQTP)

FOR

LIQUID FUEL SYSTEMS MAINTENANCE

(3E4X2)

MODULE 16

LIQUID FUELS ELECTRICAL

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LIQUID FUELS ELECTRICAL

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Career Field Education and Training Plan (CFETP) references from 1 Jul 02 version.

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Supersedes AFQTP 3E4X2-16, 1 Oct 1999

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AIR FORCE QUALIFICATION TRAINING PACKAGES
FOR
LIQUID FUEL SYSTEMS MAINTENANCE
(3E4X2)

INTRODUCTION

Before starting this AFQTP, **refer to and read the "AFQTP TRAINER/TRAINEE GUIDE."**

AFQTPs are mandatory and must be completed to fulfill task knowledge requirements on core and diamond tasks for upgrade training. ***It is important for the trainer and trainee to understand*** that an AFQTP ***does not*** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks*.*

MANDATORY minimum upgrade requirements:

Core task:
AFQTP completion
Hands-on certification

Diamond task:
AFQTP completion
CerTest completion (80% minimum to pass)

Note: *Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location*.

Put this package to use. Subject matter experts under the direction and guidance of HQ AFCESA/CEOF revised this AFQTP. If you have any recommendations for improving this document, please contact the Career Field Manager at the address below.

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Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

LIQUID FUELS ELECTRICAL

CIRCUIT COMPONENTS

MODULE 16 **AFQTP UNIT 4**

INTERPRET SCHEMATICS: BLOCK, WIRING, CONNECTION, SCHEMATIC, LADDER (16.4.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

INTERPRET SCHEMATICS: BLOCK, WIRING, CONNECTION, SCHEMATIC, LADDER

Task Training Guide

STS Reference Number/Title:	16.4., Interpret schematics: block, wiring, connection, schematic, ladder (Circuit Components)..
Training References:	1. Career Development Course (CDC) 3E452, Liquid Fuel System Maintenance Volume 2, Unit 5-2, Section 237: *What Is A Blueprint, Its Parts and Its Symbols,* and 238: *Characteristics of Electrical Diagrams,* and Volume 5, Unit 3-1, Section 825: *Type III Pump Control Room Equipment*. 2. ANSI Y32.2 IEEE and American National Standard Graphic Symbols for Electrical and Electronic Diagrams.
Prerequisites:	1. **Possess as a minimum a 3E432 AFSC.** 2. **Review the following references:** 2.1. CDC 3E452, Volume 2, Unit 5-2, Sections 237, 238, and Volume 5, Unit 3-1, Section 825. 2.2. ANSI Y32.2 IEEE and American National Standard Graphic Symbols for Electrical and Electronic Diagrams.
Equipment/Tools Required:	1. Schematic diagram. 2. Manufacturers Manual.
Learning Objective:	Trainee should understand the meaning of schematics
Samples of Behavior:	1. The trainee should know how to: 1.1. Distinguish between the types of drawings. 1.2. Understand the symbols. 1.3. Understand the flow of the diagram.
Notes:	
Trainer will demonstrate and test trainee on various applications to insure safe operations.	

INTERPRET SCHEMATICS: BLOCK, WIRING, CONNECTION, SCHEMATIC, LADDER

1. Background: It has been said that a picture is worth a thousand words. Every day you can see this is true by just observing your surroundings. People have used pictures to convey their thoughts for centuries. It would be difficult for an engineer or architect to describe the exact length, width, or height of a building or what the finished product will look like without a drawing of some type. A word description of a building would be very long and hard to read. Like workers in the building trades, you need blueprints and drawings to tell you where a circuit is to be located, what size it will be, and to provide other details about the electrical installation.

2.1. The first thing you will need before attempting to work on any circuit is something that tells you exactly what size the circuit is and where the circuit is to be located. This information usually is contained in a blueprint or drawing of some kind. Therefore, it is necessary that you are able to read and interpret drawings, diagrams, and blueprints.

2.2. A diagram is defined as a line drawing that shows arrangement or relationship of parts. Electrical diagrams are usually used to show how parts of a piece of equipment or several pieces of equipment are wired together.

2.3. There are basically four types of electrical diagrams: block, wiring, connection, and schematic. These diagrams are similar to each other and their names are sometimes used interchangeably, but they do have differences. Figure 1 below shows examples of each.

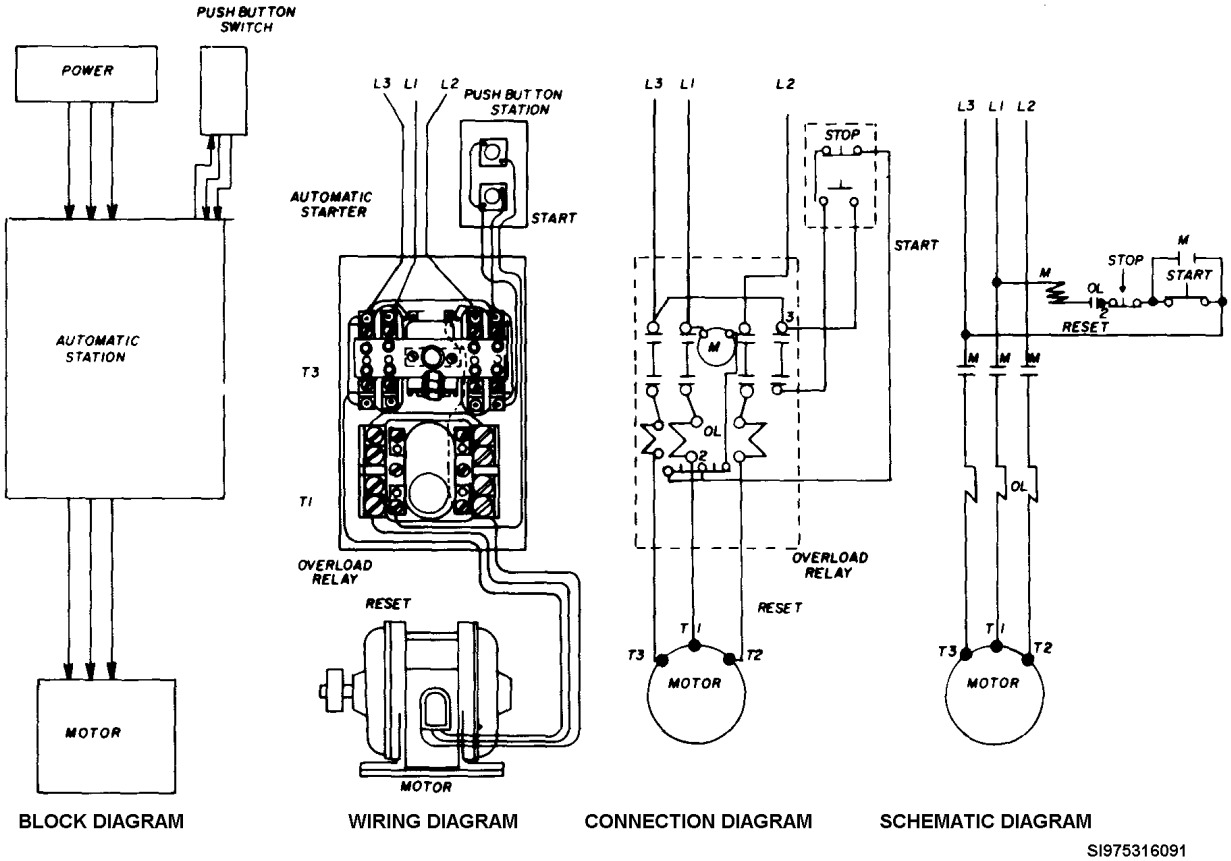


Figure 1. Electrical Diagrams

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

1.1.1. A **block diagram** is a simple drawing showing the relationship of major parts of a system. Block diagrams are used often to explain power distribution systems. These drawings would be of little help for troubleshooting.

1.1.2. The **wiring diagram**, which is like a picture drawing, shows the wiring between components and the relative position of the components. Wiring diagrams are used often with a list of repair parts and can be used to do some troubleshooting.

1.1.3. The **connection diagram** makes use of diagram symbols instead of pictures to show components. This diagram can be used to help you connect all the wiring and trace any part of the circuit, which makes it a very valuable troubleshooting tool. It is often found inside the cover of a piece of equipment.

1.1.4. The **schematic diagram** is a drawing that shows the electrical plan of operation of a piece of equipment or component. The relative position of parts is not shown in this type of diagram. The schematic diagram, like the connection diagram, makes use of symbols instead of pictures. It is laid out so that the components are in line to make it easy to trace the operation. Notice the use of heavy and light lines in the drawing. In this case, the heavy lines show the main power circuit and the light lines show the control circuit. The schematic is sometimes called an elementary or one-line diagram and is very useful in troubleshooting or tracing the plan of operation.

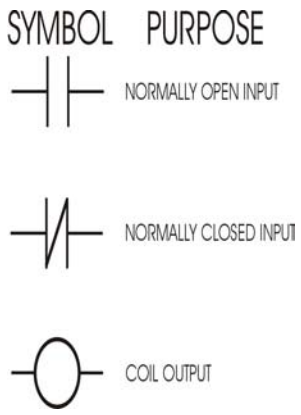


Figure 2. Program Symbols

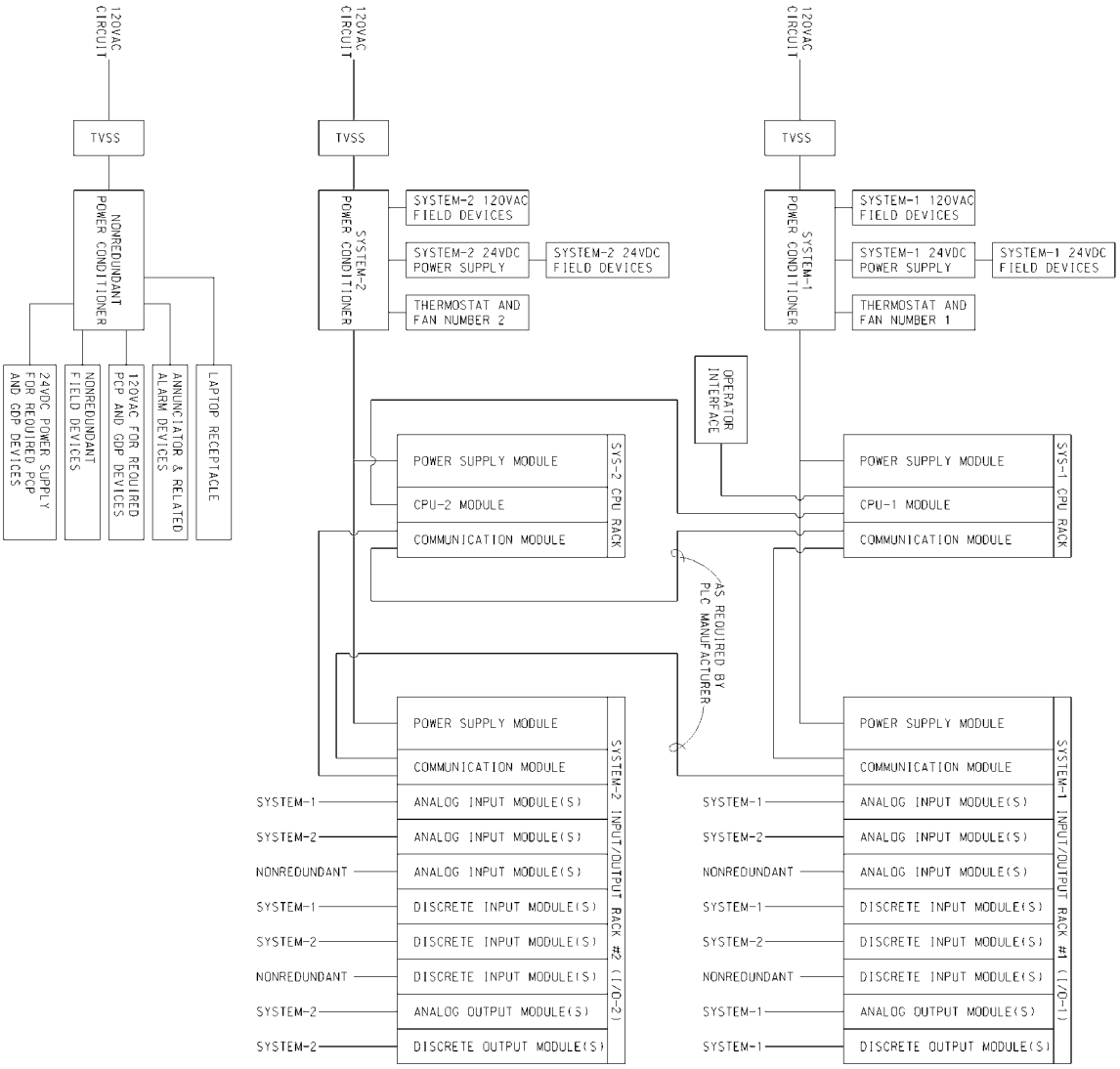
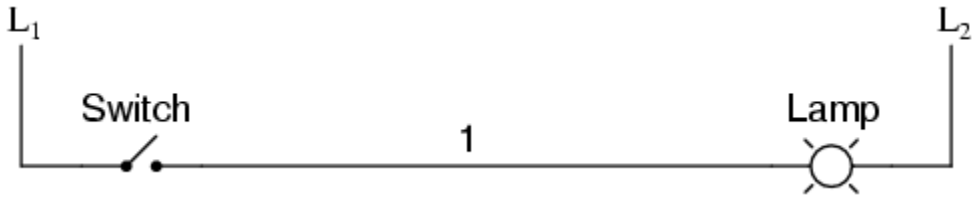


Figure 3. Control System Connection Diagram

1.1.5. Ladder diagrams are specialized schematics commonly used to document industrial control logic systems. They are called "ladder" diagrams because they resemble a ladder, with two vertical rails (supply power) and as many "rungs" (horizontal lines) as there are control circuits to represent. If we wanted to draw a simple ladder diagram showing a lamp that is controlled by a hand switch, it would look like this:



The "L_1" and "L_2" designations refer to the two poles of a 120 VAC supply, unless otherwise noted. L_1 is the "hot" conductor, and L_2 is the grounded ("neutral") conductor.

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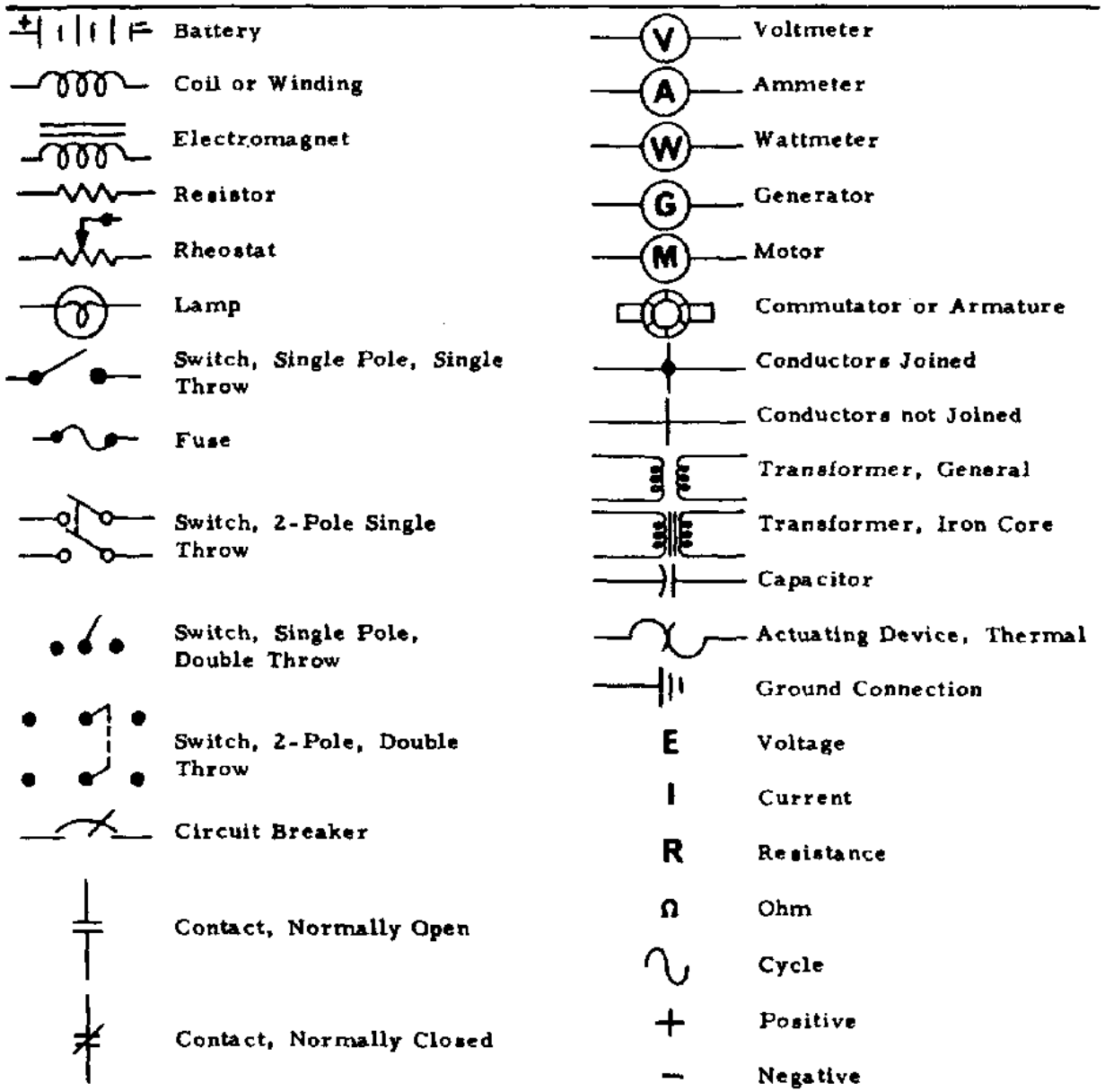


Figure 4. Basic Symbols

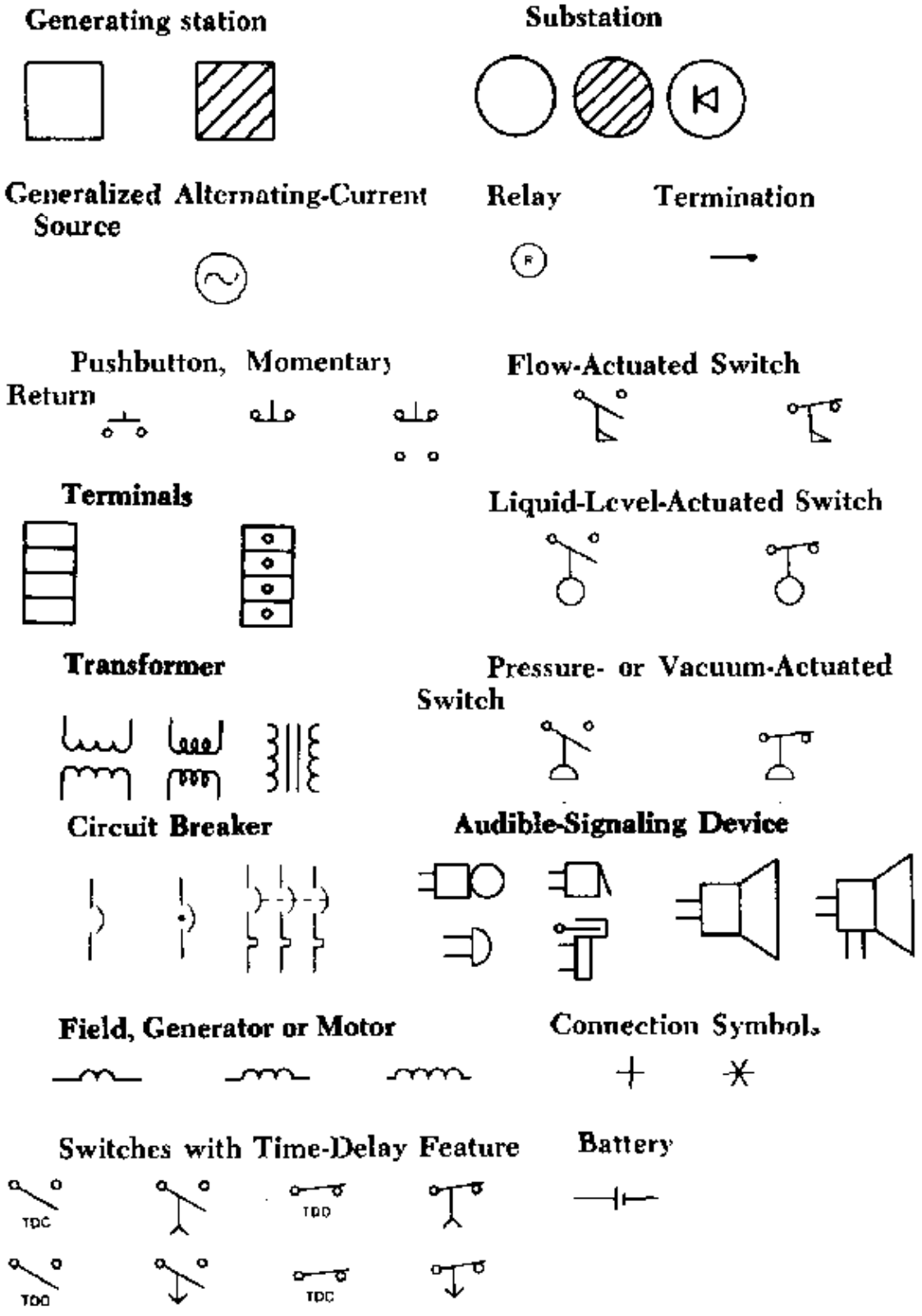


Figure 5. Additional Symbols

SAFETY:

1. REMOVE ALL JEWELRY BEFORE WORKING ON FUEL SYSTEMS. LOCK-OUT/TAG-OUT PROCEDURES ON THE MAIN CONTROL PANEL WILL BE REQUIRED. SEE A GROUND SAFETY TECHNICIAN OR AN ELECTRICAL TECHNICIAN FOR MORE DETAILS.

2. REMEMBER TO ENSURE POWER TO THE CONTROL BOX HAS BEEN CUTOFF BY TESTING WITH A METER BEFORE YOU START PROBING INSIDE ANY ELECTRICAL BOX.

NOTE TO TRAINER:

In order for the trainee to accomplish this task, you must build an exercise scenario where there is an electrical malfunction in a fuel system. Provide the trainee with different electrical diagrams and have him/her locate the problem.

2. ***To perform this task, follow these steps:***

Step 1: Trainee is provided equipment, schematics, and electrical problem scenario in which to perform task.

Step 2: Identify the type(s) of diagram(s).

Step 3: Identify the symbols.

3.1. After you have identified the type of diagram, you should identify the symbols utilized.

3.2. Figure 4 and 5 show some of the more common symbols you may run across in a schematic. Some diagrams come with a legend so that you may easily identify the symbols provided.

3.3. Before attempting to interpret the schematic you should make sure you know what each symbol in the schematic represents.

Step 4: Follow flow of current through the circuit.

4.1. Begin to trace the path of current flow. Start from your power source, for example, in Figure 1 the power source is the 3 lines coming in labeled L1, L2, and L3. This path will show the components that the current will travel through to get to your main piece of equipment, which provides a logic path to check when troubleshooting your circuits.

Step 5: Locate major components identified in the schematic.

5.1. Remember the schematic is a simplified diagram to easily understand the current flow. It is not like the wiring diagram, which shows the actual position of the component parts.

5.2. Before you begin any troubleshooting, you will need to locate the components, (relays, switches, etc.) which are identified in the diagram.

5.2.1. For example, your diagram may show a start/stop switch in the circuit for a pump. However, your control box may be in a pump house, the motor out on a pump pad, and the start/stop switch out in a hydrant control pit.

Step 6: Locate the electrical malfunction using the diagram(s).

REVIEW QUESTIONS
FOR
INTERPRET SCHEMATICS: BLOCK, WIRING, CONNECTION, SCHEMATIC, LADDER

QUESTION	ANSWER
1. All diagrams will have a legend provided.	a. True. b. False.
2. Some components can have more than one symbol to represent it in a schematic.	a. True. b. False.
3. Can you use a schematic to trace the current flow?	a. Yes. b. No.
4. The electrical schematic can be used for _____.	a. showing the proper flow of fuel through a system. b. determining the location of components. c. providing a logic path for troubleshooting. d. shows the wiring between components.
5. Which type of diagram is a simple drawing showing the relationship of major parts of a system?	a. Block. b. Wiring. c. Connection. d. Schematic.

INTERPRET SCHEMATICS: BLOCK, WIRING, CONNECTION, SCHEMATIC, LADDER

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….?	YES	NO
1. Identify the different electrical diagrams		
2. Successful identify the symbols		
3. Followed flow of current through the circuit(s)		
4. Successful locate the electrical malfunction using the diagram(s)		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

LIQUID FUELS ELECTRICAL

USE TEST EQUIPMENT TO MEASURE

MODULE 16 AFQTP UNIT 6

VOLTAGE (16.6.1.)

USE TEST EQUIPMENT TO MEASURE VOLTAGE

Task Training Guide

STS Reference Number/Title:	16.6.1., Use test equipment to measure voltage.
Training References:	1. Career Development Course (CDC) 3E452, Liquid Fuel System Maintenance Volume 2, Unit 5-1, Section 225: *Understanding the Purpose of Electrical Meters*, and Section 226: *Using Multimeters to Check for Ohms, Volts, and Amps.* 2. Air Force Instruction (AFI) 32-1064; *Electrical Safe Practices.* 3. Technical Order (T.O.) 33A1-12-1300-1; *Fluke Digital Multi-meter.* 4. Air Force Occupational Safety and Health Standards (AFOSHSTD) 91-45; Hazardous Energy Control and Mishap Prevention Signs and Tags.
Prerequisites:	1. **Possess as a minimum a 3E432 AFSC**. 2. **Review the following references:** 2.1. CDC 3E452, Volume 2, Unit 5-1, Sections 225 and 226. 2.2. AFI 32-1064. 2.3. T.O. 33A1-12-1300-1. 2.4. AFOSHSTD 91-45.
Equipment/Tools Required:	1. Multi-meter. 2. Lock-out/Tag-out kit.
Learning Objective:	Trainee should know proper procedure used to measure voltage.
Samples of Behavior:	1. Trainee will know how to take proper safety precautions when measuring voltage. 2. Trainee will know how to measure voltage.
Notes:	
1. Any safety violation will result in failure. 2. Trainer will demonstrate and test trainee on various applications to insure safe operations. 3. If more than one type of meter is available you must train on all meters.	

USE TEST EQUIPMENT TO MEASURE VOLTAGE

1. Background: Just as you need pressure of some sort to keep fuel flowing through a pipe, electrical *pressure* is needed to make current flow through a conductor. The source that produces this pressure may be a battery or an electric generator that can produce a potential difference in the conductor. While fuel pressure is measured in pounds per square inch, electrical pressure is measured in volts. One volt is the electrical pressure required to force 1 ampere of current through a resistance of 1 ohm. Electrical pressure, electromotive force (EMF), and potential difference are all terms that are used interchangeably; they all mean the same thing—voltage. Voltage can be defined as the force that moves the electrons in a conductor and is measured in volts.

1.1. Voltage can be either direct current (DC) or alternating current (AC). The voltage of an ordinary dry cell battery, such as a flashlight battery, is 1.5 volts DC. The voltage for most domestic electrical service is about 120 volts AC. When voltage is applied to a circuit, a certain amount of current flows through the circuit. If the voltage is increased, then the current flow increases in direct proportion to the voltage.

1.2. Voltmeters are used to check the potential difference between two points. They can be used to check AC or DC voltage. The reading on a voltmeter scale indicates applied voltage (electrical pressure). A very big difference in voltage between any two "legs" in a motor disconnect box is indicative of trouble. A 3-phase motor, for example, will not run normal when it is missing a "leg" or phase. You can expect a 3φ (phase) motor to "groan" or make quite a bit of noise if it is missing a leg. In addition to a voltmeter, a multi-meter can be used to check for proper voltage. These days, most electricians will use a multi-meter to check for voltage because of its versatility — a multi-meter can also be used to check for resistance and current (covered in subsequent units in this module. For this reason, further discussion will be limited to that of a multi-meter.

SAFETY:

REMOVE ALL JEWELRY BEFORE WORKING ON FUEL AND ELECTRICAL SYSTEMS. THIS TASK MAY REQUIRE LOCK-OUT / TAG-OUT PROCEDURES.

2. ***To perform this task, follow these steps:***

Step 1: Turn off power to electrical unit and remove cover.

Step 2: Turn power back on.

Step 3: Connect the test leads to the multi-meter and place the multi-meter function switch in the correct position.

3.1. Determine the type of current you have, either AC or DC, and select the appropriate setting. Refer to the appropriate technical manual to determine the proper setting for reading voltage.

SAFETY:

IF THE VOLTAGE IS NOT KNOWN, ALWAYS SELECT THE HIGHEST RANGE ON THE MULTI-METER. IF VOLTAGE IS KNOWN, USE THE NEXT HIGHEST SCALE. THIS IS A SAFETY PRECAUTION THAT PROTECTS YOU AND PREVENTS OVERLOAD DAMAGE TO THE METER. BE VERY CAREFUL OR YOU MAY DAMAGE THE METER AND CAUSE INJURIES TO YOU AND YOUR CO-WORKERS.

Step 4: Perform tests and note readings.

4.1. Place the black lead (negative) onto a good electrical ground, such as the control box or the metal conduit running to the box or a green ground screw.

4.2. Then place the red lead (positive) on the “hot” line.

4.3. Take your readings.

SAFETY:

DO NOT PUT YOUR TWO LEADS ACROSS AN INSTALLED FUSE, EVEN WITH THE POWER OFF--DOING SO MAY DAMAGE THE METER. ALWAYS REMOVE A FUSE FIRST BEFORE YOU CHECK IT.

NOTE:

When you have finished using the multi-meter, turn it off. This will prevent the batteries from being drained.

REVIEW QUESTIONS
FOR
USE TEST EQUIPMENT TO MEASURE VOLTAGE

QUESTION	ANSWER
1. When using a multi-meter to test voltage, what range must you select if the circuit voltage being tested is unknown?	a. The lowest scale. b. The highest scale. c. RX1000 scale. d. Select the +D.C. switch.
2. Electrical pressure is measured in _____.	a. PSI. b. amperes. c. volts. d. ohms.
3. A 3-phase motor will run normally if it is missing a “leg”.	a. True. b. False.
4. Which lead is touched to ground?	a. Red. b. Positive. c. Black.
5. Safety precautions are not required during the testing procedure.	a. True. b. False.

USE TEST EQUIPMENT TO MEASURE VOLTAGE

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….?	YES	NO
1. Turn off the power and remove cover		
2. Turn power back on		
3. Connect the test leads to the multi-meter and place the multi-meter function switch in the correct position		
4. Properly perform voltage test		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

LIQUID FUELS ELECTRICAL

USE TEST EQUIPMENT TO MEASURE

MODULE 16 AFQTP UNIT 6

RESISTANCE (16.6.2.)

USE TEST EQUIPMENT TO MEASURE RESISTANCE

Task Training Guide

STS Reference Number/Title:	16.6.2., Used test equipment to measure resistance.
Training References:	1. Career Development Course (CDC) 3E452, Liquid Fuel System Maintenance Volume 2, Unit 5-1, Section 225: *Understanding the Purpose of Electrical Meters*, and Section 226: *Using Multimeters to Check for Ohms, Volts, and Amps.* 2. Air Force Instruction (AFI) 32-1064; *Electrical Safe Practices.* 3. Technical Order (T.O.) 33A1-12-1300-1; *Fluke Digital Multi-meter.* 4. Air Force Occupational Safety and Health Standards (AFOSHSTD) 91-45; Hazardous Energy Control and Mishap Prevention Signs and Tags.
Prerequisites:	1. **Possess as a minimum a 3E432 AFSC**. 2. **Review the following references:** 2.1. CDC 3E452, Volume 2, Unit 5-1, Sections 225 and 226. 2.2. AFI 32-1064. 2.3. T.O. 33A1-12-1300-1. 2.4. AFOSHSTD 91-45.
Equipment/Tools Required:	1. Multi-meter. 2. Lock-out/Tag-out kit.
Learning Objective:	Trainee should know proper procedure used to measure resistance.
Samples of Behavior:	1. Trainee will know how to use proper safety precautions when measuring resistance. 2. Trainee will know how to take a resistance reading.
Notes:	
1. Any safety violation will result in failure. 2. Trainer will demonstrate and test trainee on various applications to insure safe operations. 3. If more than one type of meter is available you must train on all meters.	

USE TEST EQUIPMENT TO MEASURE RESISTANCE

1. Background: The definition of resistance is *the opposition to the movement of free electrons through a circuit or conductor*. The ohm is the standard unit of measurement for resistance. The amount of opposition offered depends on the type of material used, its length, its cross-sectional area, and its temperature. Resistance to electric current is present in all matter, but one material may have much more resistance than another.

1.1. Since copper is a good conductor and is relatively inexpensive, it is widely used in electrical circuits. However, copper is seldom used in its pure form. It usually is mixed with other metals to form a copper alloy. Three things determine the resistance of a copper wire: the cross-sectional area of the wire, its temperature, and its length. Since a wire with a large diameter has a greater cross-sectional area than a smaller wire, it has less resistance. A long wire has more resistance than a short wire, and a cold wire has less resistance than a hot wire. Since copper is a good conductor, it offers very little resistance. This is why copper is used in some cooking pots and pans. Pots and pans made out of copper heat up more rapidly than other types because copper offers very little resistance.

1.2. Ohmmeters are used to check the resistance of a unit or a circuit. However, further discussion will be on multi-meters due to their ability to measure voltage, resistance, and current. In terms of electricity, you can think of resistance as a break or obstruction in a circuit. Any obstruction in the path of electricity (resistance) will cause the electrical unit to fail or work inefficiently, depending upon the amount of resistance. For example, a wire that has somehow become corroded over the years would show a high resistance because it is harder for the electricity to flow *through* the corroded area of that wire. Depending on the degree of corrosion, that same wire would show a proportionate increase in ohms resistance. For a Liquid Fuels technician, the multi-meter (in ohms function) will normally be used to check fuses for resistance.

SAFETY:

1. REMOVE ALL JEWELRY BEFORE WORKING ON FUEL AND ELECTRICAL SYSTEMS. THIS TASK WILL REQUIRE LOCK-OUT / TAG-OUT PROCEDURES.

2. NEVER USE AN OHMMETER ON AN ENERGIZED CIRCUIT. THIS WILL DAMAGE YOUR METER.

2. ***To perform this task, follow these steps:***

Step 1: Connect the test leads to the multi-meter and set the multi-meter function switch to the correct scale in ohms.

1.1. Most of the time you start a measurement with the range switch in the RX-1 position and work up to the most accurate scale.

Step 2: Test the meter.

2.1. To do this, touch the test leads together and note the reading in the LCD display. The display should indicate 0 ohms since there is no resistance between the two contacting leads.

NOTE:

Keep your hands on the insulated part of the meter leads. When you touch the leads, body resistance distorts your ohmmeter reading.

NOTE:
You must test the meter each time you choose a new range scale.

Step 3: Isolate the equipment or unit to be tested.

3.1. Ensure your meter leads make good contact with the item being tested.

Step 4: Test unit for resistance and note reading.

NOTE:
When you have finished using the multi-meter, turn it off. This will prevent the batteries from being drained.

REVIEW QUESTIONS
FOR
USE TEST EQUIPMENT TO MEASURE RESISTANCE

QUESTION	ANSWER
1. When checking for resistance, set the multi-meter to one of the ohms functions.	a. True. b. False.
2. When using a multi-meter to check for resistance, most of the time you will start with the function switch in what position?	a. RX1 Range. b. RX2 Range. c. RX1000 Range. d. The highest range.
3. When using a multi-meter, why must you keep your hands on the insulated part of the meter leads?	a. It will cause the leads to rust. b. The leads are delicate and may break if touched. c. It will shock you. d. It will distort your reading if you are touching the metal portion of the leads while testing.
4. Resistance is measured in what units?	a. Volts. b. Amperes. c. Ohms. d. PSI.
5. What factor(s) determine(s) the resistance of a material?	a. Cross-sectional area. b. Length. c. Temperature. d. All of the above.

USE TEST EQUIPMENT TO MEASURE RESISTANCE

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….?	YES	NO
1. Connect the test leads to the multi-meter and set the multi-meter function switch to the correct scale in ohms		
2. Test the meter correctly		
3. Isolate the equipment or unit to be tested		
4. Isolate the electrical unit		
5. Test unit for resistance and note reading		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

LIQUID FUELS ELECTRICAL

USE TEST EQUIPMENT TO MEASURE

MODULE 16 **AFQTP UNIT 6**

CURRENT (16.6.3.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

USE TEST EQUIPMENT TO MEASURE CURRENT

Task Training Guide

STS Reference Number/Title:	16.6.3., Current (Use test equipment to measure).
Training References:	1. Career Development Course (CDC) 3E452, Liquid Fuel System Maintenance Volume 2, Unit 5-1, Section 225: *Understanding the Purpose of Electrical Meters*, and Section 226: *Using Multimeters to Check for Ohms, Volts, and Amps.* 2. Air Force Instruction (AFI) 32-1064; *Electrical Safe Practices.* 3. Technical Order (T.O.) 33A1-12-1300-1; *Fluke Digital Multi-meter.* 4. Air Force Occupational Safety and Health Standards (AFOSHSTD) 91-45; Hazardous Energy Control and Mishap Prevention Signs and Tags.
Prerequisites:	1. **Possess as a minimum a 3E432 AFSC**. 2. **Review the following references:** 2.1. CDC 3E452, Volume 2, Unit 5-1, Sections 225 and 226. 2.2. AFI 32-1064. 2.3. T.O. 33A1-12-1300-1. 2.4. AFOSHSTD 91-45.
Equipment/Tools Required:	1. Multi-meter. 2. Lock-out/Tag-out kit.
Learning Objective:	Trainee should know proper procedure to use for measuring electrical current.
Samples of Behavior:	1. Trainee will know how to take proper safety precautions when measuring electrical current. 2. Trainee will know how to measure current.
Notes:	
1. Any safety violation will result in failure. 2. Trainer will demonstrate and test trainee on various applications to insure safe operations. 3. If more than one type of meter is available you must train on all meters.	

USE TEST EQUIPMENT TO MEASURE CURRENT

1. Background: Current flow is simply the movement of electrons through a conductor. To provide a standard method of indicating the direction of current flow, one terminal of the battery used as a source of electrical energy is marked positive (+); the other terminal is marked negative (–). Current has four effects: heat, magnetism, chemical action, and physical shock.

1.1. When we check for amperage we are really checking for current *flow*. This becomes especially critical when checking a three-phase motor. We can tell whether or not a motor is working too hard by comparing "working" *current draw* (amperage) on each "leg" with the "normal" amperage limits listed on the motor's data plate. A motor that is drawing more amps than it is supposed to, under a load condition, would indicate potential trouble. A few causes of abnormal motor amperage are:

1.1.1. Worn out bearings due to improper lubrication.

1.1.2. Pump effluent restriction such as a partially closed valve.

1.1.3. Higher than normal solids movement through a pump.

1.1.4. Potential motor windings problem.

1.2. Of course, there are many more causes of abnormal amperage. This is just a list to give you a general idea. You need to remember that higher or lower than normal amperage on a motor indicates potential trouble.

SAFETY:

1. REMOVE ALL JEWELRY BEFORE WORKING ON FUEL AND ELECTRICAL SYSTEMS. THIS TASK WILL REQUIRE LOCK-OUT / TAG-OUT PROCEDURES.

2. WHEN CHECKING CURRENT, NEVER CONNECT THE LEADS OF A MULTI-METER ACROSS DIFFERENT POTENTIALS (e.g. BETWEEN PHASES OR BETWEEN PHASE AND GROUND). THE METER IS ALWAYS CONNECTED IN SERIES WITH THE LOAD.

2. ***To complete this task, follow these steps:***

Step 1: Connect the test leads to the multi-meter and set the function switch to the proper amperage setting.

Step 2: Turn off the power to the circuit being tested, and open the circuit by disconnecting the leads to the item you want to test.

Step 3: Connect the meter in series with the circuit.

SAFETY:

ON A DC CIRCUIT, CONNECT THE RED LEAD TOWARD THE POSITIVE SIDE OF THE CIRCUIT AND THE BLACK LEAD TOWARD THE NEGATIVE SIDE. FAILURE TO DO SO COULD DAMAGE THE METER. ON AN AC CIRCUIT THIS RULE DOES NOT APPLY, THE METER WILL READ EITHER WAY.

Step 4: Close the circuit (turn the power back on) and observe the meter.

Step 5: Turn power off.

Step 6: Restore the circuit to original condition.

REVIEW QUESTIONS
FOR
USE TEST EQUIPMENT TO MEASURE CURRENT

QUESTION	ANSWER
1. If the voltage on a circuit is increased, the amperage is also increased.	a. True. b. False.
2. When testing for current your meter must be in _____ with the load.	a. series. b. series-parallel. c. parallel. d. sync.
3. Current is measured in what unit?	a. Volts. b. Amperes. c. Ohms. d. PSI.
4. Which of the following is an effect of current?	a. Increased pressure. b. Faster delivery. c. Magnetism. d. Resistance.

USE TEST EQUIPMENT TO MEASURE CURRENT

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….?	YES	NO
1. Connect the test leads to the multi-meter and set the function switch to the proper amperage setting		
2. Turn off the power to the circuit being tested, and open the circuit by disconnecting the leads to the item you want to test		
3. Connect the meter in series with the circuit		
4. Close the circuit by turning power back on and observe the meter		
5. Turn the power back off		
6. Restore the circuit to original condition		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

LIQUID FUELS ELECTRICAL

MODULE 16 AFQTP UNIT 7

INSPECT ELECTRICAL COMPONENTS/CIRCUITS (16.7.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

INSPECT ELECTRICAL COMPONENTS/CIRCUITS

Task Training Guide

STS Reference Number/Title:	16.7., Inspect electrical components/circuits.
Training References:	1. Air Force Manual (AFMAN) 32-1275, *Maintenance of Petroleum Systems.* 2. Manufacturer's Manual. 3. Air Force Occupational Safety and Health Standards (AFOSHSTD) 91-45; *Hazardous Energy Control and Mishap Prevention Signs and Tags.*
Prerequisites:	1. **Possess as a minimum a, 3E432 AFSC.** 2. **Review the following references:** 2.1. AFMAN 32-1275. 2.2. Manufacturer's manual. 2.3. AFOSHSTD 91-45.
Equipment/Tools Required:	1. General tool kit. 2. Lock out/Tag out kit. 3. Multi-meter.
Learning Objective:	The trainee should learn basic steps required to safely inspect electrical components and circuits.
Samples of Behavior:	Trainee will be able to perform inspections on electrical components and circuits.
Note:	
Any safety violation is an automatic failure.	

INSPECT ELECTRICAL COMPONENTS/CIRCUITS

1. Background: Inspections of electrical equipment in fuel systems are usually limited to visual inspections and operational checks by Liquid Fuels System Maintenance (LFM) personnel. You may be required to inspect electrical system components and circuits as part of the Recurring Work Program, while troubleshooting an electrical problem, or when replacing an electrical component (covered in a later unit). A qualified electrician should perform major maintenance beyond the capabilities of LFM personnel. For the purpose of this unit, inspect electrical components and circuits will consist of internal visual inspections for proper connections, corrosion, and operational (functional) checks. The internal inspections will be performed first, and then operational checks will be performed to ensure system integrity.

SAFETY:

REMOVE ALL JEWELRY BEFORE WORKING ON FUEL AND ELECTRICAL SYSTEMS. LOCK-OUT/TAG-OUT PROCEDURES ON THE MAIN CONTROL PANEL WILL BE REQUIRED. SEE A GROUND SAFETY TECHNICIAN OR AN ELECTRICAL TECHNICIAN FOR MORE DETAILS.

2. ***To perform the task, follow these steps:***

Step 1: Isolate power to item to be inspected.

1.1. Lock-out / tag-out main control panel. De-energize component/circuit control panel to access circuits.

Step 2: Remove component covers (if applicable).

2.1. Various components to be inspected include pump switches, starters, contacts, relays, timers, control panels, emergency stop switches, circuit breakers, etc.

Step 3: Visually inspect components for the following:

3.1. Exposed wire: loose terminal connection, melted insulation, corrosion, or discoloration of the insulation.

3.2. Fuses and switchblades: security of connections, visual signs of over heating, and conditions of mating surfaces (i.e. pitting and roughness).

3.3. Control switches and circuit breakers: distinctive audible clicks when the switch is operated.

Step 4: Replace covers (if applicable).

Step 5: Restore power.

5.1. Remove lock-out/tag-out items.

Step 6: Perform operational check.

6.1. Ensure switches operate smoothly and all electrical/mechanical components operate properly.

Step 7: Return system to original condition.

REVIEW QUESTIONS
FOR
INSPECT ELECTRICAL COMPONENTS/CIRCUITS

QUESTION	ANSWER
1. When inspecting electrical system components and circuits, exposed wires should be checked for which of the following items?	a. Melted insulation. b. Signs of arching. c. Security of connections. d. All of the above.
2. LFM personnel are required to perform all electrical maintenance on the fuel system.	a. True. b. False.
3. Fuses and switchblades should be inspected for which of the following items?	a. Snappiness and sharpness. b. Pitting and dipping. c. Secure connections and sharpness. d. Overheating and pitting.
4. When inspecting electrical system components, what must be done before you remove a switch cover?	a. Ensure the system is in service. b. Ensure the circuit to the switch is closed. c. Perform lock-out/tag-out procedures. d. Perform operational check.

INSPECT ELECTRICAL COMPONENTS/CIRCUITS

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….?	YES	NO
1. Isolate power to the item to be inspected		
2. Remove component covers (if applicable)		
3. Properly inspect the component		
4. Replace covers (if applicable)		
5. Properly restore power		
6. Properly perform an operational check		
7. Return the system to original condition		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

LIQUID FUELS ELECTRICAL

MODULE 16 AFQTP UNIT 9

REPLACE ELECTRICAL COMPONENTS (16.9.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

REPLACE ELECTRICAL COMPONENTS

Task Training Guide

STS Reference Number/Title:	16.9., Replace electrical components.
Training References:	1. Air Force Manual (AFMAN) 32-1275, *Maintenance of Petroleum Systems.* 2. Manufacturer's Manual. 3. Air Force Occupational Safety and Health Standards (AFOSHSTD) 91-45; Hazardous Energy Control and Mishap Prevention Signs and Tags. 4. Electrical schematics. 5. AFQTP 3E4X2 Module 16, Unit 4: *Interpret Schematics: Block, Connection, Schematic, Ladder*.
Prerequisites:	1. **Possess as a minimum a, 3E432 AFSC.** 2. **Review the following references:** 2.1. AFMAN 32-1275. 2.2. Manufacturer's manual. 2.3. AFOSHSTD 91-45. 2.4. AFQTP 3E4X2 Module 16, Unit 4.
Equipment/Tools Required:	1. General tool kit. 2. Lock out/Tag out kit. 3. Multi-meter. 4. Wire marking kit.
Learning Objective:	The trainee should learn basic steps required to safely replace electrical components.
Samples of Behavior:	Trainee will be able to replace electrical components.
Notes:	
1. To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions. 2. Any safety violation is an automatic failure.	

REPLACE ELECTRICAL COMPONENTS

1. Background: Any major maintenance or extensive troubleshooting (beyond the expertise of an LFM technician) should be performed by a qualified electrician. If LFM personnel are not qualified to perform tasks like replacing starters, relays, or wiring transfer pumps, a qualified electrician should be consulted. Under certain circumstances minor maintenance, to include ohm continuity, multi-meter testing, markings, kiss plate, and solenoid replacement, can be performed by LFM personnel (if the individual is knowledgeable and certified to perform each electrical task).

1.1. Before replacing electrical system components, you must use your knowledge and experience to troubleshoot the fuel system to determine that an electrical system component is actually the problem. For example, just because a KISS switch will not energize a refueling pump does not mean the KISS switch is faulty—the control panels may not be properly set up, maybe an emergency stop switch was activated and the system has not yet been reset, or maybe an emergency stop switch was pushed and is stuck. As you can see, many times you can troubleshoot and resolve a problem without having to replace anything.

NOTE:
The National Electric Code (NEC) requires all electrical equipment such as switches, motor starters, relays, and wiring in hazardous locations to be housed in totally enclosed, explosion proof case. This requirement helps maintain the safety of all fuel systems.

SAFETY:
REMOVE ALL JEWELRY BEFORE WORKING ON FUEL AND ELECTRICAL SYSTEMS.

2. ***To perform this task, follow these steps.***

Step 1: Troubleshoot the problem to determine an electrical component needs replaced.

Step 2: Isolate power.

2.1. Main power circuit breaker to the facility should not be shut off if mission requirements will be affected.

2.2. As a minimum, the power box to the component should be isolated.

SAFETY:
ENSURE ALL LOCK-OUT / TAG-OUT PROCEDURES ARE FOLLOWED.

Step 3: Verify isolation of component.

3.1. Use a multi-meter to ensure all power to component is off.

3.2. Ensure that all fuel sources have been eliminated if component is in the fuel line.

Step 4: Disconnect the electrical wiring and associated piping (if applicable).

NOTE:
Before removing any electrical connections, the wiring should be marked or color-coded to ensure proper connections later.

SAFETY:
ENSURE YOU USE PROPER TOOLS FOR PERFORMING ELECTRICAL MAINTENANCE, SUCH AS RUBBER HANDLED SCREWDRIVERS.

Step 5: Remove component.

Step 6: Inspect connections.

6.1. Inspect and repair all connections.

6.2. Check wire nuts for corrosion, wiring for fraying, check the integrity of the insulation, and check all pipe threads and conduit.

6.3. Prepare all connections for installation of new component.

Step 7: Install replacement component.

Step 8: Connect wiring.

8.1. Connect marked or color coded wires to the appropriate terminal connections or with wire nuts in the junction box.

Step 9: Secure electrical boxes.

9.1. Restore all electrical box covers to the original closed condition. Occasionally some boxes will require special gaskets or sealant compound to re-establish the vapor proof condition of the box.

Step 10: Perform operational check.

10.1. Ensure proper installation by checking for leaks and ensuring the proper electrical connections were made.

Step 11: Restore system to original condition.

REVIEW QUESTIONS
FOR
REPLACE ELECTRICAL COMPONENTS

QUESTION	ANSWER
1. When replacing electrical components, what should you do if you cannot turn the main power circuit breaker off due to mission requirements?	a. Postpone replacement until it can be turned off. b. Proceed with replacement only if the component you're replacing is not used at the time. c. Turn the main breaker off halting POL operations. d. Turn off circuit breaker to the individual component.
2. Before replacing an electrical component, how would you verify the component is electrically isolated?	a. Ensure the main circuit breaker is off. b. Ensure the circuit is closed. c. Test with a multi-meter. d. Install lock-out/tag-out kit.
3. What helps ensure proper wiring reconnections?	a. Nothing. b. Trial and error. c. Marking the wiring. d. Memorizing what goes where.
4. What must you do prior to installing the new component?	a. Connect the wiring. b. Perform an operational check. c. Replace cover sealant. d. Inspect connections.
5. After replacing electrical components, electrical box covers should be _____.	a. open. b. closed. c. locked. d. blocked.

REPLACE ELECTRICAL COMPONENTS

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….?	YES	NO
1. Troubleshoot the system to determine the component needs replaced		
2. Isolate power to the component		
3. Verify isolation of component		
4. Disconnect wiring and associated piping		
5. Properly remove the component		
6. Inspect the internal components and connections		
7. Properly install replacement component		
8. Properly reconnect the wiring		
9. Secure the electrical box		
10. Properly perform an operational check		
11. Return the system to original condition		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

LIQUID FUELS ELECTRICAL

MODULE 16 AFQTP UNIT10

APPLY SAFETY PRECAUTIONS (16.10.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

APPLY SAFETY PRECAUTIONS

Task Training Guide

STS Reference Number/Title:	16.10.., Apply safety precautions.
Training References:	1. Air Force Manual (AFMAN) 32-1275, *Maintenance of Petroleum Systems.* 2. Manufacturer's Manual. 3. Air Force Occupational Safety and Health Standards (AFOSHSTD) 91-45; *Hazardous Energy Control and Mishap Prevention Signs and Tags.* 4. Air Force Instruction (AFI) 32-1064, *Electrical Safety Practices.* 5. Career Development Course (CDC) 3E452 Liquid Fuel Systems Maintenance, Volume 2, Unit 5-1: Electrical Safety.
Prerequisites:	1. **Possess as a minimum a 3E432 AFSC.** 2. **Review the following references:** 2.1. AFMAN 32-1275. 2.2. Manufacturer's Manual. 2.3. AFOSHSTD 91-45. 2.4. AFI 32-1064. 2.5. CDC 3E452, Volume 2, Unit 5-1.
Equipment/Tools Required:	1. General Tool Kit. 2. Lock-out/Tag-out Kit. 3. Multi-meter.
Learning Objective:	Trainee should learn how to apply safety precautions when performing electrical maintenance.
Samples of Behavior:	Trainee will be to apply safety precautions when performing electrical maintenance.
Notes:	
1. To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions. 2. Any safety violation is an automatic failure.	

APPLY SAFETY PRECAUTIONS

1. Background: The most important part of any job is to get the job done ***SAFELY***. Facilities, work areas, equipment, and work procedures must comply with safety, fire, and health policies. To ensure safe procedures are in place, plan the work properly, review job requirements, and try to determine all the hazards that may be encountered.

1.1. Although this unit deals with electrical safety, you must keep in mind that all related precautions must also be considered, such as confined space entry, materials handling, personal protective equipment, and good housekeeping.

2. ***To perform this task, follow these steps:***

> **NOTE:**
> Ensure all work to be performed is coordinated with Fuels Control Center (FCC).

Step 1: Know emergency phone numbers.

1.1. Know emergency phone numbers at your base, such as the fire department, hospital, ambulance, etc.

Step 2: Remember the two-person policy.

2.1. Remember that the two-man policy applies to all situations.

2.2. Ensure that your supervisor is aware of your location.

Step 3: Review manuals.

3.1. Review all applicable technical manuals and follow all precautions listed.

Step 4: Assemble and inspect personal protective equipment (PPE).

Step 5: Remove jewelry.

5.1. Ensure all jewelry has been removed before working on fuel and/or electrical systems.

Step 6: Inform POL operator's of required work.

6.1. Coordinate work with POL facility operators; be sure they are aware of what you are working on and what systems will be affected.

Step 7: Examine job site.

7.1. Examine the area to locate all associated hazards.

7.2. Review the job and determine the hazards that will be encountered.

Step 8: Perform lock-out/tag-out procedures.

Step 9: Attach grounding and bonding cables (if applicable).

Step 10: Verify system is de-energized.

10.1. Test with a multimeter.

Step 11: Select appropriate tool for the job.

Step 12: After repairs are made, perform operational check.

Step 13: Return system to original condition.

REVIEW QUESTIONS
FOR
APPLY SAFETY PRECAUTIONS

QUESTION	ANSWER
1. When concerned with electrical safety, other safety matters should not be considered.	a. True. b. False.
2. Work procedures should comply with _____.	a. safety policies. b. fire policies. c. health policies. d. All of the above.
3. How do you check to see if your system is safe to work on?	a. Stick finger into control box. b. Stick a screwdriver into the control box. c. Test lines with a multi-meter. d. Just hope all switches are off.
4. PPE may be required while performing electrical maintenance.	a. True. b. False.

APPLY SAFETY PRECAUTIONS

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

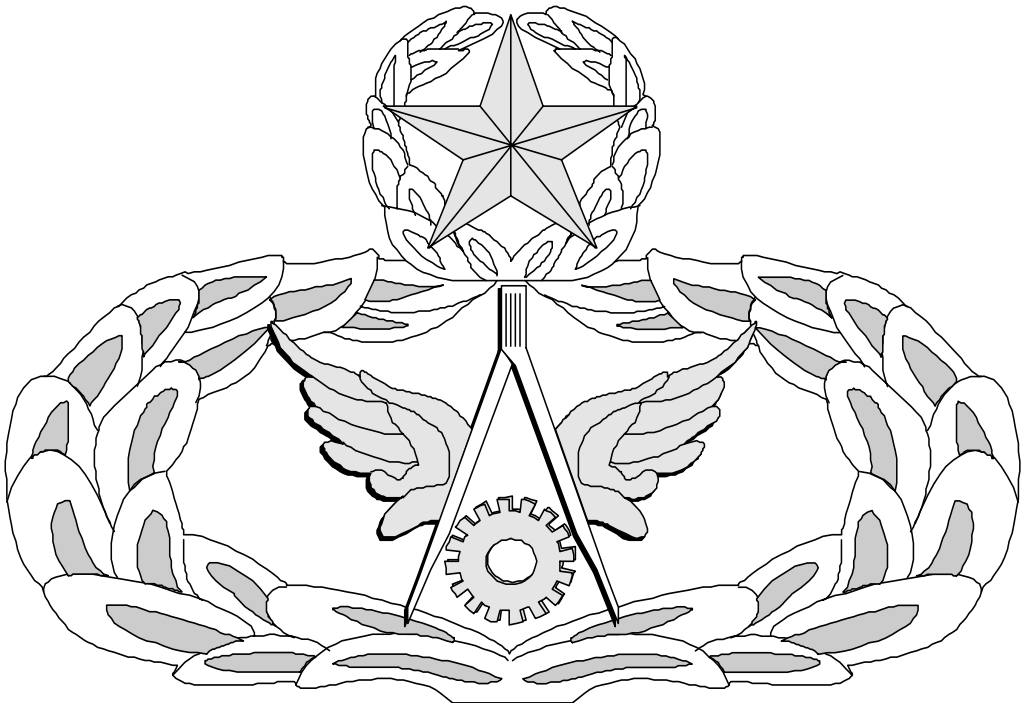
DID THE TRAINEE….?	YES	NO
1. Know emergency contact numbers		
2. Remember the two-person policy		
3. Review manuals (if applicable)		
4. Assemble and inspect appropriate PPE		
5. Remove jewelry		
6. Inform POL operators of the required work		
7. Examine the job site		
8. Perform lock-out/tag-out procedures		
9. Attach grounding and bonding cables (if applicable)		
10. Verify the system was de-energized		
11. Select the appropriate tool for the job		
12. Perform an operational check		
13. Return the system to original condition		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

Air Force Civil Engineer

QUALIFICATION TRAINING PACKAGE (QTP)

REVIEW ANSWER KEY



FOR

LIQUID FUEL SYSTEMS MAINTENANCE
(3E4X2)

MODULE 16

LIQUID FUELS ELECTRICAL

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

INTERPRET SCHEMATICS: BLOCK, WIRING, CONNECTION, SCHEMATIC, LADDER
(3E4X2-16.4.)

QUESTION	ANSWER
1. All diagrams will have a legend provided.	b. False.
2. Some components can have more than one symbol to represent it in a schematic.	a. True.
3. Can you use a schematic to trace the current flow?	a. Yes.
4. The electrical schematic can be used for_____.	c. providing a logic path for troubleshooting.
5. Which type of diagram is a simple drawing showing the relationship of major parts of a system?	a. Block.

USE TEST EQUIPMENT TO MEASURE VOLTAGE
(3E4X2-16.6.1.)

QUESTION	ANSWER
1. When using a multi-meter to test voltage, what range must you select if the circuit voltage being tested is unknown?	b. The highest scale.
2. Electrical pressure is measured in _____.	c. volts.
3. A 3-phase motor will run normally if it is missing a “leg”.	b. False.
4. Which lead is touched to ground?	c. Black.
5. Safety precautions are not required during the testing procedure.	b. False.

USE TEST EQUIPMENT TO MEASURE RESISTANCE
(3E4X2-16.6.2.)

QUESTION	ANSWER
1. When checking for resistance, set the multi-meter to one of the ohms functions.	a. True.
2. When using a multi-meter to check for resistance, most of the time you will start with the range switch in what position?	a. RX1 Range.
3. When using ohmmeter, why must you keep your hands on the insulated part of the meter leads?	d. It will distort your reading if you are touching the metal portion of the leads while testing.
4. What factor(s) determine(s) the resistance of a material?	d. All of the above.

USE TEST EQUIPMENT TO MEASURE CURRENT
(3E4X2-16.6.3.)

QUESTION	ANSWER
1. If the voltage on a circuit is increased, the amperage is also increased.	a. True.
2. When testing for current your meter must be in _____ with the load.	a. series
3. Current is measured in what unit?	b. Amperes.
4. Which of the following is an effect of current?	c. Magnetism.

INSPECT ELECTRICAL COMPONENTS/CIRCUITS
(3E4X2-16.7.)

QUESTION	ANSWER
1. When inspecting electrical system components and circuits, exposed wires should be checked for which of the following items?	d. All of the above.
2. LFM personnel can perform all electrical maintenance on the fuel system.	b. False.
3. Fuses and switchblades should be inspected for which of the following items?	d. Overheating and pitting.
4. When inspecting electrical system components, what must be done before you remove a switch cover?	c. Perform lock-out/tag-out procedures.

REPLACE ELECTRICAL COMPONENTS
(3E4X2-16.9.)

QUESTION	ANSWER
1. When replacing electrical components, what should you do if you cannot turn the main power circuit breaker off due to mission requirements?	d. Turn off circuit breaker to the individual component.
2. Before replacing an electrical component, how would you verify the component is electrically isolated?	c. Test with a multimeter.
3. What helps ensure proper wiring reconnections?	c. Marking the wiring.
4. What must you do prior to installing the new component?	d. Inspect connections.
5. After replacing electrical components, electrical box covers should be _____.	b. closed.

APPLY SAFETY PRECAUTIONS
(3E4X2-16.10)

QUESTION	ANSWER
1. When concerned with electrical safety, other safety matters should not be considered.	b. False
2. Work procedures should comply with _____.	d. All of the above.
3. How do you check to see if your system is safe to work on?	c. Test lines with a multi-meter.
4. PPE may be required while performing electrical maintenance.	a. True.

Appendix A

MEMORANDUM FOR HQ AFCESA/CEOF
139 Barnes Drive Suite 1
Tyndall AFB, FL 32403-5319

FROM:

SUBJECT: Qualification Training Package Improvement

1. Identify module.

   Module # and title_____

2. Identify improvement/correction section(s):

   _____ STS Task Reference
   _____ Training Reference
   _____ Evaluation Instructions
   _____ Performance Resources
   _____ Steps in Task Performance
   _____ Performance Checklist
   _____ Feedback
   _____ Format
   _____ Other

3. Recommended changes--use a continuation sheet if necessary.

   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

4. You may choose to call in your recommendations to DSN 523-6380 or FAX DSN/Commercial 523-6488 or (850) 283-6488 or email ceof.helpdesk@tyndall.af.mil.

5. Thank you for your time and interest.

YOUR NAME, RANK, USAF
Title/Position