ELECTROMECHANICAL EQUIPMENT OPERATION AND MAINTENANCE

NTQF Level III

Learning Guide -17

Unit of Competence: - Maintain Induction Motor Functions

Module Title: - Maintaining Induction Motor Functions

LG Code:- EIS EME3 M05 LO-03-17

TTLM Code: - EIS EME3 M05 0219TTLM-V1

LO-03: - Mounting equipment and testing devices

Instruction Sheet	Learning Guide #03

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Tools and testing instruments
- Identifying defective/Sub-standard electrical materials
- Cleaning work areas

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Select Tools and testing instruments
- Identify defective electrical materials
- Clean work areas.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 20.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” in page 5.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Read the information written in the “Information Sheet 2”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
9. Accomplish the “Self-check 2” in page 7.
10. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 2).

11. Read the information written in the “Information Sheets 3 . Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
12. Accomplish the “Self-check 3” in page 11.
13. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 3).
14. If you earned a satisfactory evaluation proceed to “Operation Sheet 1” in page 12. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
15. Read the “Operation Sheet 1” and try to understand the procedures discussed.
16. If you earned a satisfactory evaluation proceed to “Operation Sheet 2” in page 13. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
17. Read the “Operation Sheet 2” and try to understand the procedures discussed.
18. If you earned a satisfactory evaluation proceed to “Operation Sheet 3” in page 14. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
19. Read the “Operation Sheet 3” and try to understand the procedures discussed.
20. Do the “LAP test” in page 15 (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work.

Information Sheet-1	Tools and testing instruments

1.1 Tools

Tools: - refer to the small materials used for working, commonly by using your hand and with the force of your arm, wrist or hand. This is called as hand tools

Some hand tools vary according to its use or purpose. Some are categorized depending on its purpose. Categories may be classified into:

- Cutting tools
- Hammering tools
- Leveling Tools
- Measuring tools
- Driving tools
- Holding tools

Examples of electrical cutting tools are:- pliers, electrical knife ,saw, nippers etc.

Pliers: - are electrical hand tools used to cutting and twisting electrical wire. Use only pliers with insulated handles when working on electrical parts. Cutting pliers are mostly used when working on wirings. There are different types cutting pliers.

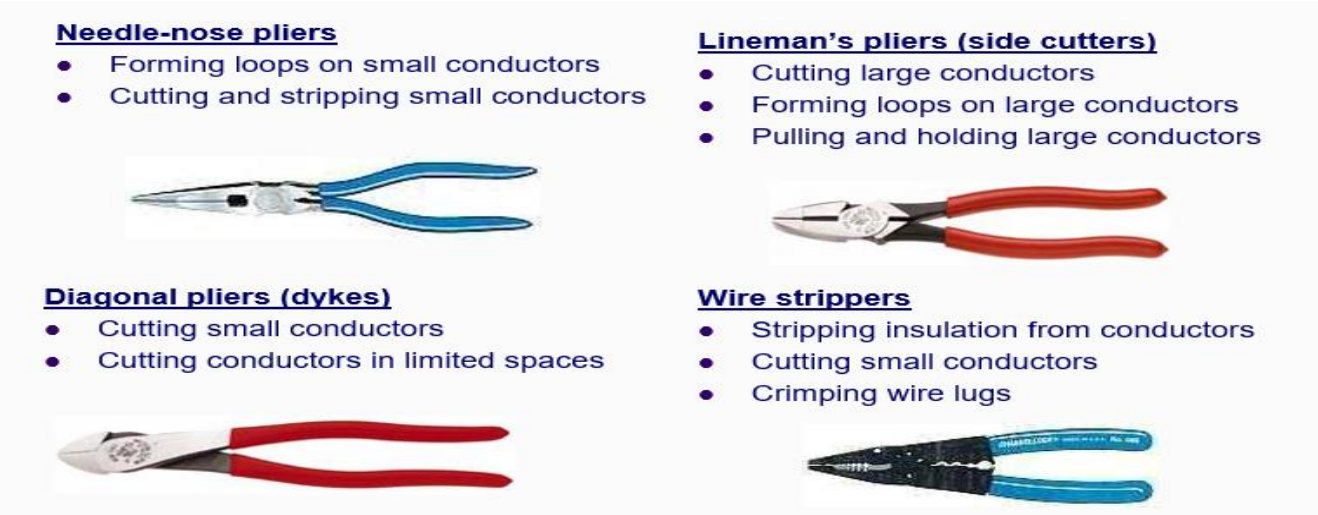


Figure 1.1 different types of electrical cutting pliers

Screwdrivers: - are used to tight or loose different shape of screws. There are different types of screw drivers flat head screw drivers, Phillips head screw drivers

Flat-head screwdriver: used to Installing and removing slot-head screws

Phillips head screw drivers: - used to installing and removing Philips-head/cross head screws

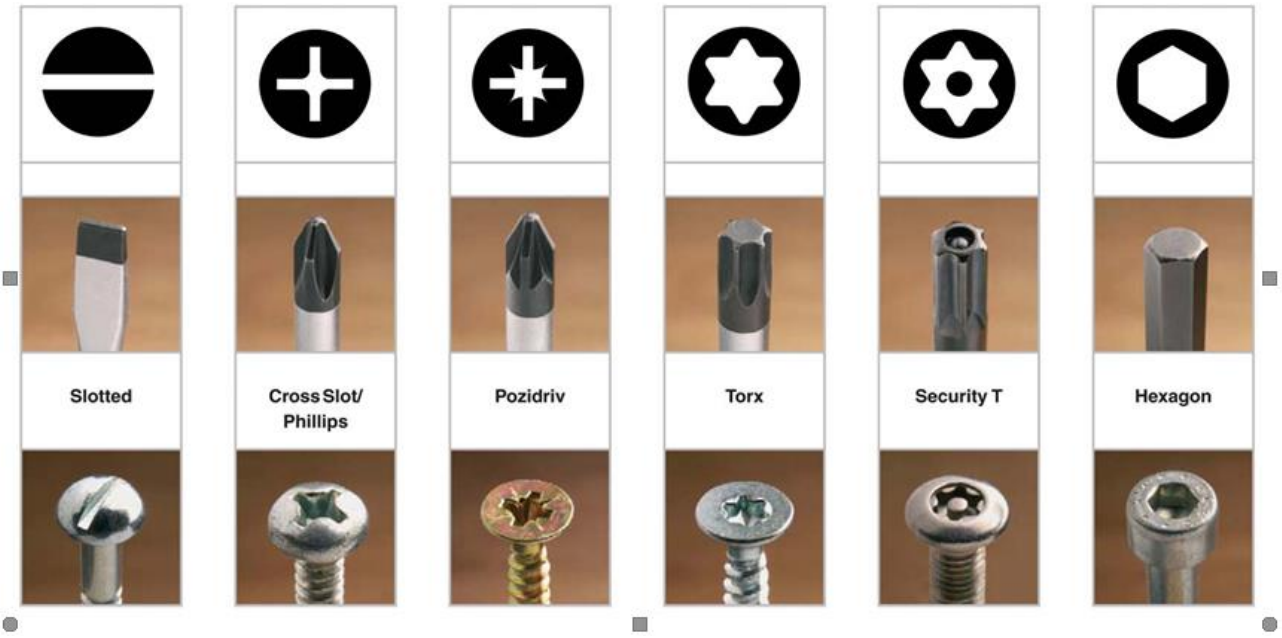


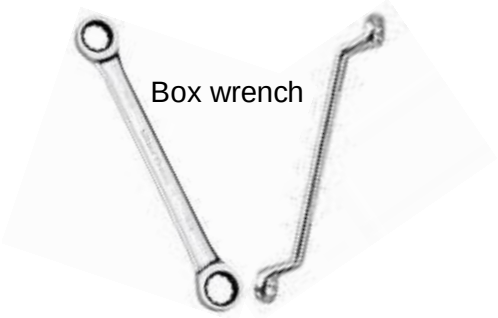
Figure1.2. Different heads of screw and its drivers

wrench or spanner: - is a tool used to provide grip and mechanical advantage in applying torque to turn objects. There are different Types of wrenches open-end, box- end, combination box/open end, adjustable, socket wrenches.

open-end wrench: - A one-piece wrench with a U-shaped opening that grips two opposite faces of the bolt or nut .it is often double-ended, with a different-sized opening at each end. It allows a greater range of movement in enclosed spaces by flipping the wrench over

Box-wrench: - A one-piece wrench with an enclosed opening that grips the faces of the bolt or nut. The recess is generally a six-point or twelve-point opening for use with nuts or bolt heads with a hexagonal shape.

can be used in a tight space where a socket wrench cannot go. Box wrenches are usually 12-point and provide a powerful non damaging grip and the nut or bolt.



combination wrench: - A double-ended tool with one end being like an open-end wrench or open-ended spanner, and the other end being like a box-end wrench. Both ends generally fit the same size of bolt.

An adjustable wrench :- is an open-end wrench with a movable jaw, allowing it to be used with different sizes of fastener head (nut, bolt, etc.) wrench.

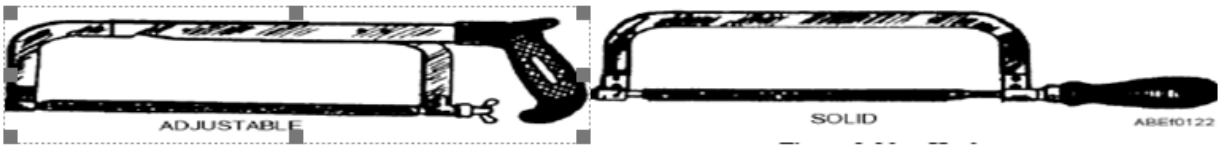
A wire stripper:- is a small, hand-held device used to strip the electrical insulation from electric wires.

Electrician knives: - This tool is used primarily for cutting of papers, cardboards and the like. Also used for cutting or stripping off the insulation of the wire.

Electrical hand drill: - is a fastening tool used to secure screws or bolts. It can also be used with a drill bit to tighten fasteners

Measuring tools: -Steel tape/ruler is used for measuring linear measurements. Such as electrical fixtures and centering lighting fixture boxes. Measuring wall height and depth as well as wire length represent just some of the common electrical works.

Hack saws: -is cutting tools used to cut metal that is too heavy for snips or bolt cutters. Thus, metal bar stock can be cut readily with hacksaws.



1.2. Testing instruments: are electrical device used to test or measure electrical quantities. - almost all industrial machines, home appliances etc. are working on electrical energy, it is must to inspect and test the electrical energy for its quality before energizing machines/appliances. Example of testing instruments are voltage tester screwdriver
, analog and digital multimeter, etc.

1.2.1. VOLTAGE TESTER SCREWDRIVER:

A test light, test lamp, voltage tester, or mains tester is a very simple piece of electronic test equipment used to determine the presence or absence of an electric voltage in a piece of equipment under test.

1.2.1. Continuity Test:

Continuity refers to being part of a complete connected or not connected whole. In electrical applications, when an electrical circuit is capable of conducting current, It is also said to be closed if not conducting said to open. In short, by performing continuity test, we can determine the following

i) existence of continuity in the electrical wiring circuit

ii) existence of any open circuit in the circuit

iii) existence of any short circuit in the circuit

Continuity testers are simple devices designed to verify a complete electrical path through an object. Best examples are analog and digital multimeter

Open circuit test and Short circuit test: Multimeter can be used for this test. For this, multimeter should be set in resistance mode of measurement. To check the existence of any open circuit or short circuit between any two points in the wiring circuit, the electrical supply to the circuit should be switched off first. Then put the multimeter probes between the two testing points in the circuit. If multimeter reads infinitive (∞) ohm at any range, it indicates open circuit. If multimeter reads zero (0) ohms at any range, it indicates short circuit

Multimeter: -is an instrument used to measure electrical quantities and test the continuity of electrical circuit whether it broken or not. See figure 1.3 A and B

Figure 1.3A Analog multimeter

figure 1.3.B Digital multimeter

Camp meter: - is an electrical test tool that combines a basic digital multimeter with a current sensor. Clamps measure current. Probes measure voltage

Refer..

https://www.youtube.com/watch?v=HfAz9iVQoiY

https://www.youtube.com/watch?v=WDTVE7lxJQ8

Insulation Tester : is an electrical device used to test the insulation of materials . best example is Megger .

A Megger insulation resistance tester is especially useful when you have carried out electrical work on your home and want to make sure you didn't damage insulation or make a wiring mistake. Which uses an applied DC voltage (typically either 250Vdc, 500Vdc or 1,000Vdc for low voltage equipment <600V and 2,500Vdc and 5,000Vdc for high voltage equipment) to measure insulation resistance in either kΩ, MΩ or GΩ. The measured resistance is intended to indicate the condition of the insulation or dielectric between two conductive parts, where the higher the resistance, the better the condition of the insulation. Ideally, the insulation resistance would be infinite, but as no insulators are perfect, leakage currents through the dielectric will ensure that a finite (though high) resistance value is measured.

Phase sequence: - is the sequence in which three phase voltages attain their positive maximum values is defined as the phase sequence. It refers to the relation between the voltages or currents in three phase system. Consider the three phases as red-R, yellow-Y and blue-B phases.

Phase sequence meter: - is used for detecting the sequence of the supply in three-phase electric circuits. Since the direction of rotation of three phase electric motors can be changed by changing the phase sequence of supply.

Figure 1.4 phase sequence meter

Refer…

https://www.youtube.com/watch?v=HvtMtm9pJIg

https://www.youtube.com/watch?v=S9h3z9HPZcA

Self-Check 1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. ---------- one of the following is not hand tools
   - A. Screw driver
   - B. wrenches
   - C. knife
   - D. multimeter

2. ---------- An electrical hand tool used to determine the presence or absence of an electric voltage in a piece of equipment under test.
   - A. Test light
   - B. Voltmeter
   - C. Wrench
   - D. none

3. ---------- measuring instrument used to measure the the insulation resistance is known as
   - A . Megger
   - B. Multimeter
   - C. Clamp meter
   - D. A and B

Note: **Satisfactory rating – 3points** **Unsatisfactory – below3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer sheet

1. __
2. ___
3. ____

Information Sheet-2	Identify defective electrical materials

2.1. Introduction to Electrical Maintenance

Electrical maintenance covers all aspects of testing, monitoring, fixing, and replacing elements of an electrical system. Usually performed by a licensed professional with a complete knowledge of the National Electric Code and local regulations, electrical maintenance covers Electrical motor, Generators, Lighting systems any electrical device …etc

Electrical equipment defects can result in serious injuries, such as electrocution, burns, and electric shock. In some cases, electrical equipment defects can even result in death. The failure of a single component in the electrical system can cause extensive downtime or data loss.

Before you start any type of electrical work, you must follow these following safety precautions:

- Switch off the main power at the consumer unit/fuse box. Isolate the circuit you plan to work on by removing the circuit fuse. Put this in your pocket to avoid accidental replacement or switch off the breaker and lock it if you can
- Attach a note to the unit to advise you are working on the circuit
- Check the circuit is dead with a socket tester or voltage tester/meter for lighting circuits

Defective components can by identified by testing instruments such as multimeter, and megger by troubleshooting method. defective components can be caused by excessive electrical power to the components

Figure 2.1 defective test multimeter

As we say ,defective component can be recognized by ohmmeter we can see one of two things if the digital multimeter/ohmmeter dial is on the wrong resistance setting

1 or open loop(OL)

If the display reads 1 or OL the setting is to low turn the multimeter dial to the next highest resistance setting. continue increasing the setting until you have reading a full number .

Less than 1

If the number on the screen is less than 1 the setting is to high .Turn the multimeter dial to the next to lowest setting to get accurate reading .continue until you have reading that a full number.

2.2. Ways to recognize Faults.

1. infinity resistance (∞): - if the display shows 1 or OL no matter the resistance setting you have most likely got a fault defective device/components on your hands. Infinity reading means open /broken device.

2. low resistance (zero ohm reading) if the display shows zero reading at lowest range it indicates that the components are short circuit in parts.

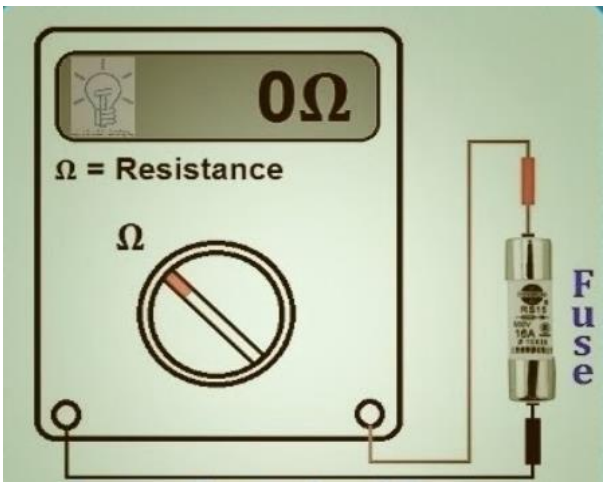


Figure 2.2 testing electrical component and device

Refer ……

https://www.youtube.com/watch?v=ztzn6eMMrCo

https://www.youtube.com/watch?v=aDy9-lGNeQM

https://www.youtube.com/watch?v=0PdFPtkG1OY

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. ---------- Defective components can be identified by
   A. digital multimeter
   B. ohmmeter
   C. test light
   D. All.
2. ----------defective components are caused by
   A. power interruption problem
   B. excessive current flow
   C. Limited date of the components
   D. All of the above
3. ----------. When you check the component, if the ohmmeter reads infinity at any range what can you say about the component
   A. Open circuit component(broken)
   B. Short circuit (blow)
   C. Damaged component
   D. A and c

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer sheet

1._____
2._____
3._____

Information Sheet-3	Cleaning work areas

3.1. Cleaning of worksite, tools and equipment

Electrical equipment should be kept clean for maximum efficiency and service longevity. Keeping electrical equipment clean is an important part of any electrical preventive maintenance program, but using the wrong cleaning methods could be costly. Cleaning involves sweeping floors, dusting furniture and other surfaces, mopping or washing floors, polishing surfaces, articles and accessories, tools and device, rearranging cleaned areas and putting things in their specific place.

We can say that cleaning is a process of removing dust, dirt or any other undesirable materials like colors, spots, contents of an ashtray, etc. What happens if cleaning is not done on a regular basis? Yes, your house will become the breeding ground of insects such as cockroaches, spiders, ants, flies and mosquitoes. It will look dirty and will be most uncomfortable. Living in such circumstances can also lead to diseases such as asthma, bronchitis, etc. Thus, cleaning is necessary for a general presentable appearance and also to ensure good hygienic conditions.

What do you understand by dust and dirt? ‘Dust’ collectively refers to the loose particles, which are very easily moved by air and settle on any surface. It is easily removed with the help of a dry cloth. ‘Dirt’ refers to dust which sticks to any surface with the help of moisture or grease. It is more difficult to remove dirt as compared to dust. Dirt has to be removed either with a detergent or any other cleaning agent.

3.2. Methods of cleaning

Dusting :-You are already familiar with the term ‘dust’. But how do you remove dust? When any surface is wiped with a piece of dry cloth, (duster), it carries the loose dust with it and the process is known as dusting. This should be done with a clean soft cloth.

Figure 3.1 Dusting with a cloth

Sweeping: -When a sweeper or a brush is used to carry the dust laterally along the room, the process is known as sweeping. While sweeping any vertical surface as walls, you should remember to start from the top and sweep downwards. Similarly, for lateral sweeping as for floors, start from one end of the room and move to another, preferably a door, and carry the dust all along or collect in a dust pan. All the movable articles kept on the floor should be lifted, swept under, and kept back in place.

Polishing: -When some reagent is rubbed on a surface to bring out the shine, the process is known as polishing and the reagent applied is known as the 'polish'. Similarly, many other articles/ decorative items made of brass, wood, marble etc, may be polished

3.3. Cleaning Equipment

Following are some of the equipment which you will come across during the process of cleaning.

Dusters - These are mostly made of soft cotton, flannel or artificial feathers mounted on a stick. These are used to clean loose dust and are also used for wiping various surfaces. It should be washed and dried after use.

Dust pans- these are made of either plastic or metal and have flat surfaces, rounded at the sides. After sweeping, dirt and dust is collected directly into these with the help of a sweeper and carried to a wastepaper basket.

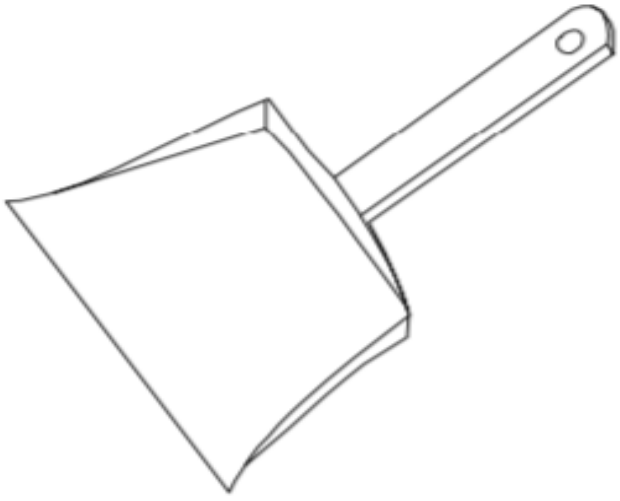


Figure 3.2. A dust pan

Brushes-are available in various sizes and shapes and are made of different materials. Different brushes are used for specific jobs. Brushes with nylon or plastic bristles are used for cleaning carpets or furniture, round feather brushes are used to remove dusts, metal brushes are used to clean wire mesh in the windows

Figure 3.3. Various types of brushes

Vacuum cleaner- it works on electricity and has a fan. This sucks in the dirt and dust from the surfaces and stores it in a disposable bag inside. This bag should be emptied regularly.

Figure 3.4. A vacuum cleaner

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is cleaning?
2. What is the importance of cleaning tools and materials?
3. Write at list three methods of cleaning

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer sheet

1._____

_____

2._____

_____

3._____

_____

Operation Sheet 1	Identifying defective electrical components Techniques

Techniques to identify defective electrical components

1. Check the your multimeter functionality (turn on power)
2. Disconnect the power source before checking, servicing, repairing or installing electrical equipment and devices.
3. Turn “ON” your multimeter and set to the lowest resistance setting. The resistance settings are the ones measured in Ohms.
4. Test your multimeter is working by pressing the probes together. The multimeter screen should read 0.00 also known as short circuit (inexpensive meters may read close to this from resistance of their leads). When the probes part the screen should read 1 or OL, also known as open circuit.
5. Find the two connections where wires connect to your part.
6. Push the metal parts of your multimeter probes firmly onto these connections, one probe on each connection.
7. Keep the probes still until you get a reading on the multimeter screen. Take note of the reading.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 2 hours.

Task 1. Identify defective components of control panel

- Prepare instruments to appropriate function switch and range switch
- Check your probe
- Turn off the power supplied to control panel
- Trace the fault.

List of Reference Materials

4. https://www.youtube.com/watch?v=HfAz9iVQoiY
5. https://www.youtube.com/watch?v=WDTVE7lxJQ8
6. https://www.youtube.com/watch?v=HvtMtm9pJIg
7. https://www.youtube.com/watch?v=S9h3z9HPZcA
8. https://www.youtube.com/watch?v=ztzn6eMMrCo
9. https://www.youtube.com/watch?v=aDy9-lGNeQM
10. https://www.youtube.com/watch?v=0PdFPtkG1OY