BUILDING ELECTRICAL INSTALLATION

Level-III

Based on November 2018, Version 5 Occupational standards (OS)

Module Title: - Trouble- Shoot and Repair Faults in Low Voltage Electrical Apparatus and Circuits

LG Code: EIS BEI3 M10 LO (1-3)-LG (36-38)

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December 2020

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LG #36	LO #1- Prepare to trouble-shoot and rectify faults

Instruction sheet

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

- Determining the extent and nature of the electrical installation
- Identifying, obtaining and understanding safety and regulatory requirements
- Identifying OHS procedures for a given work area
- Following OHS risk control measures and procedures
- Visualizing the extent of work to be undertaken from fault/breakdown reports
- Requiring advice from the work supervisor

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Determine the extent and nature of the electrical installation
- Identify, obtain and understand safety and regulatory requirements
- Identify OHS procedures for a given work area
- Follow OHS risk control measures and procedures
- Visualize the extent of work to be undertaken from fault/breakdown reports
- Require advice from the work supervisor

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
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4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
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Information Sheet 1- Determining the extent and nature of the electrical installation

1. Determining the extent and nature of the electrical installation

An electrical installation comprises all the fixed electrical equipment that is supplied through the electricity meter. Satisfactory earthing arrangements are in place to ensure that a fuse or circuit breaker can quickly clear an electrical fault before it causes an electric shock or fire

Selection of cross-sectional-areas of cables or isolated conductors for line conductors is certainly one of the most important tasks of the design process of an electrical installation as this greatly influences the selection of overcurrent protective devices, the voltage drop along these conductors and the estimation.

5 Different Types of Electrical House Wiring Systems

- Cleat Wiring. This wiring comprises of PVC insulated wires or ordinary VIR that are braided and compounded.
- Casing and Capping Wiring.
- Batten Wiring.
- Lead Sheathed Wiring.
- Conduit Wiring

They inspect electrical wires for fraying or damage:-

In doing this, they leave no space unexamined – electricians would check everything from wire encased in plain sight to those looped through nooks and crannies. They note where wiring has or could become unsafe, then recommend the necessary fixes

Creating an electrical installation:-Calculation of the conductor cross-sections, Protection for each level in the **installation**, Selection of the appropriate electrical devices and equipment.

- Analysis of the loads. Actual Power Diagram.
- Calculation of the currents.
- Calculation of the power according to the load types.

- Power of the source.

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction: - choose and write the letter of the correct answer on the space provided. (4 each)

1. Calculation of the conductor cross-sections, Protection for each level in the **installation**

A. Power of the source.
B. Analysis of the loads
C. Calculation of the currents
D. All

2. An electrical installation comprises all the fixed electrical equipment that is supplied through the_____? Electricity meter

A. Power of the source
B. Electricity meter
C. Calculation of the currents
D. All

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

Score = _____

Rating: _____

Information Sheet 2- Identifying, obtaining and understanding safety and regulatory requirements

2. Identifying, obtaining and understanding safety and regulatory requirements

Safety regulations are the strongest form of official advice that employers have to follow, and they are legally enforceable. Regulations are made by government ministers, often following proposals from the Health and Safety Executive (HSE), and approved by Parliament.

The purpose of Occupational Health and Safety (OH&S) legislation is to protect you, the worker, against hazards on the job. It outlines the general rights and responsibilities of the employer, the supervisor and the worker.

Most safety regulations in the workplace are enforced by the Occupational Health and Safety Administration, according to the U.S. Department of Labor. Safety regulations are meant to protect workers, while punishing businesses that put their employees in danger.

What are the legal requirements for health and safety in the workplace? Management of Health and Safety at Work Regulations (MHSWR) 1999 These Regulations require employers to consider the health and safety risks to employees and to carry out a risk assessment to protect employees from exposure to reasonably foreseeable risks. Those risks include work-related violence.

Self-check 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction I: - write true if the statement is correct or write false if the statement is incorrect and write the answer on the space provided**.**

1. Safety regulations are the strongest form of official advice that employers have to follow, and they are legally enforceable. (5 point)

2. The purpose of Occupational Health and Safety (OH&S) legislation is to protect the workers against hazards on the job. (5 point)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Score = _____

Rating: _____

Information Sheet 3- Identifying OHS procedures for a given work area

3. Identifying OHS procedures for a given work area

What are the OHS procedures?

The **purpose** of the Health and Safety policies and procedures is to guide and direct all employees to work safely and prevent injury, to themselves and others. All employees are encouraged to participate in developing, implementing, and enforcing Health and Safety policies and procedures

What are the main methods used in OH&S evaluation?

Therefore, the five core activities of most OHSMSs (and especially OHSAS 18001) are policy, planning, implementation, checking, and management review. Each activity is associated with a set of criteria that have certain effects on system performance

- Here are some tips to help make your workplace safe.
- Understand the risks.
- Reduce workplace stress.
- Take regular breaks.
- Avoid stooping or twisting.
- Use mechanical aids whenever possible.
- Protect your back.
- Wear protective equipment to suit the task.
- Stay sober

A Safety Moment is a brief safety talk about a specific subject at the beginning of a meeting or shift. Including a Safety Moment at the beginning of your meeting can help bring safety issues or topics up in a timely, clear, brief, and non-threatening way.

Self-check 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

INSTUCTON III: - Give short answer for the following questions and write the answer on the space provided? (6pts)

1. Mention the Activities associated with the set of criteria that have certain effects on system performance work area?

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

Score = _____

Rating: _____

Information Sheet 4- Following OHS risk control measures and procedures

4.Following OHS risk control measures and procedures

What are risk control procedures?

Risk control measures are actions that are taken in response to a risk factor that has the potential to cause accident or harm in the workplace.The control measures can either be designed to reduce the risks or eliminate them completely with the latter obviously being preferred.

There are three main types of internal controls: detective, preventative, and corrective

How to Monitor Risk Controls

1. Consult the workers or learners involved with the controls.
2. Consult management who administer the controls.
3. Check accident and incident reports to see how effective the controls have been.

5 best risk assessment control measures

1. Elimination. We have already discussed this earlier on in this post, and elimination should always be the first **control measure** you consider. ...
2. Substitution. Substitution is the second best control measure you could use. ...
3. Engineering controls. ...
4. Administrative controls. ...
5. Personal protective clothes and equipment

Regularly check that the implemented control measures are effective through:

1. Meetings and worker feedback.
2. Inspections, observations and walkthroughs.
3. Checklists and audits.
4. Independent reviews.
5. Technology such as monitoring alarms.
6. Environmental monitoring such as air quality and noise testing

Self-check 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

INSTUCTON III: - Give short answer for the following questions and writ the answer on the space provided? (10 point)

1. How to Monitor Risk Controls procedures (mention)?

1. _____

2. _____

3. _____

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Score = _____

Rating: _____

Information Sheet 5- Visualizing the extent of work to be undertaken from fault/breakdown reports

5. Visualizing the extent of work to be undertaken from fault/breakdown reports

Use breakdowns when you want to know more about how a report item or segment relates to other reports. This is often called “breaking down” a report by another report. An example is a breakdown of a custom traffic report called Age

How to Write a Damage Report

- Gather all of these necessary facts, which includes the following information:
  - ✓ Date, time, location of the incident
  - ✓ The extent of the damage done
  - ✓ Names and designations of the people involved
  - ✓ Names and claims of witnesses
  - ✓ Series of events leading up to the incident
  - ✓ Environmental conditions during the time
  - ✓ Specific injuries sustained by people

Table 1- report format

UTILITY DAMAGE INCIDENT REPORT

General Information

Project: _____ Project No.: _____

Contractor: _____

Contractor POC for This Incident _____ Cell #: _____

Utility Owner: _____

Date/Time Damaged: _____ Date/Time 1st Identified: _____

General Location of Work Area: _____

Address Where Incident Occurred: _____

Damage 1st Reported By: _____

Describe Incident & Damage to Utility Asset: (attach photos & supplemental information) _____

_____

_____

_____

Describe Collateral Damage to Equipment or Property: (attach photos & supplemental information) _____

_____

_____

Did Personal Injuries Result for this Incident? ☐Yes ☐No (If yes, complete & Attach Accident Incident Report

Utility Interaction

Date/Time Utility Notified: _____ Name Contractor Notifier: _____

Name/Title Utility POC: _____ Cell/Telephone #: _____

Summarize Utility Initial Response: _____

_____

_____

_____

_____

Date/Time Utility 1st on Site: _____

Did Utility Repair Damage on Initial Visit? ☐Yes ☐No (If no, complete attached Utility Contact Log)

Date/Time Utility Completed Repairs: _____

Does Utility Require Special Work Methods? ☐Yes ☐No (If Yes, attach agreed requirements)

Self-check 5	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

INSTUCTON III: - Give short answer for the following questions and writ the answer on the space provided?

1. What Information Does a Damage Report Consist of? (10pt)

1. _____
2. _____
3. _____
4. _____
5. _____

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Score = _____

Rating: _____

Information Sheet 6- Requiring advice from the work supervisor

6.1 Requiring advice from the work supervisor

The supervisor's overall role is to communicate organizational needs, oversee employees' performance, provide guidance, support, identify development needs, and manage the reciprocal relationship between staff and the organization so that each is successful.

It's the supervisor's responsibility to enforce safe work practices and procedures; failure to do so is an invitation for accidents to occur. Workers must be encouraged to identify unsafe or unhealthful workplace conditions or hazards and absolutely not be disciplined for doing so!

Supervision often includes conducting basic management skills (decision making, problem solving, planning, delegation and meeting management), organizing teams, noticing the need for and designing new job roles in the group, hiring new employees, training new employees, employee performance management (setting goals

Supervisor responsibilities include:

- Setting goals for performance and deadlines in ways that comply with company's plans and vision.
- Organizing workflow and ensuring that employees understand their duties or delegated tasks.
- Monitoring employee productivity and providing constructive feedback and coaching.

Important Supervisor Qualities

- Effective Communication. .
- Leadership.
- Empathy and Compassion.
- Conflict Resolution.
- Ability to Delegate.
- Problem Solving.
- Time and Priority Management.

- Confidence.

Supervisors becoming leaders

Here are the 6 supervisory skills steps to lead by example and provide you with.

1. **Inspire:** Be an inspiration to your employees. Employees always seek for guidance and they will instantly take their supervisor as an example. Setting the right example to your employees helps them do the job more efficiently as well as ensuring that they will feel safer knowing that their supervisor is there to help.
2. **Acknowledging failure:** As a supervisor, you are still prone to failing or taking a wrong decision. Yet, failure can be a success if acknowledged and fixed. Being the supervisor, some employees might find it intriguing and will not acknowledge their mistakes due to fear. Your task is to assure them that it is okay to fail but it is not okay to keep on doing the wrong thing.
3. **Motivation:** To be a leader you should motivate. Motivation is a necessary factor that humans cherish. If an employee fails to do a job or lacks motivation, be a leader, help them with their work or guide them. A manager tells an employee to do a task; a leader will do the task with the employees and supervise it.
4. **Listening:** Listening skills are vital to leadership. Listening to a suggestion from a team member could change the course of a task, action, or decision and direct it to the right path. As a supervisor, you should encourage everyone to speak, and you should listen.
5. **Courage:** As a leader, hard decisions must be made from time to time. Calculating risks and taking them needs a courageous leader. It also sets an example for the employees to always have the courage to suggest, commit to a task even if it is risky as well as empowering you as a leader.
6. **Compassion:** Being compassionate with your employees or team members is a humanitarian act that every leader should practice. Employees are only humans and are prone to work-related or personal issues as well as the daily hassles that face them. Be the source of comfort to your employees and make them feel safe, but be tough when needed

Self-check 6	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

INSTUCTON III: - Give short answer for the following questions and writ the answer on the space provided?(6pts)

1. From the following characters, one is not the characters of the work supervisor?

A. Motivation
B. Listening
C. Courage
D. None

2. The supervisor's overall role is to _____ in to working area.

A. communicate organizational needs
B. oversee employees
C. provide guidance
D. All

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

Score = _____

Rating: _____

LG #37	LO #2-Trouble-shooting and repairing faults.

Instruction sheet

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

- Following OHS risk control measures and procedures
- Determining the need to test or measure
- checking Circuits/machines/plant as being isolated
- Documenting safety hazards resulting from the fault or breakdown
- Approaching trouble-shooting
- Dismantling circuit/apparatus components
- Rechecking faulty circuits/components
- Sourcing and Obtaining materials/replacement parts
- Testing in effectiveness of the repair
- Reassembling finally testing and preparing Apparatus for return to service.
- Dealing unexpected situations with safely
- Carrying trouble-shooting and repair activities out without damage

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, **you will be able to**:

- Follow OHS risk control measures and procedures
- Determining the need to test or measure
- Check Circuits/machines/plant as being isolated
- Document safety hazards resulting from the fault or breakdown
- Approach trouble-shooting

- Dismantle circuit/apparatus components
- Recheck faulty circuits/components
- Source and Obtaining materials/replacement parts
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Information Sheet 1- Following OHS risk control measures and procedures

1.1 Following OHS risk control measures and procedures

What are risk control procedures?

Risk control measures are actions that are taken in response to a risk factor that has the potential to cause accident or harm in the workplace. The control measures can either be designed to reduce the risks or eliminate them completely, with the latter obviously being preferred

The key elements of successful occupational health management are based on five steps:

Step 1: Setting your policy.

Step 2: Organizing your staff.

Step 3: Planning and setting standards.

Step 4: Measuring your performance.

Step 5: Learning from experience - audit and review.

How to Monitor Risk Controls

- Consult the workers or learners involved with the **controls**.
- Consult management who administer the controls.
- Check accident and incident reports to see how effective the controls have been.

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

INSTUCTON III: - Give short answer for the following questions and writ the answer on the space provided?

1. List the 4 steps of the key elements successful occupational health risk control measures and procedures? (10 point)

1. _____
2. _____
3. _____
4. _____

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Score = _____

Rating: _____

Information Sheet 2-Determining the need to test or measure

2.1 Determining the need to test or measure

The test is specific instrument for measurement. Administration of a test is a process of measurement, without test, measurement is not possible. Measurement is a technique necessary for evaluation. It represents status of a certain attributes or properties and is a terminal process.

What is Test and Measurement?

Tests and measurements are standardized instruments, such as questionnaires, inventories, and scales, which are used to measure constructs in various social science disciplines. They are used for diagnosis, research, or assessment.

There are different stages for manual testing such as unit testing, integration testing, system testing, and user acceptance testing. Testers use test plans, test cases, or test scenarios to test software to ensure the completeness of testing

TYPES OF TEST:-There are seven types of test.

- Diagnostic Test uses measures the knowledge and skills of student.
- Proficiency Test
- Achievement Test
- Aptitude Test
- Placement Test
- Personality Test
- Intelligence Test

Test: countable noun a test is a deliberate action or experiment to find out how well something works. Testing: 2. uncountable noun Testing is the activity of testing something or someone in order to find out information

Self-check 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction I: - write true if the statement is correct or write false if the statement is incorrect and write the answer on the space provided**.(**6pts)

_____1. The test is specific instrument for measurement.

_____2. Without test, measurement is possible.

_____3. Measurement is a technique necessary for evaluation.

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

Score = _____

Rating: _____

Information Sheet 3- checking Circuits/machines/plant as being isolated

3.1 Electrical Isolation Definition

Electrical isolation is separating the part with the non-ideal effects from the other parts. In electronic circuits, the dielectric is isolated by blocking the direct current (DC).

An isolation procedure is a set of predetermined steps that must be followed to ensure that plant and related hazards cannot risk the safety of those working on the plant. There must be an isolation procedure for each item of plant, including the application of isolation devices, locks and tags, as practicable.

To isolate a circuit, you need to terminate the flow of electricity through it.

- Decide whether you want to isolate a complete circuit or a particular electrical appliance. ...
- Flip the trip switch or remove a fuse in your fuse box by hand if you want to completely isolate a circuit such as the lights or wall sockets.

Isolate the voltage:-

- Identify correct isolation point or device. ...
- Check condition of voltage indicating device —such as a test lamp or two-pole voltage detector.
- Switch off installation/circuit to be isolated. ...
- Verify with voltage indicating device that no voltage is present.

Safe isolation procedures are in place to ensure that workers on site are not exposed to danger when working on or near live electrical systems. There are many reports where these procedures have not been followed correctly and sadly this has resulted in needless loss of life.

One such report involves a large UK electrical contractor, where a circuit had been labeled as not in use. The engineer working on the system did not have the necessary equipment to prove the system was dead. As a result he came into contact with a live conductor and was killed.

Fig-1 checking Circuits

However, every isolation procedure should include the following basic steps:

- Shut the plant down
- Identify all energy sources and other hazards
- Identify all isolation points
- Isolate all energy sources
- De-energize all stored energies
- Locking out all isolation points.
- Tagging
- Testing isolation procedure

Self-check 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction I: - write true if the statement is correct or write false if the statement is incorrect and write the answer on the space provided**.** (6pts)

_____1. Electrical isolation is separating the part with the non-ideal effects from the other parts.

_____2. In electronic circuits, the dielectric is isolated by blocking the direct current

_____3. An isolation procedure is a set of predetermined the safety of those working on the plant.

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

Score = _____

Rating: _____

Information Sheet 4-Document safety hazards resulting from the fault or breakdown

4.1 Document safety hazards resulting from the fault or breakdown

An electrical fault is the deviation of voltages and currents from nominal values or states. Under normal operating conditions, power system equipment or lines carry normal voltages and currents which results in safer operation of the system. ... Those are symmetrical and unsymmetrical faults

If the correct voltage is not present, then the control fuse is open. If the fuse is open, then there is either a short circuit or ground fault. If the fuse is not open, then there is an open circuit fault. This is our first indication that the fault is an open circuit fault.

Short-circuited fault is one of the most dangerous and common faults occurring in power system, which includes three-phase short circuit, two-phase short circuit, two-phase grounding short circuit and single-phase grounding short circuit

Maintain the first test probe at the hot wire terminal of the circuit. Remove the second probe from the neutral terminal then place it on the ground terminal for the circuit. Once more the multi meter will read "OL" or infinity if the circuit is open or zero if the circuit is functioning

Types of Faults

Electrical faults in three-phase power system mainly classified into two types, namely open and short circuit faults. Further, these faults can be symmetrical or unsymmetrical faults. Let us discuss these faults in detail.

Open Circuit Faults

These faults occur due to the failure of one or more conductors. The figure below illustrates the open circuit faults for single, two and three phases (or conductors) open condition.

The most common causes of these faults include joint failures of cables and overhead lines, and failure of one or more phase of circuit breaker and also due to melting of a fuse or conductor in one or more phases.

Open circuit faults are also called as series faults. These are unsymmetrical or unbalanced type of faults except three phase open fault.

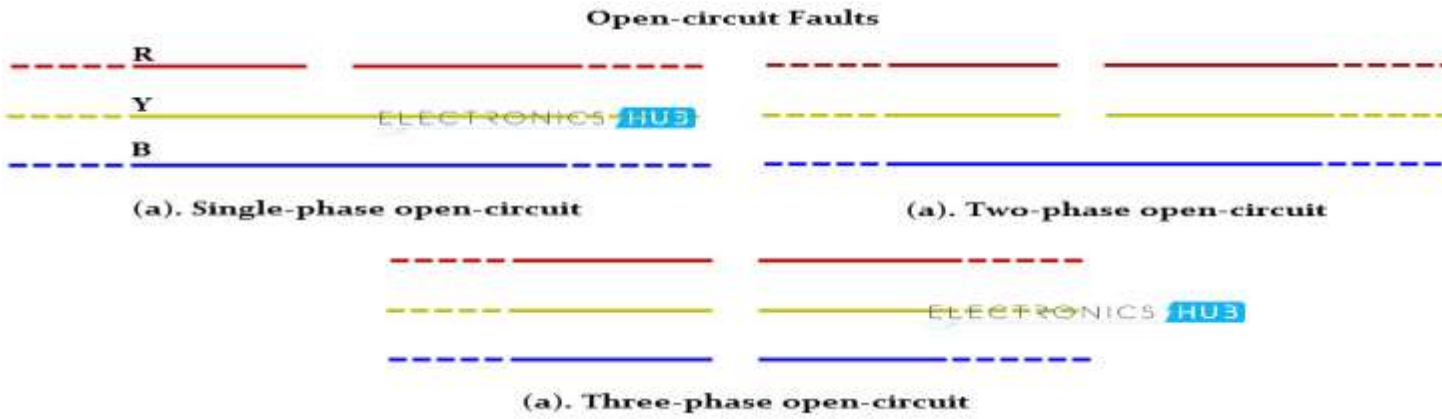


Fig 2- open circuit fault

Consider that a transmission line is working with a balanced load before the occurrence of open circuit fault. If one of the phase gets melted, the actual loading of the alternator is reduced and this cause to raise the acceleration of the alternator, thereby it runs at a speed slightly greater than synchronous speed. This over speed causes over voltages in other transmission lines.

Thus, single and two phase open conditions can produce the unbalance of the power system voltages and currents that causes great damage to the equipment.

Causes

Broken conductor and malfunctioning of circuit breaker in one or more phases.

Effects

- Abnormal operation of the system
- Danger to the personnel as well as animals
- Exceeding the voltages beyond normal values in certain parts of the network, which further leads to insulation failures and developing of short circuit faults.

Although open circuit faults can be tolerated for longer periods than short circuit faults, these must be removed as early as possible to reduce the greater damage.

Short Circuit Faults

A short circuit can be defined as an abnormal connection of very low impedance between two points of different potential, whether made intentionally or accidentally.

These are the most common and severe kind of faults, resulting in the flow of abnormal high currents through the equipment or transmission lines. If these faults are allowed to persist even for a short period, it leads to the extensive damage to the equipment.

Short circuit faults are also called as shunt faults. These faults are caused due to the insulation failure between phase conductors or between earth and phase conductors or both.

The various possible short circuit fault conditions include three phase to earth, three phase clear of earth, phase to phase, single phase to earth, two phase to earth and phase to phase plus single phase to earth as shown in figure.

The three phase fault clear of earth and three phase fault to earth are balanced or symmetrical short circuit faults while other remaining faults are unsymmetrical faults.

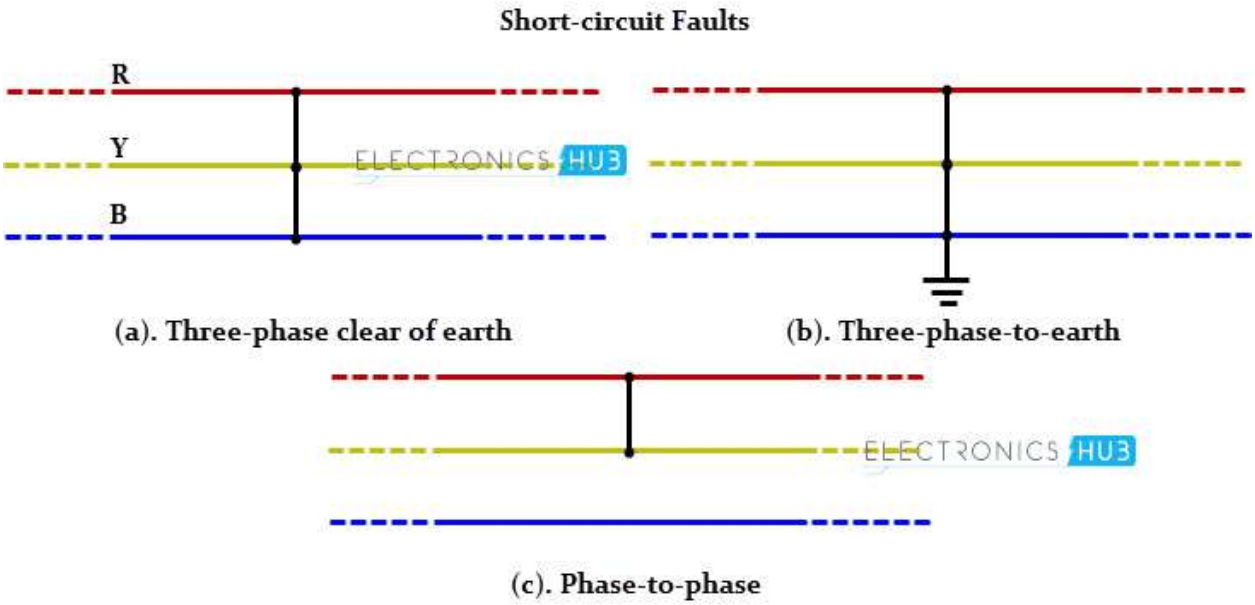


Fig3 – phase to phase circuit fault

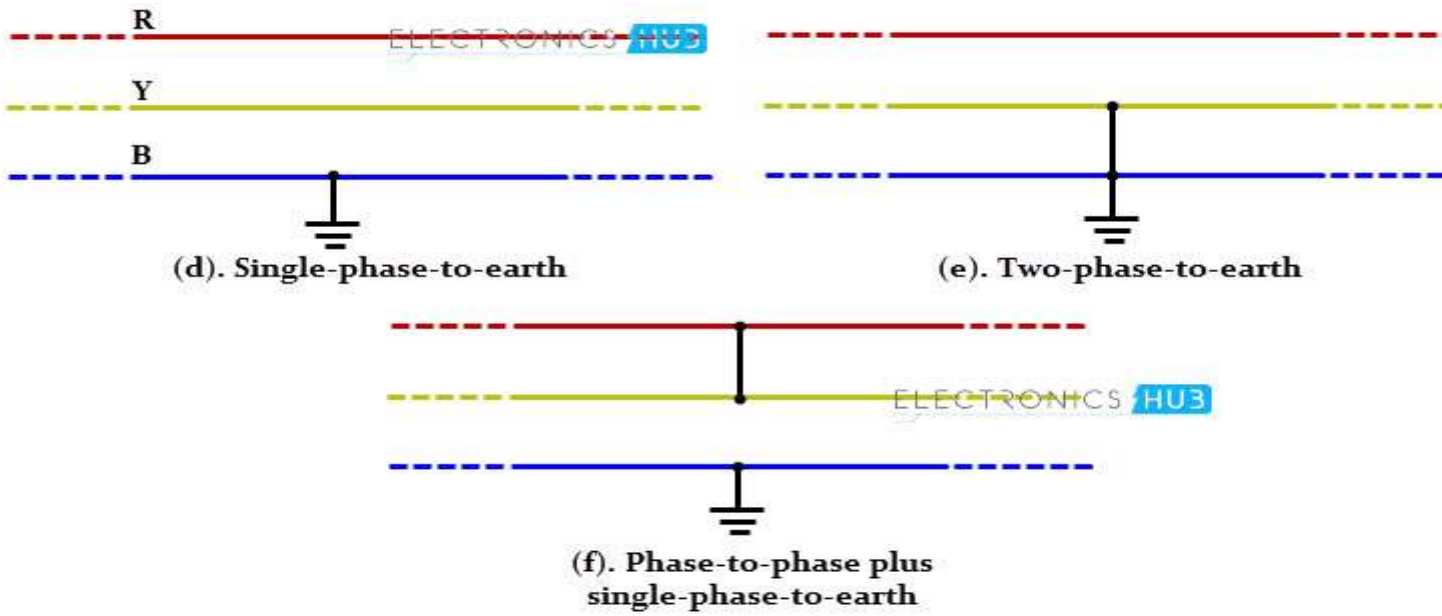


Fig4 – phase to phase plus single phase circuit fault

Causes

These may be due to internal or external effects

- Internal effects include breakdown of transmission lines or equipment, aging of insulation, deterioration of insulation in generator, transformer and other electrical equipment, improper installations and inadequate design.
- External effects include overloading of equipment, insulation failure due to lighting surges and mechanical damage by public.

Effects

- Arcing faults can lead to fire and explosion in equipment such as transformers and circuit breakers.
- Abnormal currents cause the equipment to get overheated, which further leads to reduction of life span of their insulation.

- The operating voltages of the system can go below or above their acceptance values that creates harmful effect to the service rendered by the power system.
- The power flow is severely restricted or even completely blocked as long as the short circuit fault persists.

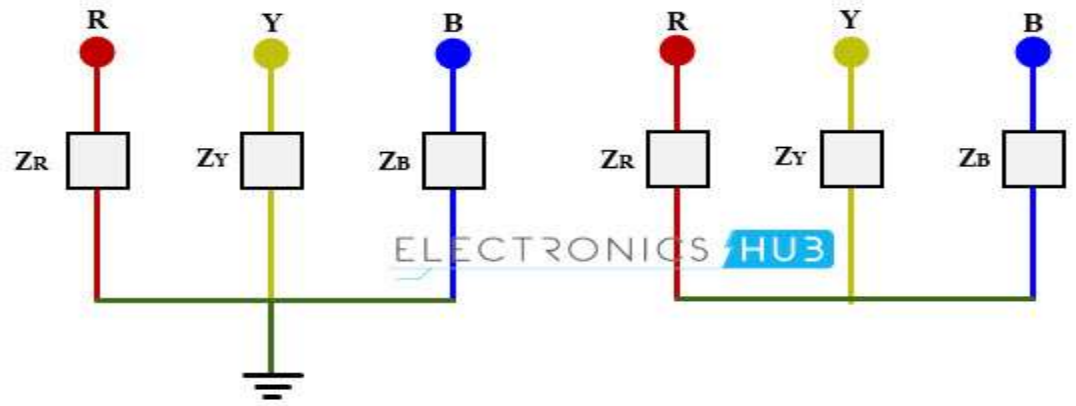
Symmetrical and Unsymmetrical Faults

As discussed above that faults are mainly classified into open and short circuit faults and again these can be symmetrical or unsymmetrical faults.

Symmetrical Faults

A symmetrical fault gives rise to symmetrical fault currents that are displaced with 1200 each other. Symmetrical fault is also called as balanced fault. This fault occurs when all the three phases are simultaneously short circuited.

These faults rarely occur in practice as compared with unsymmetrical faults. Two kinds of symmetrical faults include line to line to line (L-L-L) and line to line to line to ground (L-L-L-G) as shown in figure below.



(a). Three-phase-to-earth (L-L-L-G) (b). Three-phase-fault (L-L-L)

A rough

Fig5 – A. three phase to phase earth B. three phase –phase fault

Occurrence of symmetrical faults is in the range of 2 to 5% of the total system faults. However, if these faults occur, they cause a very severe damage to the equipment even though the system remains in balanced condition.

The analysis of these faults is required for selecting the rupturing capacity of the circuit breakers, choosing set-phase relays and other protective switchgear

Unsymmetrical Faults

The most common faults that occur in the power system network are unsymmetrical faults. This kind of fault gives rise to unsymmetrical fault currents (having different magnitudes with unequal phase displacement). These faults are also called as unbalanced faults as it causes unbalanced currents in the system.

Up to the above discussion, unsymmetrical faults include both open circuit faults (single and two phase open condition) and short circuit faults (excluding L-L-L-G and L-L-L).

The figure below shows the three types of symmetrical faults occurred due to the short circuit conditions, namely phase or line to ground (L-G) fault, phase to phase (L-L) fault and double line to ground (L-L-G) fault.

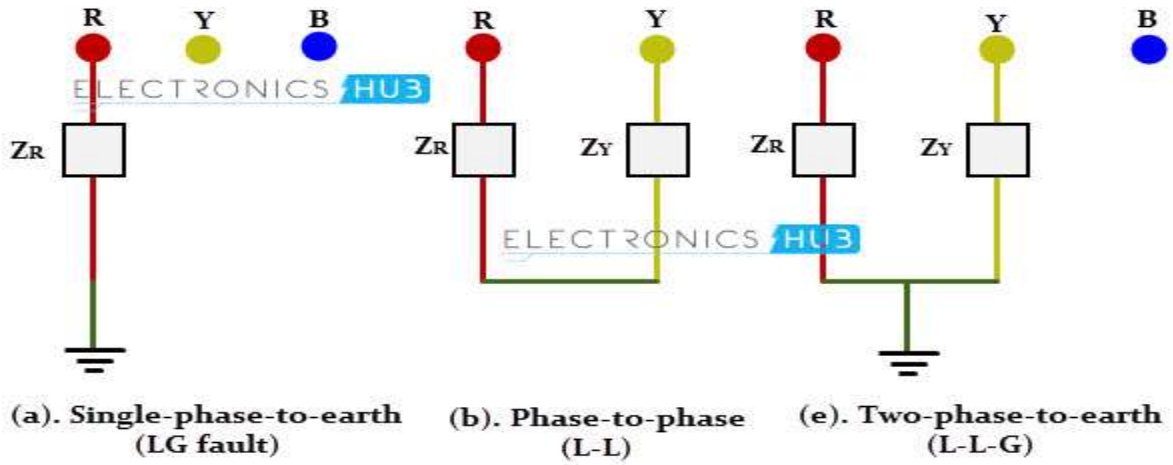


Fig6 – A. single phase-to phase fault B. Phase to phase C. two –phase- earth

A single line-to-ground (LG) fault is one of the most common faults and experiences show that 70-80 percent of the faults that occur in power system are of this type. This forms a short circuit path between the line and ground. These are very less severe faults compared to other faults.

A line to line fault occur when a live conductor get in contact with other live conductor. Heavy winds are the major cause for this fault during which swinging of overhead conductors may touch together. These are less severe faults and its occurrence range may be between 15-20%.

In double line to ground faults, two lines come into the contact with each other as well as with ground. These are severe faults and the occurrence these faults is about 10% when compared with total system faults.

Unsymmetrical faults are analyzed using methods of unsymmetrical components in order to determine the voltage and currents in all parts of the system. The analysis of these faults is more difficult compared to symmetrical faults.

This analysis is necessary for determining the size of a circuit breaker for largest short circuit current. The greater current usually occurs for either L-G or L-L fault.

Protection Devices against Faults

When the fault occurs in any part of the system, it must be cleared in a very short period in order to avoid greater damage to equipment and personnel and also to avoid interruption of power to the customers.

The fault clearing system uses various protection devices such as relays and circuit breakers to detect and clear the fault.

Some of these fault clearing or faults limiting devices are given below.

Fuse

It opens the circuit whenever a fault exists in the system. It consists of a thin copper wire enclosed in a glass or a casing with two metallic contacts. The high fault current rises the temperature of the wire and hence it melts. A fuse necessitates the manual replacement of wire each time when it blows.

Circuit Breaker

It is the most common protection device that can make or break the circuit either manually or through remote control under normal operating conditions.

There are several types of circuit breakers available depending on the operating voltage, including air brake, oil, vacuum and SF6 circuit breakers. For more information on circuit breakers, follow the link attached.

Protective Relays

These are the fault detecting devices. These devices detect the fault and initiate the operation of the circuit breaker so as to isolate the faulty circuit. A relay consists of a magnetic coil and contacts (NC and NO). The fault current energizes the coil and this causes to produce the field, thereby the contacts get operated.

Fig7 –protective relay

Some of the types of protective relays include

- Magnitude relays
- Impedance relays
- Directional relays
- Pilot relays
- Differential relays

Lighting Arrestor

Surges in the power system network caused when lightning strikes on transmission lines and equipment. This causes high voltage and currents in the system. These lighting faults are reduced by placing lighting arrestors at transmission equipments

In order to control workplace hazards and eliminate or reduce the risk, you should take the following steps:

- Identify the hazard by carrying out a workplace risk assessment;
- Determine how employees might be at risk;
- Evaluate the risks;
- Record and review hazards at least annually, or earlier if something changes.

Self-check 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

INSTUCTON III: - Give short answer for the following questions and writ the answer on the space provided?

1. Mention at list 4 faulty/breakdown electrical apparatus equipment?(10pt)

1._____
2._____
3._____
4._____

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Score = _____

Rating: _____

Information Sheet 5- Approaching trouble-shooting

5.1 Basic troubleshooting techniques

No matter what's causing the issue, troubleshooting will always be a process of trial and error. In some cases, you may need to use several approaches before you can find a solution; other problems may be easy to fix. We recommend starting by using the following tips.

In simple words, troubleshooting skills are the problem solving abilities of a person. Ideal troubleshooting skills mean you begin with gathering maximum information to define the actual problem, and provide the best possible solution by generating and evaluating all possible solutions.

2 General Steps to Troubleshoot an Issue

- Identify the symptom: Identify the Type of Issue. Find the problem area. ...
- Eliminate non-issues: Make sure the correct patches, drivers, and operating systems are installed. ...
- Find the cause: Check for typical causes in the area. ...
- Find the fix: Find a possible workaround.

The six steps of troubleshooting.

1. Identify the problem
2. Establish a theory of probable cause
3. Test probable cause theory to determine actual cause
4. Establish an action plan and execute the plan
5. Verify full system functionality
6. Document the process

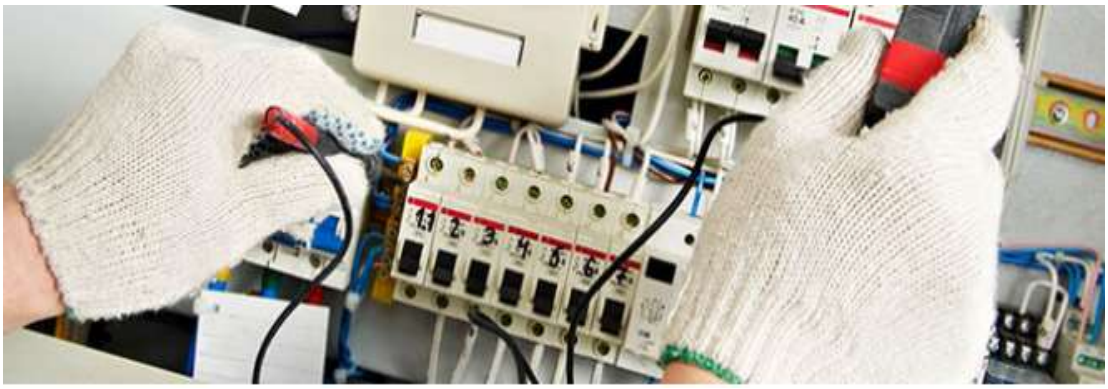
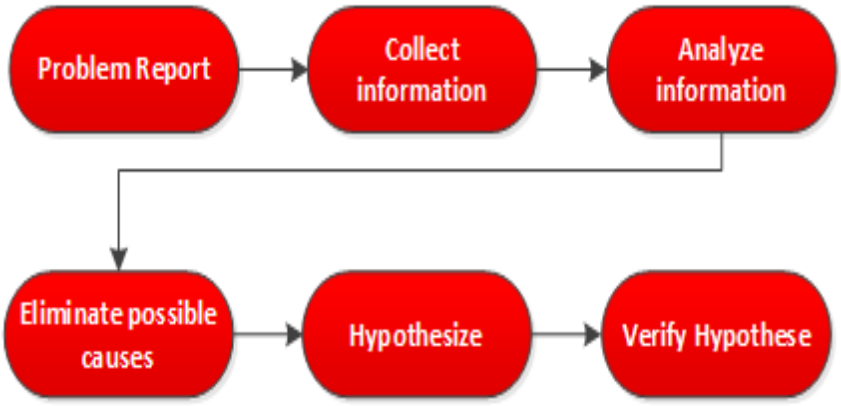


Fig 7- troubleshooting circuit backer

The sections that follow describe each of these methods in more detail.

- The Top-Down Troubleshooting Approach. ...
- The Bottom-Up Troubleshooting Approach. ...
- The Divide-and-Conquer Troubleshooting Approach. ...
- The Follow-the-Path Troubleshooting Approach. ...
- The Swap-Components Troubleshooting Approach.



Self-check 5	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

INSTUCTON III: - Give short answer for the following questions and writ the answer on the space provided?

1. List the six steps of troubleshooting method? (10)

1._____
2._____
3._____
4._____
5._____
6._____

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Score = _____

Rating: _____

Information Sheet 6- Dismantling circuit/apparatus components

6.1 Dismantling circuit/apparatus components

The electrical supply in your house is carried from room to room by electrical wires, in much the same way that pipes carry water. Electricity enters your house through a central circuit breaker, which then distributes power to different parts of your home. Removing electrical wires isn't a difficult project, but exercise caution and knows the risks when working with electricity.

Removing household wiring, for example, turn off the circuit that controls the electricity at the main circuit breaker.

Step 1

Check the location of the electrical work.

Step 2

Turn off the electricity to the wires that you wish to remove. If removing household wiring, for example, turn off the circuit that controls the electricity at the main circuit breaker. Identity the breaker, that controls the electricity for the wires and moves the breaker to the "off" setting.

Step 3

Remove any coverings, such as a socket or junction box cover, so you can access the wires.

Step 4

Test the wires you are removing with a voltmeter. The meter should read "0" when touching the wires with the probes. This will ensure that the electricity has been cut correctly.

Step 5

Unscrew the terminals holding the wires in place with a screwdriver. Pull the wires off the terminals. Bend the wires back with a pair of needle nose pliers, if needed, so you can pull off the wires.

Step 6

Locate the other end of the wires. Disconnect these wires from the terminals or other wires. If these wires are held together with wire nuts, for example, unscrew the wire nuts from the end of the wires. Untwist the wires to get them apart. Use scissors to cut away any electrical tape holding the wires together.

Step 7

Remove the wires by pulling them through the wall or conduit. Pull gently -- don't yank them. This will prevent damage if they get caught on something in a wall space or conduit.

Fig 8- Dismantling circuit

Self-check 6	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

INSTUCTON III: - Give short answer for the following questions and writ the answer on the space provided?

1. Define the methods how to Dismantling low voltage electrical circuits?(5)

_____

_____

_____

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

Score = _____

Rating: _____

Information Sheet 7- Rechecking faulty circuits/components

7.1 Rechecking faulty circuits/components

What are circuit and its types?

An electric circuit is a closed loop through which electric current can flow. A circuit must include a source of voltage and conductors such as wires to carry the current from the source of voltage and back again. Types of circuits are series and parallel circuits

Why do circuits not work?

If the power supply is inadequate to the task, it can drop in voltage and reset micro controllers or make other components erratic. Batteries, under no load, can be measured and have the proper voltage, but when connected to the circuit, the voltage can drop enough to make the circuit useless. How to Fix Short Circuits in electrical devices, short circuits are usually caused by a breakdown in a wire's insulation or when another conductor is introduced and causes the electricity to flow in an unintended way. To fix this problem, you will need to replace the wire

A simple electrical circuit contains four parts: a power source, a load, connectors and a switch. The power source provides energy for the electricity to travel along the circuits and the load is the device that the circuit is designed to power

There are two types of electric circuit. - Series and parallel.

Two wires connect to the light. For electrons to do their job in producing light, there must be a complete circuit so they can flow through the light bulb and then back out. When the switch is off, a complete circuit will not exist, and there will be no current

They occur when a low-resistance path not suited to carry electricity receives a high-volume electrical current. In simpler terms, short circuits happen when hot wire touches a conductive object it's not supposed to. The result of a short circuit can be appliance damage, electrical shock, or even a fire

First, an electrical short circuit causes the overload current. Second, this amount of current causes high heat. Last, this high heat increases the temperature of surrounding materials until the temperature reach to the Ignition temperature, the combustion will occur.

What are basic circuit components?

It comprises several different components such as resistors, transistors, capacitors, inductors, and diodes. Conductive wires or traces are used to connect the components to each other. However, a circuit is complete only if it starts and ends at the same point, forming a loop.

A short circuit is an abnormal connection between two nodes of an electric circuit intended to be at different voltages. This results in an electric current limited only by the Thévenin equivalent resistance of the rest of the network which can cause circuit damage, overheating, fire or explosion.

Fig 9- ***Rechecking faulty circuits***

Self-check 7	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction I: - write true if the statement is correct or write false if the statement is incorrect and write the answer on the space provided**.** (2 each)

_____1. An electric circuit is a closed loop through which electric current can flow

_____2. If the power supply is inadequate to the task, it can drop the voltage.

Instruction II: - choose and write the letter of the correct answer on the space provided. (3 each)

1. A simple electrical circuit contains four parts. They are_____, _____,_____ and _____.

A. power source
B. load
C. Connectors
D. Switch.
E. All

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

Score = _____

Rating: _____

Information Sheet 8-Sourcing and Obtaining materials/replacement parts

8.1 Sourcing and obtaining materials/replacement parts

Explosion Proof is a product design to contain an electrical short so that it doesn't ignite a hazardous atmosphere causing an explosion. Refineries, gas stations, paint booths are examples of where these products would be used.

Circuit Breakers

Circuit Breakers are devices that automatically interrupt the follow of an electric current to protect against a short or overload.

Electrical Connectors

Electrical Connector is a part that will join or adapt one part to another. Connector range in size from 3/8″ to 6″. They can be indoor, outdoor, corrosive protected or explosion proof.

Electrical Box

Electrical Box is an enclosure used for many purposes such as pulling, connecting or terminated an electrical circuit. Electrical box can be set screw or indoor; it can be rain tight, or outdoor. They can be made of steel, aluminum, plastic, stainless steel, or cast iron. Requirement can include corrosive protected or explosion protected by design.

Lugs

Lugs are the electrical connectors that terminate the electrical circuit. Lugs are made of copper, aluminum, or bronze. They are made for the smallest wire size, 26 gauge to the largest 2000 MCM. Lugs can be mechanical or set screw; compression or crimp, solder or weld; or clamp type.

What Types of Spare Parts are there? Genuine, OEM, Aftermarket and
Used Parts Explained.

- Genuine Original Equipment **Parts**.

- Replacement Parts.
- Aftermarket Parts.
- Remanufactured Parts.
- Reconditioned Parts.
- Salvaged Parts

Fig 10- replacement part

Self-check 8	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction: - choose and write the letter of the correct answer on the space provided. (3 each)

1. _____are devices that automatically interrupt the follow of an electric current to protect against overload.

A. Circuit Breakers
C. Electrical Box
B. Lugs
D. All

2. _____the electrical connectors that terminate the electrical circuit.

A. Circuit Breakers
C. Electrical Box
B. Lugs
D. All

3. _____is an enclosure used for many purposes such as pulling, connecting an electrical circuit.

A. Circuit Breakers
C. Electrical Box
B. Lugs
D. All

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

Score = _____

Rating: _____

Information Sheet 9- Testing in effectiveness of the repair

9.1 Testing in effectiveness of the repair

Regression testing (rarely non-regression testing) is re-running functional and non-functional tests to ensure that previously developed and tested software still performs after a change Sometimes a change impact analysis is performed to determine an appropriate subset of tests (non-regression analysis).

Materials testing

- Hardness tester.
- Compressive strength test.
- Impact test.
- Fluoroscope.
- Testing machine.
- Brinell hardness test.
- Nondestructive testing.
- Stress analysis.

Acceptance testing, a testing technique performed to determine whether or not the software system has met the requirement specifications. The main purpose of this test is to evaluate the system's compliance with the business requirements and verify if it is has met the required criteria for delivery to end users.

It's often necessary to provide additional testing of the software or version upgrades. During the maintenance phase, errors or defects may exist, which would require repairs during additional testing of the software. Monitoring the performance of the software is also included during the maintenance phase

Table 2- Comparison of maintenance type

Maintenance Type	Preventive Maintenance					Corrective Maintenance	
	Time Based Maintenance	Failure Finding Maintenance	Condition Based Maintenance	Predictive Maintenance	Risk Based Maintenance	Deferred Maintenance	Emergency Maintenance
Task Type	Scheduled Overhaul / Replacement	Functional Test	Measurement of condition	Calculation and extrapolation of	Inspection or Test	Repair / Replace	Repair / Replace
Objective	Restore or replace regardless of condition	Determine if hidden failure has occurred	Restore or replace based on a measured condition compared to a defined standard		Determine condition and conduct risk assessment to determine when next inspection, test or intervention is required.	Restore or replace following failure. Result of a Run to Failure Strategy or an unplanned failure.	Restore or replace following unplanned failure.
Interval	Fixed time or usage interval e.g. 1 month, 1,000hrs or 10,000 km	Fixed time interval (can be set based on risk assessment e.g. SIL)	Fixed time interval for condition measurements / inspections		Time based interval between tasks and scope of task is based on risk assessment	Not applicable, but intervention is deferred to allow for proper planning & scheduling.	Immediate intervention required.

Self-check 9	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction: - choose and write the letter of the correct answer on the space provided. (3 each)

1. From the following which one is testing in effectiveness of the repair?

A. Impact tests B. Fluoroscope.

C. Testing machine. D. All

2. Testing technique performed to determine whether or not the system has met the requirement Specifications is _____?

A. Impact tests B. Fluoroscope.

C. Acceptance testing D. All

Note: **Satisfactory rating - 4points** **Unsatisfactory - below 2 points**

Score = _____

Rating: _____

Information Sheet 10-Reassembling finally testing and preparing Apparatus for return to service

10.1 Reassembling finally testing and preparing Apparatus for return to service

Electrical appliance is an electricity consuming device or apparatus (including the cord) that is connected to, or capable of being connected to the electrical installation. The term includes both electrical and electronic equipment. An electrical appliance is a sub set of electrical equipment.

Electrical equipment refers to any apparatus, appliance, cable, conductor, fitting, insulator, material, and meter or wires that:

- is used for controlling, generating, supplying, transforming or transmitting electricity at a voltage greater than extra-low voltage; or
- is operated by electricity at a voltage greater than extra-low voltage; or
- is part of an electrical installation located in an area, in which the atmosphere presents a risk to health and safety from fire or explosion; or

Electrical installation refers to electrical equipment (or group of items) that:

- are permanently electrically connected together; and
- Can be supplied with electricity from an electricity supply authority or from a generating source.

The electrical installation is the electricity supply to a building, and includes the main switchboard; distribution switchboards, sub-switchboards and all associated fixed wiring including final sub-circuits, such as socket-outlets, isolation switches, lights, etc.

Electrical wiring work is the actual physical work of installing, altering, repairing, replacing or adding to the electrical installation, including the supervision of such work.
Electrical work refers to:

- connecting electricity supply wiring to electrical equipment or disconnecting electricity supply wiring from electrical equipment; or
- Installing, removing, adding, testing, replacing, repairing, altering or maintaining electrical equipment or an electrical installation.

Emergency procedures are procedures established prior to an incident, containing actions to be taken in the event of an emergency. They are utilized in order to minimize the effects of an incident causing damage to people, property or the environment.

Extra-low voltage refers to extra low voltage (not exceeding 50 Volts Alternating Current (VAC) or 120Volt ripple free Direct Current (DC)), as defined in AS/NZS 3000: Australian/New Zealand Wiring Rules.

Hostile operating environments refers to environments where:

- the normal use of electrical equipment exposes the equipment to operating conditions that are likely to result in damage to the equipment or a reduction in its expected life span, including conditions that involve exposure to moisture, heat, vibration, mechanical damage, corrosive chemicals or dust; or
- electrical equipment is moved between different locations in circumstances where damage to the equipment or to a flexible electricity supply cord is reasonably likely

Live part refers to a conductor or conductive part intended to be energized in normal use. Live parts include a neutral conductor and conductive parts connected to a neutral conductor. See AS/NZS 3000: Australian/New Zealand Wiring Rules for items not considered live parts under the multiple earthed neutral (MEN) earthing system.

Local Area - refers to a College, Research School or Service Division of the University.

Low voltage refers to an operating voltage that exceeds extra-low voltage (ELV), but not exceeding 1000V AC or 1500V DC as defined in AS/NZS 3000 Australian/New Zealand Wiring Rules.

Residual Current Device (RCD) is a safety switch that reduces the risk of electrocution. An RCD must have a tripping current that does not exceed 30 milliamps

if electricity is supplied to the equipment through a socket outlet not exceeding 20 amps.

Safety Observer is a Category 1 or 2 Competent Person assigned and specifically trained on responsibilities to observe and provide warning against the unsafe approach to exposed electrical equipment, including energized (live) conductors and other potential risks.

Safe Work Method Statement (SWMS) refers to a hazard assessment conducted by a workgroup to:

- identify the electrical work; and
- specify hazards associated with that electrical work and risks associated with those hazards; and
- describe the measures to be implemented to control the risks; and
- Describe how the risk control measures are to be implemented, monitored and reviewed.

Worker is defined as anyone who carries out work for the University. A worker includes staff, volunteers, contractor, students and visitors at the University.

Workplace is a place where work is carried out for a business or undertaking and includes any place a worker goes, or is likely to be, while at work

Self-check 10	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction I: - write true if the statement is correct or write false if the statement is incorrect and write the answer on the space provided**.** (6 each)

_____1**.** Live part refers to a conductor part intended to be energized in normal use.

_____2**.** Low voltage refers to an operating voltage that exceeds extra-low voltage.

_____3. Residual Current Device is a safety switch that reduces the risk of electrocution.

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

Score = _____

Rating: _____

Information Sheet 11- Dealing unexpected situations with safely

11. Dealing unexpected situations with safely

Definition: - Unforeseen, unexpected events. An event that can be expected, but improbable at the time or a fully unprecedented event – can be a new situation for instance. It implies a work disruption.

How to handle unexpected situation?

Let's discuss ways to deal with unexpected events.

- Accept that unexpected things can happen.
- Do you have control over any of the unexpected events that regularly occur? ...
- Prepare yourself for the unexpected.
- Never react immediately.
- Acknowledge your emotions.
- Stay Positive

If the unexpected issue is caused by a team member, talk to them professionally. Don't go blaming and taking out your anger on them. Let them tell you what happened from their perspective. Hear them out first before you start asking them further questions.

7 Steps to Accept Tough Situations in Life

1. Acknowledge the Situation. Sometimes people try to stay in denial when they face a tough situation.
2. Develop a Plan. Brainstorm potential ways to deal with the situation.
3. Seek Help When Necessary.
4. Change What You Can.
5. Identify What You Can't Change.
6. Develop Coping Skills to Deal with Your Feelings.
7. Focus on What You Can Gain

Gain some knowledge on basic electrical safety tips– these five tips will help you enjoy the devices and appliances you love while keeping everyone safe from harm.

1. Replace or repair damaged power cords

Exposed wiring is a danger that cannot go overlooked, the NFPA wrote. If you see the protective coating on a wire is stripped away, be sure to replace it or cover it with electrical tape as soon as possible.

2. Don't overload your outlets

Every outlet in your home is designed to deliver a certain amount of electricity; by plugging too many devices into it at once, you could cause a small explosion or a fire. If you have a lot of things to plug in, use a power strip (an energy saving one of course!) that can safely accommodate your needs.

3. Avoid extension cords as much as possible

Running extension cords through the house can trip up residents; this can cause injury and damage to the wire or outlet if it causes the cord to be ripped out of the wall. If you find yourself using extension cords very often, consider having an electrician install new outlets throughout your home.

4. Keep electrical equipment or outlets away from water

Water conducts electricity, so even the slightest exposure to this dangerous mix can lead to injury. Make sure you wipe up any spills to ensure that plugs don't get wet.

5. Protect small children from hazards

Toddlers and small children are very curious– and they love to explore just about everything. Parents of small children should put tamper-resistant safety caps on all unused electrical outlets. In addition, all loose cords should be tidied up and put out of reach to avoid kids tugging on them.

Fig 11- keeping everyone safe from harm.

Self-check 11	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction: - choose and write the letter of the correct answer on the space provided. (3 each)

_____1. From the following event which one is deal with unexpected events?

A. Never react immediately B .Stay Positive

C. Acknowledge your emotions D. All

_____2. Brainstorm potential ways to deal with the situation_____?

B. Never react immediately B. Develop a Plan

C. Acknowledge your emotions D. All

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 4 points**

Score = _____

Rating: _____

Information Sheet 12- Carrying out trouble-shooting and repair activities without damage

12. Carrying out trouble-shooting and repair activities without damage

Troubleshooting: Depend on procedure to fix the problem after it's happen. Maintenance: Avoiding the problems and keep the system out of issue

General Steps to Troubleshoot an Issue

- Identify the symptom: Identify the Type of Issue. Find the problem area.
- Eliminate non-issues: Make sure the correct patches, drivers, and operating systems are installed.
- Find the cause: Check for typical causes in the area.
- Find the fix: Find a possible workaround

Troubleshooting Process Steps

- Identify the problem.
- Establish a theory of probable cause.
- Test the theory to determine the cause.
- Establish a plan of action to resolve the problem and implement the solution.
- Verify full system functionality and, if applicable, implement preventive measures

Troubleshooting is a form of problem solving, often applied to repair failed products or processes on a machine or a system. In general, troubleshooting is the identification or diagnosis of "trouble" in the management flow of a system caused by a failure of some kind

Fig12 – trouble-shooting electrical apparatus without damage

Self-check 12	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

INSTUCTON III: - Give short answer for the following questions and writ the answer on the space provided?

1. List the Troubleshooting Process and Steps? (10 point)

1._____

2._____

3._____

4._____

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Score = _____

Rating: _____

LG #38	LO #3- Completion and report trouble-shoot and repair activities

Instruction sheet

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

- Following OHS work completion risk control measures and procedures
- Cleaning and making work area safe
- Making written justification for repairs to apparatus.
- Documenting work completion

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, **upon completion of this learning guide, you will be able to**:

- Follow OHS work completion risk control measures and procedures
- Clean and make work area safe
- Make written justification for repairs to apparatus.
- Document work completion

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Following OHS work completion risk control measures and procedures

1.1Following OHS work completion risk control measures and procedures

Control measures include actions that can be taken to reduce the potential of exposure to the hazard, or the control measure could be to remove the hazard or to reduce the likelihood of the risk of the exposure to that hazard being realized.

How to Monitor Risk Controls

- Consult the workers or learners involved with the controls.
- Consult management who administer the controls.
- Check accident and incident reports to see how effective the controls have been.

There are three main types of internal controls: detective, preventative, and corrective

Widely, risks can be classified into three types: Business Risk, Non-Business Risk, and Financial Risk.

Implementing Control Measures

- Identifying and documenting business processes.
- Maintaining a risks and controls framework.
- Periodically scheduling internal controls.
- Keeping track of current and past controls and their results

Control risk or internal control risk is the risk that current internal control could not detect or fail to protect significant error or misstatement in the financial statements.

For example, auditors should have proper risk assessment at the planning stages.

What is the most effective control measure?

Elimination and substitution are considered the most effective control measures. They are easiest to achieve for brand new processes. They can be more difficult to implement for existing processes, because new and/or more expensive equipment and materials may be required

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction I: - write true if the statement is correct or write false if the statement is incorrect and write the answer on the space provided(3 each)**.**

_____1. Control measure includes actions that can be taken to reduce the potential of exposure to the hazard.

_____2. Elimination and substitution are **NOT** considered the most effective control measures.

_____3. Control risk or internal control risk is the risk that current internal control could detect or fail to protect significant error or misstatement in the financial statements.

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 3 points**

Score = _____

Rating: _____

Information Sheet 2- Cleaning and making work area safe

Clean and a safe work area

A clean workplace means more than just having a sparkling, fresh building. A clean workplace also ensures the safety and health of employees and visitors.

Workplace injuries can be prevented by taking action to ensure a clean, safe work environment

Here are some tips to help make your workplace safe.

- Understand the risks. ...
- Reduce workplace stress. ...
- Take regular breaks. ...
- Avoid stooping or twisting. ...
- Use mechanical aids whenever possible. ...
- Protect your back. ...
- Wear protective equipment to suit the task. ...
- Stay sober.

10 Easy Workplace Safety Tips

1. Train employees well.

Comprehensive training is a must for preventing workplace injury. Make sure that all of your employees have access to – and complete – all safety training for their positions.

2. Reward employees for safe behavior.

Rewards are an easy way to encourage workplace safety. Giving out small rewards to employees who follow safety policies keeps them engaged, which can make a big difference in reducing workplace injuries.

3. Partner with occupational clinicians.

As mentioned above, occupational medicine clinicians can provide valuable insight into workplace injury and prevention. These clinicians can help you prevent work injuries by visiting your worksite and identifying areas where there's a high risk for employee injury. Physical and occupational therapists can also improve workplace ergonomics and

develop human performance evaluations to help you screen candidates for physically demanding roles and aid in the return-to-work process.

4. Use labels and signs.

Labels and signs are a cheap and effective way to quickly communicate important information. They're usually simple and rely on pictures to detail hazards and proper procedures. These tools are good reminders and warnings for even the most experienced worker.

5. Keep things clean.

A messy workplace can lead to unnecessary accidents. Make sure boxes are stacked safely and spills are cleaned up quickly. Conduct regular inspections to check for potential dangers such as tangled cords, messy floors, and disorganized tools. Programs like 5S often provide beneficial improvements in organization that can lead to reduced clutter.

6. Make sure employees have the right tools and have regular equipment inspections.

The right tools and equipment create a better product and a safer work environment. It's also important that all equipment is cleaned, serviced, and inspected regularly. Machine malfunctions are one of the most dangerous workplace hazards.

7. Encourage stretch breaks.

Stretch breaks are an easy way to improve workplace ergonomics and employee health. Taking even five minutes to stretch can ease muscle tension and loosen joints, reducing the potential for repetitive motion injuries. Active movements have been shown to be more effective than passive stretching alone.

8. Implement safety protocols from the start.

Workplace safety starts from day one, which means hiring qualified people who pay attention to detail. A safe workplace starts with employees who follow safety requirements and perform their jobs per the established procedures. Some employers work with physical therapists to analyze the physical demands of each job role. The findings are used to create functional job analyses and post-offer pre-placement functional testing.

9. Keep an open dialogue.

Make it easy for your employees to come to you with health and safety concerns. They can report hazards right away and identify potential areas of concern you may not have noticed. Appoint or nominate a safety captain who is empowered to communicate concerns identified by employees to leadership on a consistent basis.

10. Have regular meetings on workplace safety.

It never hurts to be over-prepared. Regular meetings to review safety rules and discuss prevention keep workplace safety top of mind so that when something does happen, everyone knows what to do right away.

As an employer, it's your responsibility to protect your employees and provide a safe workplace. Use these ten tips to get started, and partner with Concentra® to help make your workplace safe, healthy, and productive.

Self-check 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction I: - write true if the statement is correct or write false if the statement is incorrect and write the answer on the space provided**.** (2 each)

_____1. A clean workplace means more than just having a sparkling, fresh building.

_____2. A clean workplace also ensures the safety and health of employees and visitors.

_____3. The right tools and equipment create a better product and a safer work environment.

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 2 points**

Score = _____

Rating: _____

Information Sheet 3 - Making written justification for repairs to apparatus

3.1 Making written justification for repairs to apparatus

Troubleshooting is a form of problem solving, often applied to repair failed products or processes on a machine or a system. In general, troubleshooting is the identification or diagnosis of "trouble" in the management flow of a system caused by a failure of some kind.

What is the best way to define troubleshooting?

Troubleshooting is the process of diagnosing the source of a problem. It is used to fix problems with hardware, software, and many other products. The basic theory of troubleshooting is that you start with the most general (and often most obvious) possible problems, and then narrow it down to more specific issues

Look for obvious faults

- Check the supply to the circuit: The first steps in checking the circuit are to ensure that it has power being supplied to it.
- Check the outputs from the board: In the same way that broken connections may exist for the power line, the same may be true of the outputs from the board.

Recognize the 8 Techniques to Troubleshoot Your Electronics Circuit.

1. Confirm the Problem in the Circuit. ...
2. Consider Visual Inspection First. ...
3. Select Troubleshooting Tools. ...
4. Power up the Circuit.
5. Check the Power Supply Block. ...
6. Check the Individual Components. ...
7. Check the Main Controller. ...
8. Check the Loads by Metered Power Supply

The troubleshooting process steps are as follows:

- Identify the problem.
- Establish a theory of probable cause.
- Test the theory to determine the cause.
- Establish a plan of action to resolve the problem and implement the solution.
- Verify full system functionality and, if applicable, implement preventive measures.

Self-check 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction I: - write true if the statement is correct or write false if the statement is incorrect and write the answer on the space provided**.** (2 each)

_____1. Troubleshooting is a form of problem solving, often applied to repair failed electrical system.

_____2. Troubleshooting is the process of diagnosing the source of a problem.

_____3. The first steps in checking the circuit are to ensure that it has power being supplied to it.

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 2 points**

Score = _____

Rating: _____

Information Sheet 4 - Documenting work completion

4.1 Documenting work completion

By documenting your processes, you ensure efficiency, consistency, and peace of mind for anyone involved. This kind of standardization between processes ensures everyone in your organization is working the same way towards the same outcome.

What is process documentation?

A process document outlines the steps necessary to complete a task or process. It is an internal, ongoing documentation of the process while it is occurring

documentation cares more about the “how” of implementation than the “what”

of process impact.

The purpose of documentation is to: Describe the use, operation, maintenance, or design of software or hardware through the use of manuals, listings, diagrams, and other hard- or soft-copy written and graphic materials

The four kinds of documentation are:

- Learning-oriented tutorials.
- Goal-oriented how-to guides.
- Understanding-oriented discussions.
- Information-oriented reference material.

Maintaining Documentation in an Aged Care Environment – It Doesn't Need to be Hard

1. Identify what documents are needed. ...
2. Determine who is responsible for obtaining information. ...
3. Ensure that all documentation complies. ...
4. Establish a document control process. ...
5. Establish review timelines.

Self-check 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Instruction I: - write true if the statement is correct or write false if the statement is incorrect and write the answer on the space provided**.** (3 each)

_____1. A process document outlines steps is necessary to complete a task or process

_____2. The purpose of documentation is to describe the use, operation, maintenance.

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 2 points**

Score = _____

Rating: _____

Operation sheet 1– Steps how to Fix and Troubleshoot circuit breaker (CB)

Steps to Fix and Troubleshoot circuit breaker (CB)

The following steps will guide you through the preparation and termination process for UTP cable. Following these guidelines will help give you the optimum performance from the twisted pair cabling.

Step #1. Clean the CB

Step #2. Take off the Damaged Pad

Step #3. Clear Away Laminate around the Pad

Step #4. Remove Old Solder Mask

Step #5. Clean With Alcohol

Step #6. Prepare the Conductor

Step #7. Examine and Choose the Appropriate Circuit Frame

Step #8. Prepare the New Pad/Conductor

Step #9. Trace to the Old Conductor

Step #10. Hold and Dry

Operation sheet 2– Steps how to Troubleshooting Electrical apparatus

Steps how to Troubleshooting Electrical apparatus

The following steps will guide you through the preparation and termination process for UTP cable. Following these guidelines will help give you the optimum performance from the twisted pair cabling.

Step 1: Gather the information

step 2. Understand the malfunction

step 3. Identify which parameters need to be evaluated

step 4. Identify the source of the problem

step 5. Correct/repair the component

step 6. Verify the repair

step 7. Perform root cause analysis

Operation sheet 3 – Steps how to find Electrical apparatus fault

3. Steps how to find Electrical apparatus fault

Step 1: Notify what exactly *is* the problem.

Step 2: Gather more details, eliminate variables.

Step 3: Reproduce the problem.

Steps4: Develop hypothesis of root cause.

Step 5: Attempt a fix based on findings.

Step 6: maintain the fault

Lap Test	Demonstration

Name……. ID……..

Date…….

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **1** hour. The project is expected from each student to do it.

Task: 1. Fix and troubleshoot circuit breaker (CB)?

Task: 2. Troubleshooting Electrical apparatus?

Task: 3. Find the faults of Electrical apparatus?

Reference Materials

- www.wikiaccounting.com › what-is-audit-risks
- https://www.youtube.com/watch?v=gTAUupMxT1U
- https://www.youtube.com/watch?v=-1j3ZlW1Ryo
- https://www.spiceworks.com/it-articles/troubleshooting-steps/
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LO #1- Prepare to trouble-shoot and rectify faults

Information Sheet 1- Determining the extent and nature of the electrical installation

Self-check 1 Answers

1. D. All
2. B. Electricity meter

Information Sheet 2- Identifying, obtaining and understanding safety and regulatory requirements

Self-check 2 Answers

1. True
2. true

Information Sheet 3- Identifying OHS procedures for a given work area

Self-check 3 Answers

1. Understand the risks.
   - Reduce workplace stress.
   - Take regular breaks.
   - Avoid stooping or twisting.
   - Use mechanical aids whenever possible.
   - Protect your back.
   - Wear protective equipment to suit the task.
   - Stay sober

Information Sheet 4-Following OHS risk control measures and procedures

Self-check 4 Answers

1. Consult the workers or learners involved with the controls.
   - Consult management who administer the controls.
   - Check accident and incident reports

Information Sheet 5- Visualizing the extent of work to be undertaken from fault/breakdown reports

Self-check 5 Answers

1. Details of the damaged item in question

- Cause of the damage
- Impact of the damage
- Advise whether repairs are possible
- Estimation of the overall cost of repair.

Information Sheet 6- Requiring advice from the work supervisor

Self-check 6 Answers

1. D.None

2. D. All

LO #2-Trouble-shooting and repairing faults.

Information Sheet 1- Following OHS risk control measures and procedures

Self-check 1 Answers

1 Step 1: Setting your policy.

Step 2: Organizing your staff.

Step 3: Planning and setting standards.

Step 4: Measuring your performance.

Step 5: Learning from experience

Information Sheet 2-Determining the need to test or measure

Self-check 2 Answers

1. True
2. False
3. True

Information Sheet 3- checking Circuits/machines/plant as being isolated

Self-check 3 Answers

1. True
2. True
3. True

Information Sheet 4-Document safety hazards resulting from the fault or breakdown

Self-check 4 Answers

1. Fuse
2. Circuit breaker
3. Lighting Arrestor
4. Protective Relays

Information Sheet 5- Approaching trouble-shooting

Self-check 5 Answers

1. Identify the problem
2. Establish a theory of probable cause
3. Test probable cause theory to determine actual cause
4. Establish an action plan and execute the plan
5. Verify full system functionality
6. Document the process

Information Sheet 6- Dismantling circuit/apparatus components

Self-check 6 Answers

1. Removing household wiring, for example, turn off the circuit that controls the electricity at the main circuit breaker.

Information Sheet 7- Rechecking faulty circuits/components

Self-check 7 Answers

Instruction I

1. TRUE

2. TRUE

Instruction II

1. E . All

Information Sheet 8-Sourcing and Obtaining materials/replacement parts

Self-check 8 Answers

1. A , Circuit Breakers
2. B, Lugs
3. C Electrical Box

Information Sheet 9- Testing in effectiveness of the repair

Self-check 9 Answers

1. D, All
2. C, Acceptance testing

Information Sheet 10-Reassembling finally testing and preparing Apparatus for return to service

Self-check 10 Answers

1. True
2. True
3. True

Information Sheet 11- Dealing unexpected situations with safely

Self-check 11 Answers

1. D, All
2. B, Develop a Plan

Information Sheet 12- Carrying out trouble-shooting and repair activities without damage

Self-check 12 Answers

1. Identify the problem.
2. Establish a theory of probable cause.
3. Test the theory to determine the cause.
4. Establish a plan of action to resolve the problem

LO #3- Completion and report trouble-shoot and repair activities

Information Sheet 1-Following OHS work completion risk control measures and procedures

Self-check 1 Answers

1. True
2. False
3. False

Information Sheet 2- Cleaning and making work area safe

Self-check 2 Answers

1. True
2. True
3. True

Information Sheet 3 -Making written justification for repairs to apparatus

Self-check 3 Answers

1. True
2. True
3. True

Information Sheet 4 -Documenting work completion

Self-check 4 Answers

1. True
2. True