Ethiopian TVET-System

TTLM

BUILDING ELECTRICAL INSTALLATION

LEVEL II

Learning Guide-#1

Unit of Competence: Install and Terminate Wiring System

Module Title:-Installing and Terminate Wiring System

LG Code: EIS BEI2 M07 LO1-LG-23

TTLM Code: EISBEI2 M07 TTLM 0919v1

LO 1: Plan and prepare

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

- planning and preparing Installation to ensure OH&S policies and procedures
- consulting Appropriate personnel to ensure the work is coordinated
- checking wiring systems' components .
- obtaining fitting Accessories with established procedures
- Locating specific items of accessories, apparatus and circuits
- obtaining materials necessary to complete the work
- obtaining ***tools, equipment*** and testing devices needed to carry out the installation .
- checking Preparatory work is to ensure no unnecessary damage has occurred and complies with requirements.

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**:

- plan and prepare Installation to ensure OH&S policies and procedures
- consulate Appropriate personnel to ensure the work is coordinated
- check wiring systems' components .
- obtain fitting Accessories with established procedures
- Location specific items of accessories, apparatus and circuits
- obtain materials necessary to complete the work
- obtain ***tools, equipment*** and testing devices needed to carry out the installation
- check Preparatory work is to ensure no unnecessary damage has occurred and complies with requirements

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.

3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 ,Sheet 4,sheet5, sheet6,sheet7, and sheet8.”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 ,Self-check 4, self -check5, self-check6, self-check7, self-check8 ” **in page-7, 10, 17,33,36,40,50 and56** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, ”**in page -57.**
6. Do the “LAP test” **in page – 58** (if you are ready).`

Information Sheet-1	**planning and preparing Installation to ensure OH&S policies and procedures**

1.1 Introduction Planning and preparing for the installation

Before you install the installation server products, you must prepare your system and plan for choices and make during the installation process.

1.1.1. Installation Planning

Installation Planning is the planning involved in case the system requires replacement or upgrade. It is always necessary to assess the status of the current system of equipment whether there is need for upgrade or replacement of the system

1.1.2 **Steps Involved in Installation Planning**

1. Assessment - The performance of the current system in terms of reliability or productivity.
2. Readiness- Review existing installation to identify the roadblocks.
3. Benchmark- Record data on current system in order to measure the improvement in the new system to be installed.
4. Design or Plan- Identify and map all work necessary to make migration and upgrades.
5. Shutdown- Check and shutdown all the allied system.
6. Replacement- Replace or put a new installation at the designated location.
7. Testing- Do all the routine test specified in the installation guide. Also perform stress test related to the system.
8. Monitoring- Monitoring the system for a specified period to evaluate performance and check issues which might arise due to installation errors

1.2 Concepts of Occupational Health and Safety (OHS)

The term of Occupational health and safety (OHS) relates to health, safety, and welfare issues in the workplace.

OHS includes the laws, standards, and programs that are aimed at making the workplace better for workers, along with co-workers, family members, customers, and other stakeholders.

Improving a company's occupational health and safety standards ensures good business, a better brand image, and higher employee morale**.**

Occupational health and safety is concerned with addressing many types of workplace hazards, such as:

- Chemicals
- Physical hazards
- Biological agents
- Psychological fallout
- Ergonomic issues
- Accidents

Occupational health and safety standards are in place to mandate the removal, reduction, or replacement of job site hazards. OHS programs should also include material that helps minimize the effects of the hazards.

Employers and company management are obliged to provide a safe working environment for all of their employees.

1.2.1 Concepts of Health and Safety Policy

A health and safety policy describes a course of action that has been chosen to influence workplace decision-making and guide actions related to workplace health and safety

Health and safety policies commonly exist as a body of regulations that are defined at the level of government and are implemented by individual workplaces. In some jurisdictions, public intermediary corporations may also be used to develop policies

1.3 Occupational health and safety procedure

- occupational health and safety procedures
- A planned system of working to prevent illness and injury where you work by recognizing and identifying hazards and risks.

- A hazard is anything that could hurt you or someone else
- It means working out how likely it is that a hazard will harm someone and how serious the harm could be
- For example, you can pick up things from the floor and put them away to eliminate a trip hazard.
- A hazard is a situation in the workplace that has the potential to harm the health and safety of people or to damage plant and equipment.
- One of the most common physical hazards
- When working on electronic equipment always be alert.
- Always read the warnings and instructions on the label**.**
- Inside computers and electronic equipment, there is a range of voltages from 3.volts to 25 volts, most of which are harmless.
- Protect people from injury • Protect equipment from damage • Protect the environment from contamination
- Know the location of fire extinguishers, how to use them and which to use for electrical fires and for combustible fires.
- Find an escape route in case a fire gets out of control. • Know how to contact emergency services quickly • Keep the workspace clean. • Keep most solvents in a separate area.
- Thanks you for listening

1.4 The purpose of OHS policies and 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 procedure

1.5 The Importance of planning and Preparing Installation OH&S policies and procedures

- Consulting Appropriate/Technical Personnel to Ensure That Work is Coordinated with Others Who are Involved in the Activity.
- Determining the Location of the Devices/Systems to be used
- Obtaining Materials Necessary to Complete the Work in Accordance with Established Procedures
- Checking of Materials Received Against Job Requirements
- Complying with the Requirements in Installing Devices/Systems, and Peripherals
- Installing wiring system and Peripherals in Accordance with Job Requirements
- Performing Variations in Installing Devices and Systems in Accordance with Customer/Client's Requirements Obtaining Approval from Appropriate Personnel before Implementing Contingency Procedures
- Responding to Unplanned Events or Conditions in Accordance to Established Procedures
- Checking the Quality of the Work Undertaken in Accordance with the Established Procedures
- OHS Policies and Procedures in Conducting Tests.
- Checking Circuits and Systems Being Isolated Using Specified Testing Procedures.
- Testing Devices, Systems and/or Installation to Determine its Conformity with the Requirements
- Conducting Final Inspections on the Installed Devices, Systems to Ensure Conformity with the Requirement.
- Accomplishing Technical Reports on the Tests Conducted.
- Procedures in Forwarding Documentation to Appropriate Personnel and/or Authority on the Test Conducted
- Obtaining Approval from Appropriate Personnel before Implementing Contingency Procedures.

1.6 **Planning and preparing for the installation**

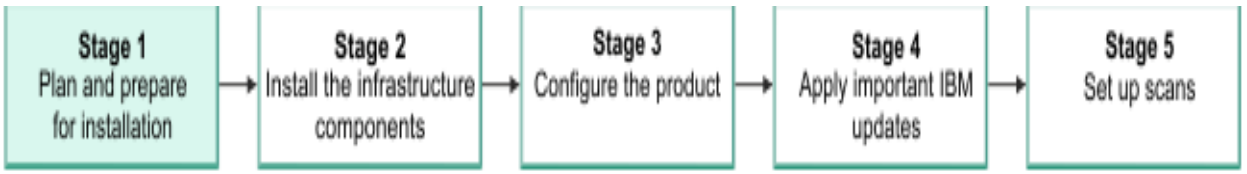

fig 1.1 Planning and preparing for the installation

- OHS Policies and Procedures in Planning for Installation Activity in Accordance with Requirements Procedures, Correct Operation and Safety on equipment / Devices/Systems
- Consulting Appropriate/Technical Personnel to Ensure That Work is Coordinated with Others Who are Involved in the Activity.
- Determining the Location of the Devices/Systems to be used
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- Procedures in Forwarding Documentation to Appropriate Personnel and/or Authority on the Test Conducted

Self-Check -1	Written Test

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

1.Occupational health and safety (OHS) relates to (2 points)

A. health C. welfare issues in the workplace

B. safety D. all

2.The Importance of planning and Preparing Installation OH&S policies andprocedures.(4 points)

A. Testing Devices B. Checking the Quality of the Work

C .Checking of Materials D.all

3.Steps Involved in Installation Planning(2 point)

A, assessment B. readiness

C ,benchmark D.all

4------- Review existing installation to identify the roadblocks(2 point)

A .assessment B. Readiness

C , benchmark D, all

Note: Satisfactory rating 5 points Unsatisfactory - below 5 points

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet- 2	consulting Appropriate personnel to ensure the work

2.1 Introduction

Consultation involves sharing of information, giving workers a reasonable opportunity to express views and taking those views into account before making decisions on health and safety matters.

A person conducting a business or undertaking must consult, so far as is reasonably practicable, with workers who carry out work for the business or undertaking and who are (or are likely to be) directly affected by a work health and safety matter.

If the workers are represented by a health and safety representative, the consultation must involve that representative.

Consultation with workers and their health and safety representatives is required at every step of the risk management process. By drawing on the experience, knowledge and ideas of your workers you are more likely to identify all hazards and choose effective risk control.

For example, if you engage an electrical contractor to carry out electrical work at your workplace you should consult with the contractor on how (in general) the work is to be carried out and in particular how risks to their health and safety and that of others at the workplace are to be managed while the work is carried out. You should also cooperate with the electrical contractor (e.g. instructing on and ensuring compliance with 'no go' zones') to ensure electrical safety of everyone at the workplace

2.2 The important of consulting Appropriate personnel to ensure the work

2.2.1Managing electrical risks

A person conducting a supervisor or undertaking must manage risks to health and safety associated with electrical risks at the workplace.

In order to manage risk under the WHS Regulations, a duty holder must:

- identify reasonably foreseeable hazards that could give rise to the risk
- eliminate the risk, so far as is reasonably practicable
- if it is not reasonably practicable to eliminate the risk, minimize the risk so far as is reasonably practicable by implementing control measures
- maintain the implemented control measure so that it remains effective
- review, and if necessary revise, all risk control measures so as to maintain, so far as is reasonably practicable, a work environment that is without risks to health and safety
- identifying hazards „
- if necessary, assessing the risks associated with these hazards
- implementing and maintaining risk control measures (e.g. inspecting and testing electrical equipment, using RCDs), and
- reviewing risk control measures.

2.2.2 Implementing risk control measures

In implementing risk controls, you may develop a safe work method statement that:

- specifies the determined risk controls
- sets out the steps that need to be taken to implement the risk controls
- identifies and allocates the resources necessary to implement the measures (i.e. time and expenses)
- allocates responsibilities and accountabilities (e.g. who does what and when)
- sets a date for reviewing the risk controls.

2.3 RISK CONTROLSWORKING NEAR ENERGISED ELECTRICAL PARTS

Electricalwork on any installation, equipment, machinery, plant or appliance may pose a risk of direct or indirect contact with nearby exposed energized electrical parts (e.g. installing or testing circuits on a switchboard adjacent to exposed live electrical parts).

In some circumstances the risks associated with undertaking electrical work near exposed live parts can be equivalent to those associated with live electrical work. Risks to be considered, but not limited to, are those arising from:

- energized parts
- exposed high temperature parts

- moisture entering the electrical equipment. Identifying and assessing the risks and developing risk control measures as described in the How to manage work health and safety risks code of practice 2011 will provide further assistance in developing safe work practices

2.3Consultation between duty holders

All persons conducting a business or undertaking at a workplace have a duty to manage electrical risks at the workplace while electrical work is being carried out, not just those carrying out the electrical work. Electrical work will often be carried out at a place that is not under the management or control of the person conducting the business or undertaking carrying out the electrical work. For example, the place where work is carried out may be under the management or control of:

- if the place is a permanent workplace—the person conducting a business or undertaking from that workplace
- if the place is a public place—the relevant local or state authority. These persons will also have duties in relation to the health and safety of the electrical worker(s) and other persons at the place where the electrical work is being carried out.

All duty holders must, so far as is reasonably practicable, consult, cooperate and coordinate activities with each other to ensure compliance with their work health and safety duties. In addition to the general duty to consult, the person conducting a business or undertaking carrying out the electrical work must ensure the electrical work is only authorized (among other things) after consulting with the person with management or control of the workplace. Consultation should ensure that all relevant persons are aware of any scheduled electrical work to be carried out and also any relevant risks to health and safety arising from that work.

Arrangements should also be put in place to ensure, so far as is reasonably practicable, that all persons at the place receive suitable and adequate information and instruction, for example about the need to comply with warning or safety signs and stay out of any ‘no go’ zones.

Self-Check -2	Written Test

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

1._____Risk controls working near energized part electrical part**(2 point)**

A. energized parts

C. moisture entering the electrical equipment

B. exposed high temperature parts D. all

2.AS trainer what is you responsible before the practical work(2 point)

A .consulting Appropriate personnel B. allocates responsibilities

C. exposed any idea D.A&B

3. The important of Managing electrical risks.(2 point)

A ,exposed high temperature parts B. Identifying and assessing the risks

C developing risk control measures D. All

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

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	checking wiring systems' components

3.1 Introduction wiring systems

Electrical wiring is a process of connecting different accessories for the distribution of electrical energy from the supplier to various appliances and equipment(fuse, switch, lights, fan etc...) at home like television, lamps, air conditioners, etc.

The different types of electrical wiring that are used in domestic properties.

3.2 Types of Electrical Wiring Systems

They are different types of electrical wiring that are used in domestic properties

- 5 Different Types of House Electrical Wiring Systems

1. Cleat Wiring

   This wiring comprises of PVC insulated wires or ordinary VIR that are braided and compounded. They are held on walls and ceilings using porcelain cleats with groves, wood or plastic. It is a temporary wiring system, therefore making it unsuitable for domestic premises. Moreover, cleat wiring system is rarely being used these days.

2. Casing and Capping Wiring

   It was quite popular in the past but it is considered obsolete these days due to the popularity of the conduit and sheathed wiring system. The cables used in this electric wiring were PVC, VIR or any other approved insulated cables. The cables were carried through the wooden casing enclosures, where the casing was made of a strip of wood with parallel grooves cut lengthwise for accommodating the cables.

3. Batten Wiring

This is when a single electrical wire or a group of wires are laid over a wooden batten. The wires are held to the batten using a brass clip and spaced at an interval of 10 cm for horizontal runs and 15 cm for vertical runs.

4. Lead Sheathed Wiring

   Lead sheathed wiring uses conductors which are insulated with VIR and are covered with an outer sheath of lead aluminum alloy which contains about 95% lead. The metal sheath gives protection to cables from mechanical damage, moisture and atmospheric corrosion.

5. Conduit Wiring

   There are two types of conduit wiring according to pipe installation:

   - Surface Conduit Wiring When GI or PVC conduits are installed on walls or roof, it is known as surface conduit wiring. The conduits are attached to the walls with a 2-hole strap and base clip at regular distances. Electrical wires are laid inside the conduits.
   - Concealed Conduit WiringWhen the conduits are hidden inside the wall slots or chiseled brick wall, it is called concealed conduit wiring. Electrical wires are laid inside the conduits. This is popular since it is stronger and more aesthetically appealing.

some Advantages and Disadvantages of Concealed Conduit Wiring System

Advantages

- It is a safe wiring system
- Safe from chemical effects, humidity and other external factors
- No risk of shock
- It is aesthetically appealing

- No risk of wear and tear, fire or damaged cable insulation
- Quite reliable
- Renovations can be easily performed as you can replace old wires easily

Disadvantages

- Expensive as compared to surface conduit wiring
- Changing the location of switches or appliances is difficult
- Installation is complex
- Hard to find defects in the wiring
- Adding additional conduit in future is a tedious task

When the wiring is not done properly or isn't maintained well, it may lead to dangerous situations such as electrical fires. Therefore, it is important that you take a lot of care while installing electrical wires and cables. If you are wondering which electrical wiring to install at your home, call us at D&F Liquidators, Inc. as we have a wide range of wiring at competitive prices and our experienced team will guide you through the selection process.

3.3 Methods of Electrical Wiring Systems

Wiring (a process of connecting various accessories for distribution of electrical energy from supplier's meter board to home appliances such as lamps, fans and other domestic appliances is known as Electrical Wiring) can be done using two methods which are

- **Joint box system or Tee system**
- **Loop – in system**

Joint Box or Tee or Jointing System

In this method of wiring, connections to appliances are made through joints. These joints are made in joint boxes by means of suitable connectors or joints cutouts. This method of wiring doesn't consume too much cables size.

You might think because this method of wiring doesn't require too much cable it is therefore cheaper. It is of course but the money you saved from buying cables will be used in buying

joint boxes, thus equation is balanced. This method is suitable for temporary installations and it is cheap.

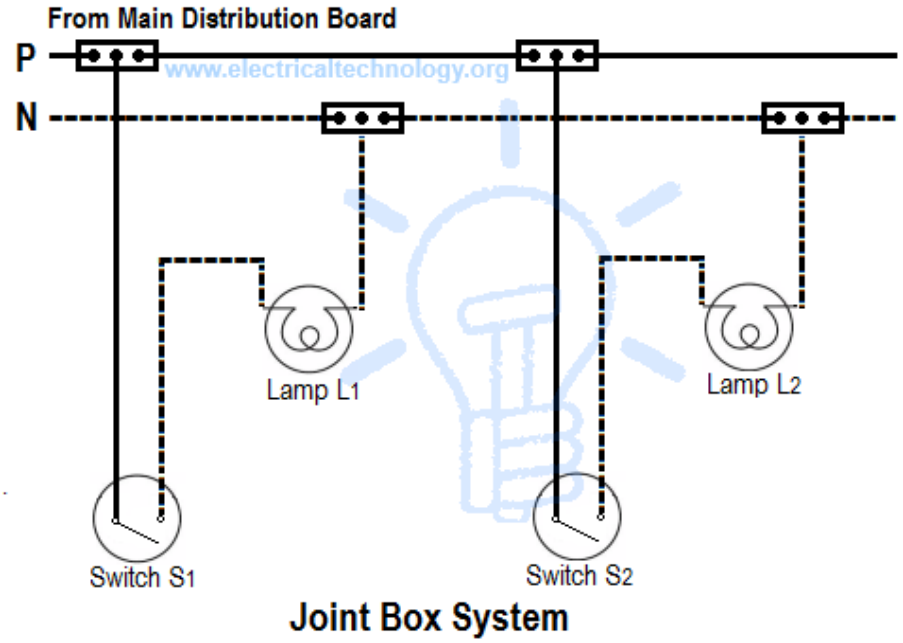


Fig 3.1 Joint box system

Loop-in or Looping System

This method of wiring is universally used in wiring. Lamps and other appliances are connected in parallel so that each of the appliances can be controlled individually. When a connection is required at a light or switch, the feed conductor is looped in by bringing it directly to the terminal and then carrying it forward again to the next point to be fed.

The switch and light feeds are carried round the circuit in a series of loops from one point to another until the last on the circuit is reached. The phase or line conductors are looped either in switchboard or box and neutrals are looped either in switchboard or from light or fan. Line or phase should never be looped from light or fan.

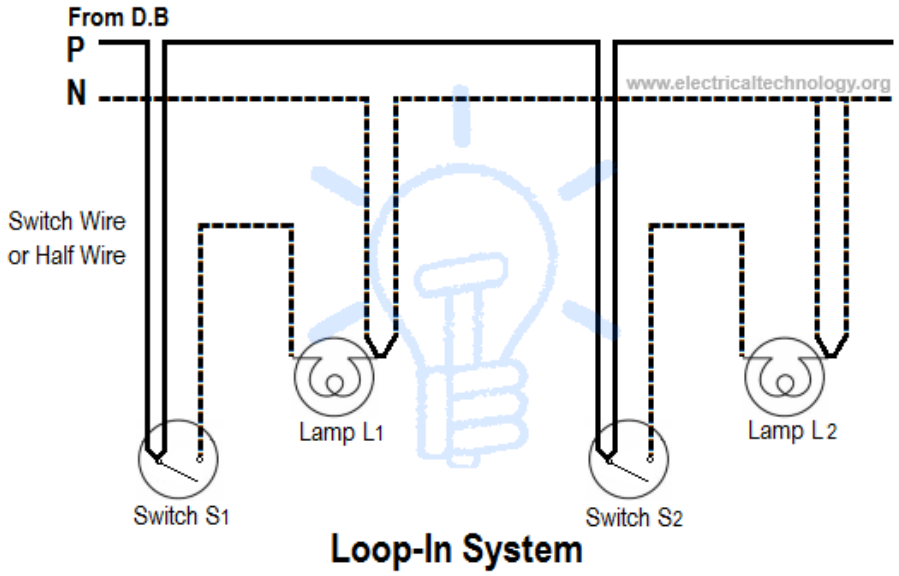


Fig 3.2 Loop system

3.4 Wiring systems' components

Electrical Wiring components is a device that used connecting and install full electrical project. include wires, fuse, switches, sockets, lights, fans, boxes, circuit breaker, main distribution board , continues power supply etc....

3.5 checking wiring systems' components

There are two kinds of checks that can be carried out and we recommend that you always employ a registered electrician to carry out such checks

3.5.1 Visual Inspection

A visual inspection is a basic check to identify any visible signs of defects, damage or deterioration. No circuit testing will be undertaken, so your electricity will likely remain on during the inspection. The electrician will need to be given access to all of the rooms in your home. The report will typically take around 1 hour to complete depending on the size of the property. Notes will be taken by the electrician as part of the visual inspection and a Visual

Inspection Report (VIR) will be issued to the home owner at the end. The Visual Inspection report will record a number of observations and recommendations and provide an overall summary of the condition of the installation. Below is a check list of the things you can expect to be looked at during a visual inspection.

Consumer Unit (main fuse board)

- Sockets
- Plugs
- Light fittings
- Light switches
- Electrical cables or leads
- Earthling and bonding
- Extension leads
- Kitchen safety
- Bathroom safety
- Signs of wear and tear
- Visible signs of burning/scorching
- RCD protection around the home

Fig 3.3 Visual Inspection

3.5.2Electrical Installation Condition Report (EICR)

An electrical installation condition report (EICR) identifies any damage, deterioration, defects and/or conditions which may give rise to danger along with observations for which improvement is recommended. It is a more detailed report than a VIR and will involve the

testing of various circuits which will require the turning off of the electrics at the main supply. This allows the contractor to identify any possible hidden defects or issues that cannot be identified during a VIR. The purpose of an EICR (also known as periodic inspection and testing of an electrical installation), is to determine, so far as is reasonably practicable, whether the installation is in a satisfactory condition for continued service. Homeowners often ask for, or obtain a condition report as part of a house sale. Similarly, landlords with an increasing awareness of their electrical safety obligations undertake regular periodic inspections in relation to their rental properties

3.6 The important Check wiring systems' components

Test that are to be used or connected to electrical equipment should meet the following conditions:

- be suitable for the work in terms of their function, operating range and accuracy
- be in good condition and working order, clean and have no cracked or broken insulation. Particular care must be taken regarding the condition of the insulation on leads, probes and clips of test equipment
- pose no danger of electrocution to workers or damage to the electrical equipment during testing
- have suitably insulated leads and connection probes that enable connection or contact with energized parts to be made with minimal risk to the electrical worker
- provide suitable protection against hazards arising from over-voltages that may arise from or during the testing or measurement process.
- Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – General requirements provides a classification for instruments on the basis of their immunity to over-voltage, which is liable to be experienced in different parts of electrical equipment. Devices should be rated as Category III or IV to enable their use on all parts of the equipment.
- Test probes and other equipment should be designed and selected so that they cannot inadvertently short circuit between live conductors or live conductors and earth. The terminals of test equipment should be shrouded and all other test sockets

on measuring instruments should be designed so as to prevent inadvertent contact with any live test socket or conductor when equipment is in use. Where appropriate, test leads and testing devices need to be provided with suitable fuse protection. Testing equipment, where used in hazardous flammable areas, should be designed and clearly marked as being suitable for use in these conditions.

- Testing equipment used for detecting an energized source should be checked to prove that it is functioning correctly immediately before and after the test has taken place. The standard test regime is to test a known source of energy, test the de-energized circuit for zero volts then test the known source age How to checking tools and equipment
- being able to use the device safely and in the manner for which it was intended
- being able to determine, by inspection, that the device is safe for use, for example the device is not damaged and is fit for purpose
- understanding the limitations of the equipment, for example when testing to prove an alternating current circuit is de-energized, whether the device indicates the presence of hazardous levels of direct current
- being aware of the electrical safety implications for others when the device is being used, for example whether the device causes the electric potential of the earthling system to rise to a hazardous level
- knowing what to do to ensure electrical safety when an inconclusive or incorrect result is obtained**.**

Self-Check -3	Written Test

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

1. _____ is the Electrical Wiring components current situation. (3 points)

A .wire B. socket

C .switch D. all

2. types of electrical wiring systems.(3 point)

A. cleat wiring B. conduit wiring

C .batten wiring D. all

3. Methods of Electrical Wiring Systems.(4 points)

A . Joint box system B. Loop system

C . Tee system D. all

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

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-4	**obtaining fitting Accessories with established procedures**

4.1 fitting Accessories

Electrical accessory" means a device associated with the Electrical wiring of a domestic installation; "adaptor" means a electrical accessory which may be engaged. With a socket, being an electrical accessory which is designed

4.1 .1 Types of electrical fittings

PVC Electrical Conduit fittings

Electrical conduit and fittings are of good quality, low cost, high safety and reliability. It has the advantages of beautiful appearance, light weight and easy bend, high strength, anti-aging, corrosion resistance, high fire resistance, good insulation and so on. It is used in the buildings and structures to protect and secure wire, cable and communication network.

An electrical conduit is a tube used to protect and route electrical wiring in a building or non building structure. Electrical conduit may be made of metal, plastic, fiber, or fired clay. Most conduits is rigid, but flexible conduit is used for some purposes.

Box connectors Box connectors join conduit to a junction box or other electrical box. A typical box connector is inserted into a knockout in a junction box, with the threaded end then being secured with a ring (called a lock nut) from within the box, as a bolt would be secured by a nut. The other end of the fitting usually has a screw or compression ring which is tightened down onto the inserted conduit. Fittings for non-threaded conduits are either secured with set screws or with a compression nut that encircles the conduit. Fittings for general purpose use with metal conduits may be made of die-cast zinc, but where stronger fittings are needed, they are made of copper-free aluminum or cast iron.

Couplings connect two pieces of conduit together. Sometimes the fittings are considered sufficiently conductive to *bond* (electrically unite) the metal conduit to a metal junction box (thus sharing the box's ground connection).

Grounding bushings Grounding bushings are used which have bonding jumpers from the bushing to a grounding screw on the box. Unlike water piping, if it the conduit is to be watertight, the idea is to keep water *out*, not in. In this case, gaskets are used with special fittings, such as the weather head leading from the overhead electrical mains to the electric meter. Flexible metal conduit usually uses fittings with a clamp on the outside of the box, just like bare cables would.

A **conduit body** can be used to provide pulling access in a run of conduit, to allow more bends to be made in a particular section of conduit, to make connections if the conduit body is rated for such use, to conserve space where a full size bend radius would be impractical or impossible, or to split a conduit path into multiple directions. Conduit bodies differ from junction boxes in that they are not required to be individually supported, this makes them very useful in practical applications. Conduit bodies are commonly referred to as conduits, a term trademarked by Cooper Crouse-Hinds company, a division of Cooper Industrials.

Conduit bodies come in various types, moisture ratings, and materials, including galvanized steel, aluminum, and PVC. Depending on the material, they use different mechanical methods for securing conduit. Among the types are:

- L-shaped bodies ("Ells") include the LB, LL, and LR, where the inlet is in line with the access cover and the outlet is on the back, left and right, respectively. In addition to providing access to wires for pulling, "L" fittings allow a 90 degree turn in conduit where there is insufficient space for a full-radius 90 degree sweep (curved conduit section).
- T-shaped bodies ("Tees") feature an inlet in line with the access cover and outlets to both the cover's left and right.
- C-shaped bodies ("Cees") have identical openings above and below the access cover, and are used to pull conductors in a straight runs as they make no turn between inlet and outlet.
- "Service Ell" bodies (SLBs), shorter ells with inlets flush with the access cover, are frequently used where a circuit passes through an exterior wall from outside to inside

Fig 4.1 PVC Electrical Conduit fittings

- **Advantages:**

1. Good price
2. Light and recyclable
3. Chemical resistance
4. Wide range of fittings
5. No vibration and noise
6. Easy to install and to operate
7. Applies to swimming pool, waste water treatment, agriculture, litigation, industrial

Electrical Wiring Supports

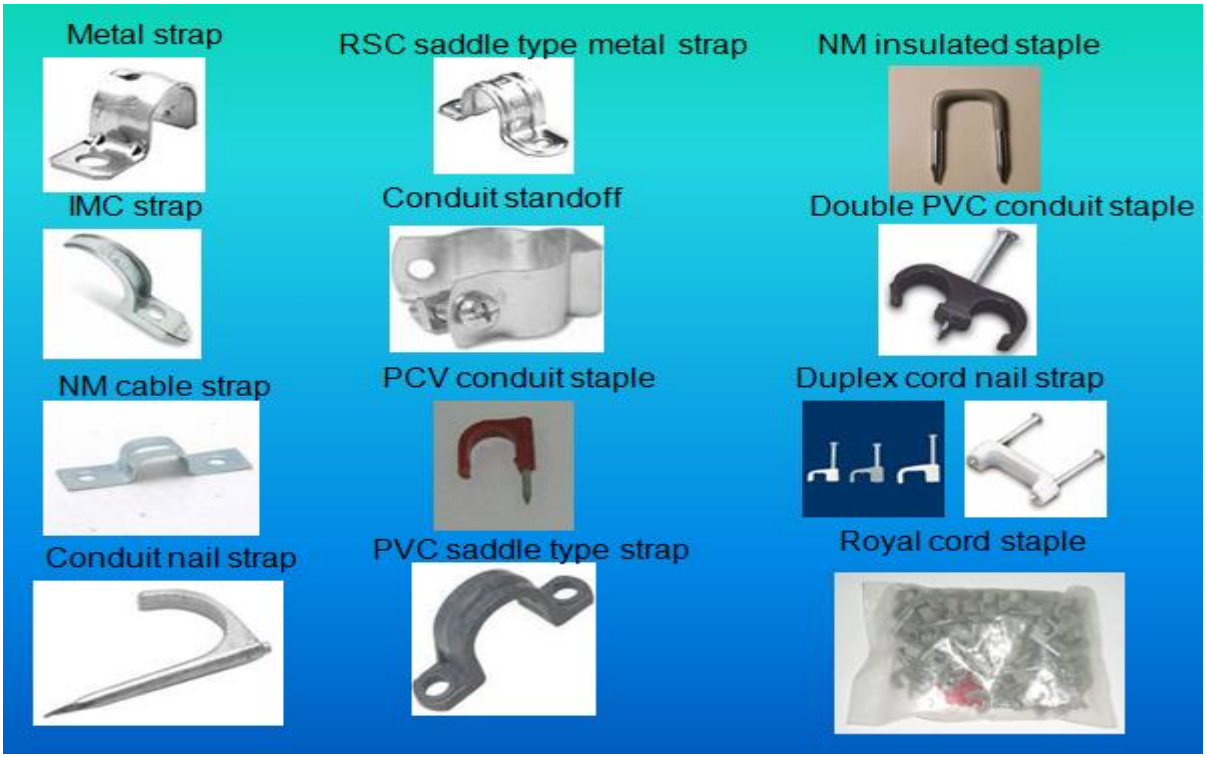


fig 4.2 Electrical Wiring Supports

B. **Lighting fitting**

The fittings you select for your home are the ones you will have to live with - so choose wisely. The number and type of power points, switches and how they will integrate with your décor is important. Light fittings should be chosen not only on the basis of looks but also on energy efficiency - all of these aspects of your house are best planned by consulting catalogues and visiting displays in stores.

You will not see the wiring in your home, but ensuring that you have an adequate number of power points is important. You should also understand the basic wiring plan of your home and be aware of possible hazards - like vermin in the roof where much of the wiring is located. Smart wiring is also a good way future proof, giving you the option to add features such as security, energy management and home automation later on.

Lighting should be carefully planned with a view to how you will live and work in different areas, and to ensure that it's not going to be an unnecessary drain on your electricity bill. Choose wisely for working areas in particular to avoid accidents and eyestrain. Light globes connect to your house's electrics through light fittings. Read about how fittings work, the different types that are available and where they should be positioned.

figure 4 .3Lighting fitting

Electric Switch Basics

An electric switch is responsible for allowing or inhibiting the transfer of electricity in an electrical circuit. The most common form of electric power switch is a basic manual electromechanical unit. When the switch is open, the electrical contacts do not touch and electricity cannot flow. When the switch is closed, however, the electrical contacts touch and electricity flows throughout the circuit.

Electric Power Switch Contacts

When it comes to electrical contacts, they usually consist of corrosion resistant metal so as to prevent insulating oxides from developing—if the metal oxidizes, the flow of electricity can be inhibited and the circuit may not work properly. Additionally, the electrical contacts should be wear resistant, relatively low cost, and possess high mechanical strength. Occasionally, conductive plastic can be used as contact material. Switches are normally classified based on their contacts.

Electrical switch contacts can have a variety of configurations, and are therefore accompanied by a variety of terminology. Pole and throw are two common terms that refer to the manner in which tow contacts in a circuit interact. A pole refers to a set of contacts that are part of a single circuit. A throw refers to the multiple positions contacts can assume, which usually corresponds to the number of poles. Types of electrical switches are usually named according to their pole and throw configurations.

Types of Basic Electrical Switches

Below we list a few of the most common types of basic electrical switch.

SPST Electric Switch

This switch's mnemonic stands for "single pole, single throw." The switch consists of one set of electrical contacts, so it has two terminals, one from each contact. It is a simple on-off switch, so when the switch is open no electricity flows, but when it's closed the contacts meet and electricity is transferred. A light switch is a good example of a SPST switch.

SPDT Electric Switch

A single pole double throw switch can also be called a changeover switch. In this case, there are three terminals—one terminal (A), faces two opposing terminals (B and C) and can be connected either, depending on the mode. It is said to be "double throw" because there are two positions this switch can operate—A is either connected to B, or A is connected to C.

DPST Electric Switch

In a double pole, single throw switch, there are two poles—two sets of connectors—but only one viable position they connect. Each pole's terminals connect. The first pole is comprised of terminals A and B, which connect. Simultaneously, the second pole, comprised of terminals C and C, connects. Because there is only one position in which these poles operate, it is a single throw device. In essence, a DPST is made up of two SPSTs, but is controlled by one mechanism.

DPDT Electric Power Switch

A double pole double throw switch is comprised of two SPDTs. Each pole has two possible throws. The first pole, with three terminals, is comprised of A, B, and C. A can be connected to B, or A can be connected to C as the two possible throw positions. In the second pole, there are also three terminals, D, E, and F, and two possible throws. D can be connected to E or D can be connected to F. A, B, C, D, E, and F are all controlled by the same mechanism, making it a double pole double throw switch.

When it comes to electric switches with multiple throws, there are several things that can happen when positions are changed. In some cases, contact is made with the new terminal before contact with the old terminal is broken, to ensure no gap in the flow of electricity. This is called a make-before-break transition, because new contact is made before the old contact is severed. In other cases, contact with the old terminal is ended before contact with the new terminal is made. This method of reconnecting means the terminals won't short each other, and is known as break-before-make because contact with the old terminal is broken before new contact is established. Depending on the application, either method can be used.

Control switch

- .A light fitting connected to an installation by means other than a socket outlet shall be controlled by a switch which shall be arranged to disconnect all the supply conductors
- The switch required by (1) above shall be separate from lighting fitting and in a readily accessible position subject to the provisions (3) and (5) below, where applicable
- Where a switch has to be situated so as to be normally inaccessible to a person who is using a bath or a shower, it 'is admissible for the switch to be placed adjacent to the normal access door of the room, or to be of the type operated by insulating cord.
- The switch or switches providing control of comprehensive lighting installation comprising more than one lighting fitting in non-domestic premises may be installed in separate rooms
- Where lighting fittings are installed over readily combustible material, every light fitting .shall be controlled by an individual wall switch

- Where way in a dwelling unit has risers, the lighting shall be controlled by intermediate wall switches or their functional equivalent located at the head .and foot of the' stairway

.

fig 4.4 Electric Switch fitting

C. Socket outlet fitting

What you may know as a power point is technically referred to as a 'socket outlet'. It's also less commonly referred to as a GPO, which stands for 'General Purpose Outlet' or 'General Power Outlet', depending on who you ask. The term 'GPO' is used in America (and therefore appears quite a lot online), but the term's outdated throughout the rest of the world.
Socket outlets are available in many different styles, and can only be installed or maintained by an electrician.

- Polarized outlets are different in that slot for the neutral wire is wider than the slot for the hot wire. This makes it difficult to insert the electrical plug the wrong way

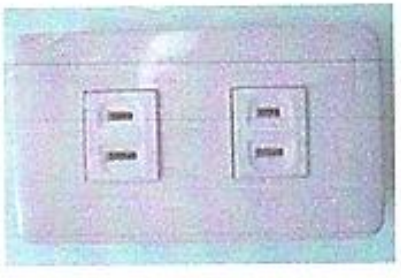


fig 4.5.1 Socket outlet fitting

- Non-Polarized outlets have two vertical slots side by side that are the same size.

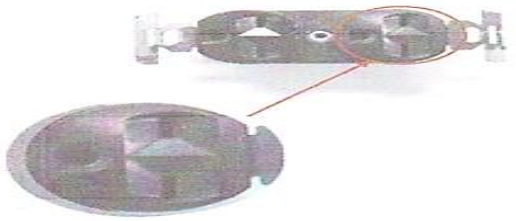


fig 4.5.2 Socket outlet fitting

- Grounded outlets have a round hole for the grounding conductor in addition to the two vertical slots. In general, electronic devices such as computers require these to provide a solid ground for the case so the electronics will work properly. It is also used as a safety feature in certain higher-power appliances such as vacuum cleaners, ensuring that whatever happens to the wiring, the case will never be energized to wall voltage.

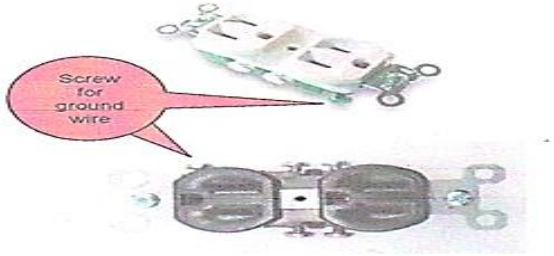


fig 4.5.3 Socket outlet fitting

- Some electrical outlets have a T shaped slot on the neutral instead of just a vertical slot. These outlets are rated for 20A, and can receive special plugs for appliances which draw more than 15A. This prevents people from tripping their circuit breakers by plugging them 15A outlets by mistake.

fig 4.5.4 Socket outlet fitting

- Convenience Outlet, 3-pin

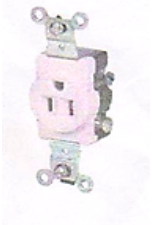
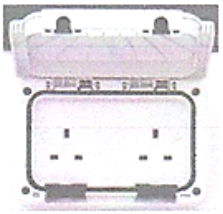


fig 4.5.5 Socket outlet fitting

- Convenience outlet, Twist lock, 3 pin

fig 4.5.5 Socket outlet fitting

- Weatherproof convenience outlet, duplex, 3-pin.



- **Schuko plug and socketCEE 7/4**

CEE 7/4, commonly called **"Schuko"** socket, has a recessed round shape with two symmetrical round receptacles and two grounding clips on the sides of the socket. The Schuko connection system is symmetrical and unpolarised by design, allowing live and neutral to be reversed. Its dimensions are compatible with CEE 7/5 (french plug/socket) except that the female ground contact is omitted.

Figure 11 - Schuko plug and socket

- **French Socket CEE 7/5**

France, **Belgium**, **Poland**, **Czech Republic**, **Slovakia** and some other countries have standardized on a round plug with two round pins measuring 4.8 by 19 mm (0.189 by 0.748 in), spaced 19 mm (0.748 in) apart and with a hole for the socket's ground pin. This standard will also accept Europlugs and CEE 7/17 plugs. Sockets are installed with the earth pin upwards. Although the plug is polarised, there is no universally observed standard for connecting the live and neutral. In the former Czechoslovakia Standard ČSN 33 2180:1979, section 6.2.2. required live to be on the left side of socket. Child-resistant outlet shutters are required by French and Belgian standards, however they are not required in all countries where this type is used.

CEE 7/5 plugs are not compatible with the CEE 7/4 socket because grounding in the CEE 7/5 socket is effected by a round male pin permanently mounted in the socket.

Figure 12 - French Socket CEE 7/5

- **CEE 7/7 plug**

  To bridge the differences between German and French standards, the CEE 7/7 plug was developed. It is polarised to prevent the live and neutral connections from being reversed when used with a French CEE 7/5 outlet, but allows polarity reversal when inserted into a German CEE 7/4 socket. The plug is rated at 16 A.

It has grounding clips on both sides to connect with the CEE 7/4 socket and a female contact to accept the grounding pin of the CEE 7/5 socket. It is used in almost all European countries. Currently, appliances are sold with non-rewriteable CEE 7/7 plugs attached. This means that the plugs are now identical between countries like France and Germany, but the sockets are different.

Figure 13 - CEE 7/7 plug

Figure 14 - CEE 7/16 plug and old socket

- **CEE 7/16 plug and old socket**

This two-pin plug is popularly known as the Europlug. The plug is ungrounded and has two round 4 mm (0.157 in) pins, which usually converge slightly towards their free ends. It is described in CEE 7/16 and is also defined in Italian standard CEI 23-5 and Russian standard GOST 7396. This plug is intended for use with devices that require 2.5 A or less. Because it is unpolarised, it can be inserted in either direction into the socket, so live and neutral are connected arbitrarily. The separation and length of the pins allow its safe insertion in most CEE 7/5, CEE 7/4 "Schuko", Israeli, CEE 7/7, Swiss, Danish and Italian outlets, as well as BS 4573 UK shaver sockets. It can be forced into BS 546 (5 A) and some BS 1363 sockets, if the shutters are opened, though the connection may be neither reliable in either case, nor safe.

The Europlug itself is used in Class II applications throughout continental Europe. It is also used in the Middle East (Iran), most African nations, South America (Brazil, Chile, Argentina, Peru and Bolivia), Asia (India, Bangladesh, Sri Lanka, Indonesia, Pakistan, South Korea, and the Philippines) as well as Russia and the former Soviet republics, such as Ukraine, Armenia, Georgia, and many developing nations. It is also used alongside the BS 1363 in many nations, particularly former British colonies.

- **Unearthed socket compatible with both Schuko and French plugs**

Europlug sockets have no ground provisions and consequently have been phased out in most countries. For example, in Germany, ungrounded outlets are rare, found only in very old installations, whereas in the Netherlands they are common in "dry areas" such as in bedrooms or living rooms. Standards also vary between countries as to whether child-resistant shutters are required. Depending on the country and the age of the socket these sockets may have 4.0 or 4.8 mm receptacles. The latter accept CEE 7/5 and CEE 7/4 plugs in addition to Europlugs, though without ground

Figure 15 - Unearthed socket compatible with both Schuko and French plugs

connection. Countries using the CEE 7/5 and CEE 7/4 standards vary in whether ungrounded Europlug sockets are still permitted in environments where the need for grounding is less critical. Adaptors and trailing sockets and power strips designed to accept only Europlugs with 4 mm (0.157 in) pins may also have plastic barriers in place to prevent CEE 7/17, Schuko or French plugs from entering.

Figure 16 - Danish Outlet

Danish 107-2-D1, standard DK 2-1a, with round power pins and half round ground pin

Outlet for Danish computer equipment plug's tilted flattened pins and half round ground pin (mainly used in professional environment), standard DK 2-5a

ThisDanish standard plug is described in the Danish Plug Equipment Section 107-2-D1 Standard sheet (SRAF1962/DB 16/87 DN10A-R). Unlike the French CEE 7/5 plug, the earthling pin is on the plug, not in the socket. The Danish socket need not be recessed to protect the earthling pin. The Danish standard provides for outlets to have child-resistant shutters.

The Danish socket will also accept the CEE 7/16 Europlug or CEE 7/17 Schuko-French hybrid plug. CEE 7/4 (Schuko), CEE 7/7 (Schuko-French hybrid), and grounded CEE 7/5 French plugs will also fit into the socket but should not be used for appliances that need earth contact. The current rating on both plugs is 13 A.

A variation (standard DK 2-5a) of the Danish plug is for use only on surge protected computer outlets. It fits into the corresponding computer socket and the normal socket, but normal plugs deliberately don't fit into the special computer socket. The plug is often used in companies, but rarely in private homes. There is a variation for hospital equipment with a rectangular left pin, it is used for life support equipment.

Side by side comparison of Italian CEI 23-16/VII plugs and sockets rated 16 A (left) and 10 A (right).

Figure 17 - Italian CEI 23-16/VII plugs and sockets

The Italian earthed plug/socket standard, CEI 23-16/VII, includes two models rated at 10 A and 16 A that differ in contact diameter and spacing (see below for details). Both are symmetrical, allowing the live and neutral contacts to be inserted in either direction. The 10 A plug is called IT1-10P or S11 and the socket is IT1-16R or P11. The 16 A plug is called IT2-16P or S17 and the socket is IT2-16R or P17.

The 10 A style extends CEE 7/16 by adding a central earthing pin of the same gauge. Thus, CEI 23-16-VII 10A sockets can accept CEE 7/16 Euro plugs. This is the plug shown in the first picture.

The 16 A style looks like a magnified version of the 10A style, identical in shape. However, the pins are 5 millimeters thick (being 4 mm thick in 10 A type), 26 mm apart (while 19 mm apart in 10 A type) and 7 mm longer. The packaging of these plugs in Italy may claim they are a "North European" type.

Figure 18 - China CPCS-CCC plug

China CPCS-CCC (Chinese 10 A/250 V) plugs

The standard for Chinese plugs and sockets is set out in GB 2099.1-2008 and GB 1002-2008. As part of China's commitment for entry into the WTO, the new CPCS (Compulsory Product Certification System) has been introduced, and compliant Chinese plugs have been awarded the CCC Mark by this system. The plug is three wire, earthed, rated at 10 A, 250 V and used for Class 1 applications; a 16 A version also exists. The Australian plug fits, though the pins on the Chinese plug are thinner and 1 mm (0.039 in) longer. Therefore, a plug or adaptor claiming to be suitable for use in both Chinese and Australian plugs may not fit either outlet correctly; the Chinese plug's thin pins may fit loosely in an Australian socket, while an Australian plug's thick pins may not fit easily into a Chinese socket. In China, the sockets are installed upside-down relative to the Australasian ones. China also uses American/Japanese NEMA 1-15 sockets and plugs for Class-II appliances. However, the

Israel SI32

Two Israeli plugs and one socket. The left plug is the old standard, the one on the right is the 1989 revision

This plug, defined in SI 32 (IS16A-R), is unique to Israel. It has three flat pins to form a Y-shape. Live and neutral are spaced 19 mm (0.75 in) apart. The plug is rated at 16 A. In 1989, the standard was revised to use three round 4.5 mm (0.177 in) pins in the same locations, allowing the socket to accept the Euro plugs used in Europe and Israel for non-earthed appliances. Sockets made since 1989 accept both flat and round pins for compatibility with both old and new plugs. As of 2008, pre-1989 sockets which accept only old-style plugs are very rare in Israel.

Figure 19 - Israel SI32

4.2Obtaining fitting Accessories with established procedures

4.1.1 Correct selection and use of equipment

1. Equipment must be properly designed, constructed, installed and maintained so that it does not present a risk of electric shock, burns, fire or explosion when properly used. There are many equipment-specific standards that include safety related requirements which, if followed, will ensure that the electrical risks are adequately controlled.
2. The main standard for low-voltage electrical installations is Requirements for electrical installations .It describes how systems and equipment can be designed, constructed and installed so that they can be used safely. The standard covers

installations that operate at low voltage (up to1000 V ac). Meeting the requirements of this standard is likely to achieve compliance with the relevant parts of the EAW Regulations.

3. Some old equipment that is still in use, including open-type switchboards and fuse boards used by electricity distributors and in industrial premises such as steelworks, is not designed or constructed to prevent people touching live conductors and suffering injuries from shock or burns. In these cases, the user must have sufficient knowledge and experience to recognize the danger and avoid it. This type of equipment should be located in a secure room or area, with access available only to those who have specific authority and are competent to prevent danger. Even then, you will need to further protect this type of open; UN insulated equipment to prevent accidental contact with live parts when competent persons are working near it.
4. Some equipment operates at voltages that are so low that they can no cause a harmful electric shock but even at these extra-low voltages an arc can occur, burns can result from overheated conductors, or an explosive atmosphere can be ignited.

A short-circuited car battery, for example, may cause the conductors to overheat and even cause the battery to explode. The following advice also applies to self contained sources of electrical energy, whether the risk is from electric shock, burn, arcing, or explosion.

5. You must select equipment that is suitable for the environment in which it is used, for example cables and equipment in heavy industries such as sheet metal works need to be protected against mechanical damage. You should consider adverse environmental factors when working on equipment. For example, excessively damp or humid conditions will increase the risk of injury because of reduced effectiveness of insulation, which may undermine the effectiveness of devices used for isolation, or increase the severity should an electric shock occur. Equipment that has corroded may not function as intended.
6. Certified explosion-protected equipment must be used in places where there could be potentially explosive atmospheres, for example if there has been a leak of

flammable gas or build-up of combustible dust that could be ignited by an electric spark; more information is available in the Dangerous Substances and Explosive Atmospheres Regulations and, for offshore installations, the Offshore Correct selection and use of equipment Electricity at work: Health and Safety Executive Installations (Prevention of Fire and Explosion, and Emergency Response)

7. You must assess the situation before work is carried out on or near equipment. Working on equipment may result in removal of components and parts that provide protection for people against electric shock when the equipment is in normal use.

8. You should ensure safety by the careful design and selection of electrical equipment. For example:

■ Switch dis connectors should have a locking-off facility or other means of Securing them in the OFF position;

■ Circuits and equipment should be installed so that all sections of the system can be isolated as necessary;

■ switch dis-connectors should be suitably located and arranged so that circuits and equipment can be isolated without disconnecting other circuits that are required to continue in service;

8. Devices used for isolating circuits must be clearly marked to show their relationship to the equipment they control; unless there could be no doubt that this would be obvious to anyone who may need to operate them.

4.3Installing Location in which specific items of accessories, apparatus and circuits

a) Shall be located on the ceiling or on the front wall above the door of the closet unless mounted on the trim of the side walls of the doorway and approved for the application; and

b) shall not be of pendant type.

(1) Luminaries in damp or wet locations shall be approved for such locations and be so marked.

Self-Check -4	Written Test

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

1.flexible conduit is used for some purposes (3 points)

A. Light and recyclable C. Chemical resistance

B. Good price D. Wide range of fittings

E .All

2. Types of Basic Electrical Switches.(5 point)

A .SPST B. SPDT

C .DPST D. DPDT e. all

3.electrical fitting accessories.(2point)

A .lighting B. pvc electrical conduit

C .socket D. all

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

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Question

Information Sheet-5	**Location specific items of accessories, apparatus and circuits**

5.1 Introduction Location specific items of accessories

Accessories and *attachments* are associated articles for any component, equipment, system, or end-item, and which are not necessary for its operation, but which enhance its usefulness or effectiveness

a) Shall be located on the ceiling or on the front wall above the door of the closet unless mounted on the trim of the side walls of the doorway and approved for the application; and

b) shall not be of pendant type.

(1) Luminaries in damp or wet locations shall be approved for such locations and be so marked.

5.2 Location specific items of accessories, apparatus and circuits

Location specific items of accessories, apparatus and circuits for building electrical installation must be consider the following :-

- the materials used in electrical wiring installation
- brand is best for house wiring
- identify the best wire for house wiring
- determine electrical cable size
- the different materials used in electrical installation
- the advantages of conduit wiring
- ampacity of wire
- observeexamples of electrical supplies and materials

- the purpose of electrical materials etc...

5.2.1 What are 5 electrical safety tips?

5 electrical safety tips you should know for your home

- Replace or repair damaged power cords. Exposed wiring is a danger that cannot go overlooked, the NFPA wrote.
- Don't overload your outlets.
- Avoid extension cords as much as possible.
- Keep electrical equipment or outlets away from water.
- Protect small children from hazards.
- Put us to the test!

5.2.2 Electrical safety tips for kids

1. Never put fingers or other objects in an outlet.
2. Keep metal objects out of toasters.
3. Never use anything with a cord or plug around water.
4. Never pull a plug out by its cord.
5. Stay away from substations and power lines.
6. Don't climb on power poles.
7. Never fly kites near power lines.

The following NEC regulations apply to Romex conductors:

Wire Gauge or Type	**Rated Amperage**	**Common Uses**
14-2 Romex	15 A	Lighting Circuits
12-2 Romex	20 A	Lighting and Outlet Circuits,

		refrigerator
10-2 Romex	30 A	Electric water heater, baseboard heaters
10-3 Romex	30 A	Electric Clothes Dryer

fig 4.5 Location specific items of accessories, apparatus

Self-Check -5	Written Test

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

1. flexible conduit is used for some purposes(3 points)

   A. Light and recyclable C. Chemical resistance

   B. Good price D. Wide range of fittings

   E .All

2. How can obtaining fitting Accessories with established procedures?(5 point)

3. The 5 electrical safety tips(2point)

A .Avoid extension cords as much as possible.

B. Keep electrical equipment or outlets away from water.

C. Protect small children from hazards.

D .all

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

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-6	Obtaining Materials necessary to complete the work

6.1 Introduction of Electrical material

Electrical material are used of wire for protection and insulation these could be rigid metallic, flexible metallic conduit(FMC),rigid nonmetallic(PVC) and male plug, difference type of wire, switches ,sockets, lamps, bell etc..

6.2 Obtaining **Materials necessary to complete the work**

Work on or near live conductors should rarely be permitted. Many accidents to electricians occur when they are working on equipment that could have been isolated. In most cases, adequate planning and work programming will allow such jobs to be carried out as the Regulations required, that is with the equipment dead.

6.2.1 Method of Obtaining Materials necessary to complete the work

1. Correct selection and use of material

- ✓ material must be properly designed, constructed, installed and maintained so that it does not present a risk of electric shock, burns, fire or explosion when properly used..
- ✓ The main standard for low-voltage electrical installations is Requirements for electrical installations .It describes how systems and material can be designed, constructed and installed so that they can be used safely.
- ✓ Some old equipment that is still in use, including open-type switchboards and fuse boards used by electricity distributors and in industrial premises such as steelworks, is not designed or constructed to prevent people touching live conductors and suffering injuries from shock or burns.
- ✓ Some material operates at voltages that are so low that they can no cause a harmful electric shock but even at these extra-low voltages an

arc can occur, burns can result from overheated conductors, or an explosive atmosphere can be ignited.

- ✓ You must select equipment that is suitable for the environment in which it is used .
- ✓ Certified explosion-protected equipment must be used in places where there could be potentially explosive atmospheres,

2 .follow Material requirement planning(MRP)

Material Requirements Planning is one of the most underutilized and misunderstood modules in the modern business system. I went through three companies in a row where MRP was either not turned on (2) or not used (because it wasn't trusted). The gains when used correctly are mind-bogglingly massive.

The Main Five Steps Of MRP Process

1) Net Requirement Calculation
2) Lot-Size Procedures / Calculation
3) Procurement Types / Proposal
4) Scheduling
5) BOM Explosion

1) Net requirement calculation

- A comparison of firmed receipts & requirements takes place along time axis.
- If a material shortage occurs then the system calculates a net requirement.
- Available Qty is Stock-Safety Stock.

Net requirement = Total requirement - Avail Qty.

2) Lot size Procedures

There are 3 Lot sizing procedures in SAP R/3 Static, Periodic & Optimum lot sizing.

a) Static lot sizing
–Lot-to-lot order quantity
–Fixed lot size
–Replenish up to maximum stock level

b) Periodic lot sizing
–Daily lot size
–Weekly / Monthly lot sizing
–Flexible periods according to planning calendar

c) Optimum lot sizing
–Part period procedure
–Least unit cost procedure
–Gross reorder procedure
–Dynamic lot size creation
-Net requirements are used in lot size calculations to determine the quantities of the individual order proposals
-For period or optimum lot-sizing procedures, several net requirements are clubbed together in one order proposal.

-Lot sizes can be restricted by using options
-–Define maximum or minimum lot size
-–Rounding value functions

3) Procurement types

- Procurement types define whether a material is produced in-house or procured externally.
- All other types of procurement like stock transfer, sub-contracting, production in other

plant are carried out using special procurement key.
- Procurement key & special procurement key are available in MRP-2 screen of material master.

4) Scheduling

Backward Scheduling
- The goods receipt processing time specifies the number of workdays required by the stores person to check the material received & to place it in stock.
- In-house production time is calculated by adding lead time & the floats before & after production.
- The opening period represents the processing time required by the MRP controller for converting the planned orders.

Forward Scheduling
- The system schedules forward starting from the basic start date.
- "today" scheduling: The system carries out forward scheduling using the current date as a basic start date.

5) BOM explosion

- In BOM explosion, the system calculates the components or assemblies required for the appropriate BOM
- The key date for evaluation of the BOM (Explosion date) is the order finish date of the planned order
- Using the lead time offset in the BOM you can displace the dependent requirements date of a specific component.

Self-Check -6	Written Test

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

1. How can Obtaining Materials necessary to complete the work?

2 what is Electrical material?

3. The steps Of MRP Process are

A. Procurement types B. BOM explosion

C .Scheduling D. all

Score = _____

Rating: _____

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

Name: _____ Date: _____

Information Sheet-7	Obtaining tools, equipment and testing devices

7.1 Introduction of tools, equipment

Tools and equipment are two words that are often used synonymously, mainly due to the similarities of their meanings. A tool can be any item that is used to achieve a goal. Equipment usually denotes a set of tools that are used to achieve a specific objective

7.1.1Electrical tools

- Pliers. Pliers are a stable of any toolbox, but they're especially critical for electricians who regularly manipulate and cut wire. ...
- Screwdrivers.
- Tape Measure.
- Electric Drill.
- Level.
- Wire Strippers.
- Fish Tape.
- Voltage Tester.

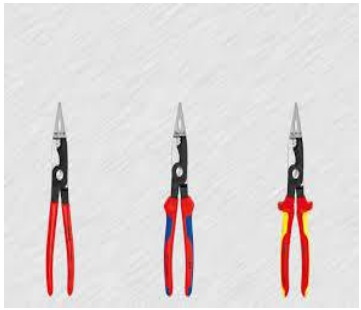


fig7.1 Wire Strippers

fig 5.2 Electrical tools

fig7.3 Electrical tools

7.1.2 Electrical equipment

Often electrical equipment refers only to components part of the electrical distribution system such as: ...

- Distribution boards.
- Circuit breakers
- Disconnects.
- Electricity meter

7.1.3Testingdevices

Testing devices should be tested regularly to ensure it provides the level of protection required. Testing intervals will depend on several factors including:

- the frequency of use
- the environment in which it is being
- manufacturer's advice.

For example, a multimeter used in a workshop environment may be subject to less damage that a multimeter carried in the back of a work van.

In absence of manufacturer's advice PCBUs should refer to a competent person with the knowledge and skills required for testing the particular type of equipment.

Items that have been misused or damaged should not be used until they have been re-retested and confirmed as functioning correctly.

Test equipment used for measurements such as earth continuity and insulation resistance should be regularly tested to confirm they are working correctly.

Some equipment such as multimeters may be able to be tested in-house, by using a calibrated resistor test block. Other equipment such as fault loop impedance testers or RCD testers may require specialist testing.

- **A multimeter**

The most basic things we measure are voltage and current and also great for some basic sanity checks and troubleshooting.

Parts of a Multimeter

- Display
- Selection Knob
- Ports

The display usually has four digits and the ability to display a negative sign. A few multimeters have illuminated displays for better viewing in low light situations.

The selection knob allows the user to set the multimeter to read different things such as milliamps (mA) of current, voltage (V) and resistance (Ω).

Two probes are plugged into two of the ports on the front of the unit. com stands for common and is almost always connected to Ground or '-' of a circuit. The **COM** probe is conventionally black but there is no difference between the red probe and black probe other than color. 10A is the special port used when measuring large currents (greater than 200mA). mAVΩ is the port that the red probe is conventionally plugged in to. This port allows the measurement of current (up to 200mA), voltage (V), and resistance (Ω). The probes have a *banana* type connector on the end that plugs into the multimeter. Any probe with a banana plug will work with this meter.

fig 7.4 multimeter

- ✓ **Measuring Voltage**

To start, let's measure voltage on a AA battery: Plug the black probe into **COM** and the red probe into **mAVΩ**. Set the multimeter to "2V" in the DC (direct current) range. Almost all portable electronics use direct current), not alternating current. Connect the black probe to the battery's ground or '-' and the red probe to power or '+'. Squeeze the probes with a little pressure against the positive and negative terminals of the AA battery. If you've got a fresh battery, you should see around 1.5V on the display (this battery is brand new, so its voltage is slightly higher than 1.5V).

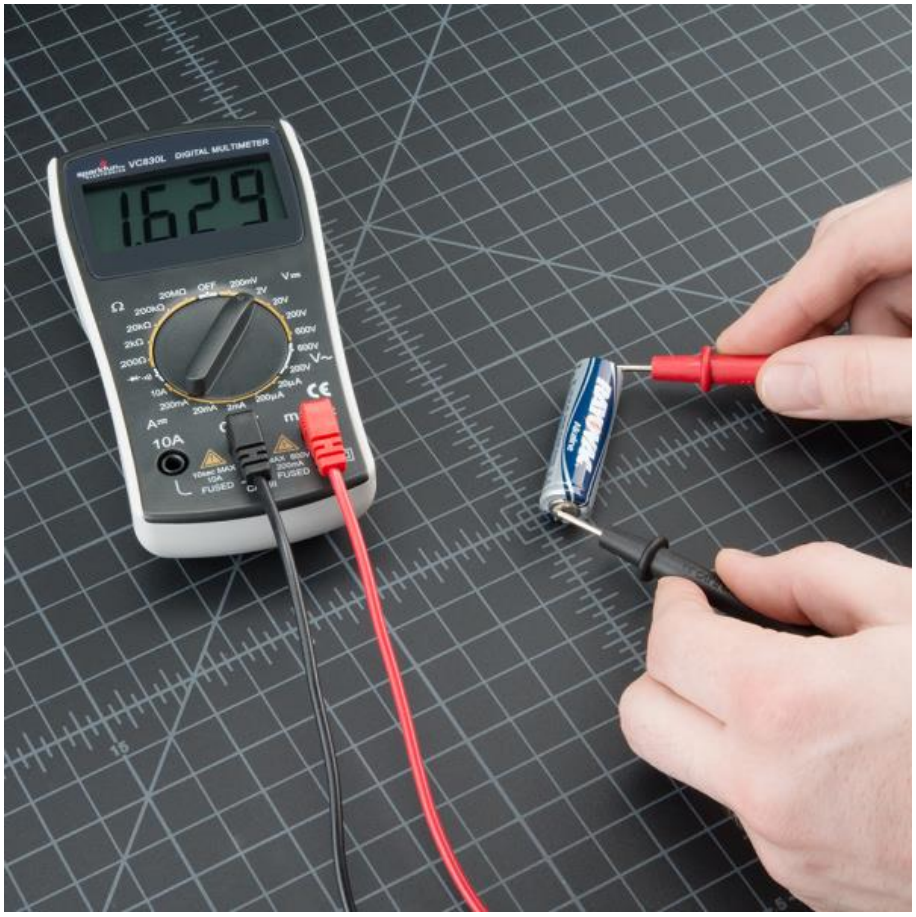


fig 7.5 Measuring Voltage

If you're measuring DC voltage (such as a battery or a sensor hooked up to an Arduino) you want to set the knob where the V has a straight line. AC voltage (like what comes out of the wall) can be dangerous, so we rarely need to use the AC voltage setting (the V with a wavy line next to it). If you're messing with AC, we recommend you get a non-contact tester rather than use a digital multimeter.

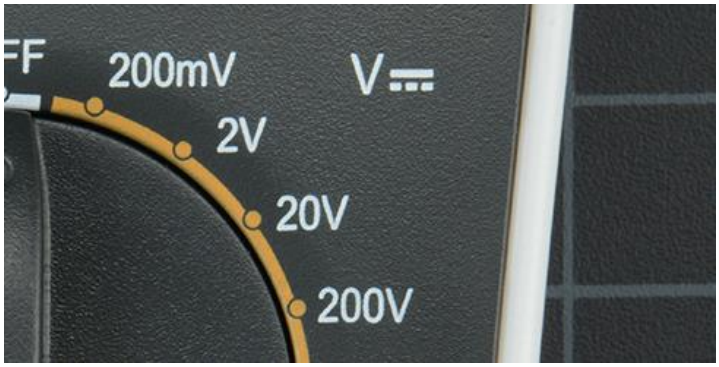


fig 7.6 Use the V with a straight line to measure DC Voltage

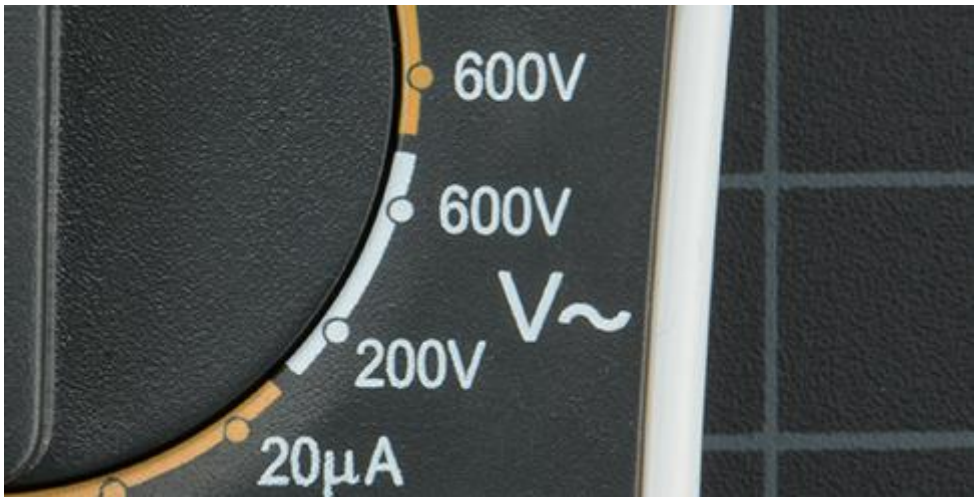


fig 7.7 Use the V with a straight line to measure AC Voltage

What happens if you switch the red and black probes? The reading on the multimeter is simply negative. Nothing bad happens! The multimeter measures voltage in relation to the common probe. How much voltage is there on the '+' of the battery compared to common or the negative pin? 1.5V. If we switch the probes, we define '+' as the common or zero point. How much voltage is there on the '-' of the battery compared to our new zero? -1.5V!

- ✓ **Overload**

What happens if you select a voltage setting that is too low for the voltage you're trying to measure? Nothing bad. The meter will simply display a 1. This is the meter trying to tell you that it is overloaded or out-of-range. Whatever you're trying to read is too much for that particular setting. Try changing the multimeter knob to a the next highest setting.

- ✓ **Measuring Current**

Reading current is one of the trickiest and most insightful readings in the world of embedded electronics. It's tricky because you have to measure current in series. Where voltage is measure by poking at VCC and GND (in parallel), to measure current you have to physically interrupt the flow of current and put the meter in-line. To demonstrate this, we'll use the same circuit we used in the measuring voltage section.

The first thing we'll need is an extra piece of wire. As mentioned, we'll need to physically interrupt the circuit to measure the current. Said another way, pull out the VCC wire going to the resistor, add a wire where that wire was connected, and then probe from the power pin on the power supply to the resistor. This effectively "breaks" power to the circuit. We then insert the multimeter in-line so that it can measure the current as it "flows" through to the multimeter into the bread board.

For these pictures, we cheated and used alligator clips. When measuring current, it's often good to watch what your system does over time, for a few seconds or minutes. While you might want to stand there and hold the probes to the system, sometimes it's easier to free up your hands. These alligator clip probes can come in handy. Note that almost all multimeters

have the same sized jacks (they're called "banana plugs") so if you're in a pinch, you can use your friend's probes.

Pick out a random resistor and set the multimeter to the 20kΩ setting. Then hold the probes against the resistor legs with the same amount of pressure you when pressing a key on a keyboard.

✓ Continuity

Continuity testing is the act of testing the resistance between two points. If there is very low resistance (less than a few Ωs), the two points are connected electrically, and a tone is emitted. If there is more than a few Ωs of resistance, than the circuit is open, and no tone is emitted. This test helps insure that connections are made correctly between two points. This test also helps us detect if two points are connected that should not be.

Continuity is quite possibly the single most important function for embedded hardware gurus. This feature allows us to test for conductivity of materials and to trace where electrical connections have been made or not made.

Set the multimeter to 'Continuity' mode. It may vary among DMMs, but look for a diode symbol with propagation waves around it (like sound coming from a speaker).

fig 7.8 Continuity testing

When a system is not working, continuity is one more thing to help troubleshoot the system. Here are the steps to take:

1. If the system is on, carefully check VCC and GND with the voltage setting to make sure the voltage is the correct level. If the 5V system is running at 4.2V check your regulator carefully, it could be very hot indicating the system is pulling too much current.
2. Power the system down and check continuity between VCC and GND. If there is continuity (if you hear a beep), then you've got a short somewhere.
3. Power the system down. With continuity, check that VCC and GND are correctly wired to the pins on the microcontroller and other devices. The system may be powering up, but the individual ICs may be wired wrong.

Assuming you can get the microcontroller running, set the multimeter aside, and move on to serial debugging or use a logic analyzer to inspect the digital signals

fig 7.9 testing circuit

- **Megger**

Megger is a portable instrument which is used to measure insulation resistance of the electrical machinery or system. It can be battery operated or mechanically operated (hand crank dc generator) and gives a direct reading in ohms. For this reason, it is also called as ohm meter. Onboard ship, different systems are present with large voltage ratings and therefore Megger comes in the range of 50, 500, 1000, 2500, and 5000 V, thereby making megger meter suitable for applications on normal voltage equipment to more demanding high-voltage applications.

Working OfMegger

The voltage for testing is supplied by a hand generator incorporated in the instrument or by battery or electronic voltage charger. It is usually 250V or 500V and is smaller in size.

- A test volt of 500V D.C is suitable for testing ship's equipment operating at 440V A.C. Test voltage of 1000V to 5000V is used onboard for high voltage system onboard.
- The current carrying coil (deflecting coil) is connected in series and carries the current taken by the circuit under test. The pressure coil (control coil) is connected across the circuit.
- Current limiting resistor – CCR and PCR are connected in series with pressure and current coil to prevent damage in case of low resistance in the external source.
- In hand generator, the armature is moving in the field of a permanent magnet or vice versa, to generate a test voltage by electromagnetic induction effect.

With an increase of potential voltage across the external circuit, the deflection of the pointer increases; and with an increase of current, the deflection of pointe

- **VOLTAGE TESTER**

Is often used by the electrician to measure approximate circuit operating voltages. Its rugged construction makes it ideally suited for rough on-the-job handling

fig 8.0 voltage tester

- **CLIP-ON AMMETER**

It is sometimes called “clamp-on” is used to measure current without any direct electrical contact with the circuit

fig8.1 clip-on ammeter

- **NEON TEST LIGHT**

Is an inexpensive device that can be used by the homeowner to indicate the presence of a voltage.

fig8.2 neon test light

- **LOGIC PROBE**

Is designed for quick checking and servicing of digital circuits. It visually displays the presence of correct logic levels by illumination of colored readouts

8.3 logic probe

- ***Phase Tester***

illustrates a phase tester, which doubles as a small terminal screwdriver. It is a very useful tool when checking if a circuit is “live” or not. It is very important to ensure that it is not used in a damp or wet condition. When in use, current flows through the body of the user. Dampness may increase this operating current to a dangerous level.

fig 8.4 testing device

Self-Check -7	Written Test

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

1.Which of the following Personal protective equipment (PPE) (3point)

A. Face Protection B. Eye Protection

C. Gloves D.ALL

2. Type of tools(3point).

A. Tape Measure B. Screwdrivers

C. Electric Drill D. all.

3. Type of equipment(2point)

A .Distribution boards B**.** disconnects C. Circuit breakers

D. all.

4._____is used to measure current without any direct electrical 4.contact with the circuit (2point)

A. clamp-on B. voltage tester C. neon test light D. none

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

You can ask you teacher for the copy of the correct answers.

Information Sheet-8	**checking Preparatory work to ensure no unnecessary damage**

8.1 check wiring in your home

Most construction trades have an acceptable fudge factor. A few trim joints could be tighter, some of the painting neater, a stair tread less squeaky.

Even new houses come with parts that are not quite right but considered close enough — except for the wiring.

There's no acceptable allowance for a switch or an outlet that almost always works. Because of the dangers from electrical shock and fire, wiring is the most closely controlled construction trade. It's zero tolerance, and why we expect the systems to work correctly all the time. The electrical system does have some weak links long term. But before you check into those problems, the first step in many homes is to sort out the circuits so you know where to look.

- The following are to check the electrical circuit

8. 1 .1 Tracking circuits

Breakers in the main panel should line up logically, room by room, and be neatly labeled. More often, and particularly in renovated homes, circuits are a confusing maze. Half the kitchen is on the No. 1 breaker and the other half is on No. 12. Improvements and additions over the years can create a jumble.

To sort it out, you could work with a partner: Try a lamp or radio in outlet after outlet, flip different breakers and shout back and forth about what's on and what's off. That trial-and-error approach takes a long time, may produce some errors and you'll have to reset the cable box, clocks.

8.1.2 Overloading

Once you have the layout pinned down, check these signs to see if your wiring system is overloaded, deteriorating or too old to be as safe as it should be. There are three giveaways:

Several duplex outlets (space for two plugs) have adapters connected to more than two plugs.

The system has permanent extension cords.

To keep the circuit breaker from tripping, you have to unplug something to run something else.

These conditions indicate that you need more outlets, maybe a new circuit and possibly a larger service, which is a major project that brings more power from the street to the main breaker panel.

fig 8.1 common hosehold electricity problem

8.1.3 Age **and condition**

The safety threshold for typical household wiring is about 40 years. Some wiring lasts longer, but with increased risks.

Warning signs include any damage to the wire insulation, most often cracking caused by brittleness. That problem usually surfaces first in an unconditioned area of the house like a cold crawl space or an attic where temperatures soar in the summer. Wire leads are stripped of insulation where they attach to outlets and switches. But those locations are

shielded by boxes mounted inside the wall. Exposed metal wiring anywhere else is dangerous**.**

8.2 checking of the system

Test instruments, tools, testing equipment and PPE for testing and fault finding must be suitable for the work, properly tested and maintained in good working order. Workers carrying out electrical testing must be appropriately trained and competent in test procedures.

8.2.1 Personal protective equipment (PPE)

PPE for electrical work, including testing and fault finding, must be suitable for the work, properly tested and maintained in good working order. The PPE must be able to withstand the energy at the point of work when working energized. Training must be provided in how to select and fit the correct type of equipment, as well as training on the use and care of the equipment so that it works effectively. Depending on the type of work and the risks involved, the following PPE should be considered:

- Face Protection—use of a suitably arc rated full face shield may be appropriate when working where there is potential for high current and arcing.
- Eye Protection—metal spectacle frames should not be worn.
- Gloves—use gloves insulated to the highest potential voltage expected for the work being undertaken. Leather work gloves may be considered for de-energized electrical work.
- Clothing—use non-synthetic clothing of non-fusible material and flame resistant. Clothing made from conductive material or containing metal threads should not be worn.
- Footwear—use non-conductive footwear, for example steel toe capped boots or shoes manufactured to a suitable standard.

- Safety Belt/Harness—safety belts and harnesses should be checked and inspected each time before use with particular attention being paid to buckles, rings, hooks, clips and webbing

8.2.2**HIGH VOLTAGE ELECTRICAL WORK**

Requirements for electrical work on high voltage equipment after switching, isolation, short circuiting and earthling are specialized requirements. Only competent electrical workers who have received appropriate training in high voltage electrical work are permitted to work on high-voltage electrical equipment. For more information you should seek further advice about working on or near high-voltage electrical installations from a specialist electrical contractor or the local electricity entity. Additional risks associated with high voltage The electrical risks and consequences of an electrical incident involving high voltage may be significantly higher than low voltage. Under fault conditions, the higher voltages (potentials) and fault current levels release massive quantities of energy. These risks must be effectively managed. Planning for high voltage installation work Persons conducting a business or undertaking who have a high voltage electrical installation should prepare an Installation Safety Management Plan for their workplace. The plan should address the risks associated with the operation and maintenance of the high voltage installation. This may include:

- a single line diagram for the installation, showing all switches and circuit breakers and their identifying labels or numbers
- site-specific operating rules covering all aspects of operating the high voltage installation, including procedures for arranging isolation of the installation from the local electricity network
- procedures for identifying hazardous areas including any confined spaces associated with the installation

- competency requirements for persons who may be permitted to operate or work on the high voltage installation, including appropriate requirements for re-training, re-testing and re- accreditation
- induction procedures for new contractors
- regular inspection and maintenance programs to ensure the installation remains serviceable and safe
- procedures for ensuring there is no extension or alteration of the installation without permission from the local electricity entity
- procedures for the safe handling of insulating oils and other substances that may be required for maintenance or repair
- procedures including warning signs for ensuring that all parts of the high voltage installation (e.g. underground cables and high voltage overhead power lines) are not damaged by heavy vehicles or other mobile plant, for example mobile cranes.

You can use either a current tester or a voltage meter to determine if an electrical cable is hot. Keep in mind that it is possible for more than one wire to be live. Touch the tip of the meter or tester to the screw where the wires are attached. Go slowly and keep your eyes and ears open. A person conducting a business or undertaking (PCBU) who carries out electrical work must ensure the electrical safety of all persons and property likely to be affected by the electrical work.

A PCBU must have procedures in place to ensure that tools, testing equipment and personal protective equipment are regularly inspected and tested.

This requirement ensures that workers carrying out the work are electrically safe and that the work, when completed, is electrically safe.

Only a person appointed as competent by their employer can test and tag electrical equipment.

Competence is based on knowledge and skills gained from training, experience, qualifications or a combination of these. It is an offence under the *Electrical Safety Act 2002* to repair electrical equipment unless you have the appropriate electrical work license.

High voltage cable fault testing and diagnostics

High voltage cable testing is practically synonymous with informed life management of an asset owner's cable infrastructure. A consistent regimen of analysis and reporting significantly improves a utility's reliability indices. Megger offers cable testing solutions for cable fault location and cable diagnostics, as a packaged cable test van and for telecom/catacomb assessment.

Cable-fault-location

Complete the steps of the fault location process quickly and safely to minimize downtime for the customer.

Cable-diagnostics

Access all of the information needed to make informed cable management decisions through the stages of the cable’s use.

Cable-test-vans

Streamline your on-site condition assessment of cables with a test van equipped with a selection of instruments.

Circuit breaker analyses and test systems

Circuit Breakers are the metaphorical “safety-valves” of electrical systems; a means of giving harmless vent to excessive energy in a circuit, thereby minimizing the risk of damage to equipment that would otherwise be subjected to non-design conditions. Various power system components depend on the proper operation of a circuit breaker including, for example, expensive power transformers (e.g., in the case of HV and MV circuit breakers) or critical processes in a nuclear power plant (as in the case of LV molded case breakers).

Testing provides assurances that a circuit breaker will operate and, moreover, will act within expected tolerances. Testing also informs circuit breaker maintenance decisions so that

maintenance dollars are spent most wisely and stretch further. Maintenance, of course, is essential to maintain maximum reliability of a circuit breaker.

Confidence in test conclusions

Accurate and well-organized testing maximizes confidence in testing conclusions by facilitating a meaningful comparison to previous/ benchmark test results. Tests must be conducted in exactly the same way and under the same conditions as previous tests to validate a comparison. Deviations and changes then reliably indicate whether the circuit breaker should be kept in operation or taken out of service for further investigation.

Analytical tools for historical trending and comparison of measurements contribute to efficient testing and boost confidence in testing conclusions as well. These are all hallmarks of Merger's circuit breaker testing solutions such as the TM1700 and TM1800 test instruments, the EGIL test set, and CABA Win software program.

Who can test electrical equipment?

Only a person appointed as competent by their employer can test and tag electrical equipment.

Competence is based on knowledge and skills gained from training, experience, qualifications or a combination of these. It is an offence under to repair electrical equipment unless you have the appropriate electrical work license.

fig 8.2 test electrical equipment

Self-Check -8	**Written Test**

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

1 check wiring in your home(3point)

A. Tracking circuits B. Age and condition

C. Overloading D.ALL

2. Personal protective equipment (PPE)(3point)

A. rigid metallic B. rigid non metallic

C. Flexible metallic D .all

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

You can ask you teacher for the copy of the correct answers.

Operation Sheet 1	Plan and Prepare installation

PURPOSE: To enable trainees develop skill how to plane the project and how to preparing installation the requirement of project

PROCEDURE:

step1 Apply safety rule.
step2 select tools, material and equipment
step3 check tools, material and equipment
step4 placing of tools, material and equipment
step5 Check the out put

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 8-10 hours.

Instructions: Given necessary templates/guides, workshop, tools and materials you are required to perform the following tasks within 2:30 hours.

Task1: Installation is planned and prepared to ensure OH&S policies and procedures are followed,

Task 2: Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site

Task 3: Location in which specific items of accessories, apparatus and circuits are to be installed is determined from job requirements

List of Reference Materials

1. AN INTRODUCTION TO COMMUNITY ASSET MAPPING. Available on: https://www.countyofsb.org/ceo/asset.c/400
2. Community Asset Mapping. Available on: http://www.sustainablejersey.com/actions certification/actions/?type=1336777436&tx_sjcert_action%5BactionObject%5D=90&tx_sjcert_action%5Baction%5D=getPDF&tx_sjcert_action%5Bcontroller%5D=Action&cHash=d8896df5ca9909fc37fd61db1c3b38da
3. Community Needs Assessment. Available on: https://www.cdc.gov/globalhealth/healthprotection/fetp/training_modules/15/community-needs_pw_final_9252013.pdf

Ethiopian TVET-System

TTLM

BUILDING ELECTRICAL INSTALLATION

LEVEL II

Learning Guide-#2

Unit of Competence: Install and Terminate Wiring System

Module Title: Installing and Terminating Wiring System

LG Code: EISBEI2 M07 LO2-LG-24

TTLM Code: EIS BEI2 M07 TTLM 0919v1

LO 2: Perform installation and termination of wiring

Instruction Sheet	Learning Guide #2

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

- Following OH&S policies and procedures for installing electrical wiring systems
- Installing Wiring systems
- Terminating and connecting accessories
- Responding to unplanned events or conditions
- Obtaining approval from appropriate personnel

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**:

- Follow OH&S policies and procedures for installing electrical wiring systems
- Install Wiring systems
- Terminate and connect accessories
- Respond to unplanned events or conditions
- Obtain approval from appropriate personnel

Learning Instructions:

7. Read the specific objectives of this Learning Guide.
8. Follow the instructions described below 3 to 6.
9. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3,sheet4 and Sheet 5”.
10. Accomplish the “Self-check 1, Self-check 2, Self-check 3,self-check4 and Self-check ” **in page -64,72, ,95,98,and102**respectively.
11. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, and Operation Sheet 2” **in page -103and 105.**
12. Do the “LAP test” **in page – 106** (if you are ready).

Information Sheet-1	Following OH&S policies and procedures for installing electrical wiring systems

1.1 The OH&S policies and procedures for installing electrical wiring systems

1. OHS Policies and Procedures for Installation Activity in Accordance with Requirements Procedures, Correct Operation and Safety on equipment / Devices/Systems
2. Consulting Appropriate/Technical Personnel to Ensure That Work is Coordinated with Others Who are Involved in the Activity.
3. Determining the Location of the Devices/Systems to be used
4. Obtaining Materials Necessary to Complete the Work in Accordance with Established Procedures
5. Checking of Materials Received Against Job Requirements
6. OHS Procedures in Installing Devices, Systems, and Peripherals

7Complying with the Requirements in Installing Devices/Systems, and Peripherals

8 Installing wiring system and Peripherals in Accordance with Job Requirements

9.Performing Variations in Installing Devices and Systems in Accordance with Customer/Client's Requirements OHS Procedures in Installing Devices, Systems, and Peripherals

10. Complying with the Requirements in Installing Devices/Systems, and Peripherals

11. Installing wiring system and Peripherals in Accordance with Job Requirements

12. Performing Variations in Installing Devices and Systems in Accordance with Customer/Client's Requirements

13. Obtaining Approval from Appropriate Personnel before Implementing Contingency Procedures

14. Responding to Unplanned Events or Conditions in Accordance to Established Procedures

15. Checking the Quality of the Work Undertaken in Accordance with the Established Procedures

16. OHS Policies and Procedures in Conducting Tests.

17. Checking Circuits and Systems Being Isolated Using Specified Testing Procedures.

18. Testing Devices, Systems and/or Installation to Determine its Conformity with the Requirements

19. Conducting Final Inspections on the Installed Devices, Systems to Ensure Conformity with the Requirement.

20. Accomplishing Technical Reports on the Tests Conducted.

21. Procedures in Forwarding Documentation to Appropriate Personnel and/or Authority on the Test Conducted

1.2 When Following OH&S policies and procedures for installing electrical wiring systems?

- WARNING: When using electric products, basic precautions should always be taken, including the following. This manual contains instructions that shall be followed during installation, operation and maintenance of the unit.
- For permanently connected (hardwired) charging stations, Charge Point Home must be installed by a qualified electrician and in accordance with all local electrical codes and ordinances. Read all instructions before installing and using Home.
- All documents can also be found online at chargepoint.com/home. Adult supervision is required when using Home near children
- . Do not operate your Home if there is visible damage to the unit or charging cord. Call Charge Point customer support immediately .
- Do not put fingers into the charging connector.
- Do not install Home near flammable, explosive, or combustible materials.
- Do not operate Home in temperatures outside its operating range of -22˚F to 122˚F (-30˚C to 50˚C). Other than the charging cord, Home contains no user serviceable parts.
- Do not attempt to repair or service any other part of the unit yourself. If the unit requires servicing, contact Charge Point, Inc. Ensure that the Home charging cord is positioned so it will not be stepped on, tripped over, or subjected to damage or stress. Do not close a garage door on the charging cord

Self-Check -1	Written Test

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

1. What is the important of Follow OH&S policies and procedures.(3 points)
2. Explain the OH&S policies and procedures?(3 point)
3. OHS Procedures in Installing(4 point)

A. Devices B. Peripherals

C .Systems. D. all

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

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet- 2	Installing Wiring systems

2.1 Introduction Electrical Installation

Electrical Installation An assembly of associated electrical equipment, to fulfill a specific purpose or purposes and having co-ordinate characteristics.

Before any wiring system is installed account must be taken of environment in which system is operate.

- Commercial
- Residential
- Industrial

There are many influences that may contribute to the final design of the installation.

All materials used for electrical installation purpose should comply with international and local Standards

IEC (InternationalElectrotechnicalCommission)

EBCS(EthiopianBuildingcodestandard)

2.1.1 Electrical wiring

Electrical wringing general refers to insulated conductors used to carry electricity, and associated devices. This article describes general aspects of electrical wiring as used to provide power in buildings and structures, commonly referred to as building wiring.

2.1.2 Wiring safety codes

are intended to protect people and property from electrical shock and fire hazards. Regulations may be established by city, county, provincial/state or national legislation, usually by adopting a model code (with or without local amendments) produced by a technical standards-setting organization, or by a national standard electrical code.

Electrical codes arose in the 1880s with the commercial introduction of electrical power. Many conflicting standards existed for the selection of wire sizes and other design rules for

electrical installations. The first electrical codes in the United States originated in New York in 1881 to regulate installations of electric lighting. Since 1897 the US National Fire Protection Association, a private non-profit association formed by insurance companies, has published the **(**EBCS)States, counties or cities often include the NEC in their local building codes by reference along with local differences. The NEC is modified every three years. It is a consensus code considering suggestions from interested parties. The proposals are studied by committees of engineers, tradesmen, manufacturer representatives, fire fighters, and other invitees.

Since 1927, the Canadian Standards Association (CSA) has produced the Canadian *Safety Standard for Electrical Installations*, which is the basis for provincial electrical codes. The CSA also produces the Canadian Electrical Code, the 2006 edition of which references IEC60364 (*Electrical Installations for Buildings*) and states that the code addresses the fundamental principles of electrical protection in Section 131. The Canadian code reprints Chapter 13 of IEC 60364, but there are no numerical criteria listed in that chapter to assess the adequacy of any electrical installation.

Although the US and Canadian national standards deal with the same physical phenomena and broadly similar objectives, they differ occasionally in technical detail. As part of the North American Free Trade Agreement (NAFTA) program, US and Canadian standards are slowly converging toward each other, in a process known as harmonization.

In European countries, an attempt has been made to harmonize national wiring standards in an IEC standard, IEC 60364*Electrical Installations for Buildings*. Hence national standards follow an identical system of sections and chapters. However, this standard is not written in such language that it can readily be adopted as a national wiring code. Neither is it designed for field use by electrical tradesmen and inspectors for testing compliance with national wiring standards. By contrast, national codes, such as the NEC or CSA C22.1, generally exemplify the common objectives of IEC 60364, but provide specific rules in a form that allows for guidance of those installing and inspecting electrical systems.

In Germany, DKE (the German Commission for Electrical, Electronic and Information Technologies of DIN and VDE) is the organization responsible for the promulgation of electrical standards and safety specifications. DIN VDE 0100 is the German wiring regulations document harmonized with IEC 60364.

In the United Kingdom, wiring installations are regulated by the Institution of Engineering and Technology *Requirements for Electrical Installations: IEE Wiring Regulations, BS 7671:: 2008,* which are harmonized with IEC 60364. The 17th edition (issued in January 2008) includes new sections for micro generation and solar photovoltaic systems The first edition was published in 1882.

In Australia and New Zealand, the AS/NZS 3000 standard, commonly known as the "wiring rules", specifies requirements for the selection and installation of electrical equipment, and the design and testing of such installations. The standard is mandatory in both New Zealand and Australia; therefore, all electrical work covered by the standard must comply.

The international standard wire sizes are given in the IEC 60228 standard of the International Electro technical Commission. In North America and Philippines, the American Wire Gauge standard for wire sizes is used.

Color code

An electrical "3G" power cable found commonly in modern European houses. The cable consists of 3 wires (2 wires + 1 grounding in case if cable has "3G" name) and is double-insulated.

To enable wires to be easily and safely identified, all common wiring safety codes mandate a colour scheme for the insulation on power conductors. In a typical electrical code, some color coding is mandatory, while some may be optional. Many local rules and exceptions exist. Older installations vary in color codes, and colors may shift with insulation exposure to heat, light, and ageing.

Many electrical codes now recognize (or even require) the use of wire covered with green insulation, additionally marked with a prominent yellow stripe, for safety grounding (earthling) connections. This growing EBCS was adopted for its distinctive appearance, to reduce the likelihood of dangerous confusion of safety grounding wires with other electrical functions, especially by persons affected by red-green color blindness. Standard color code for grounding or earth ground is shown below

Wires: Unless otherwise specified all wires shall be PVC insulated single core, stranded copper conductor conforming to BS 6004. All wires shall be colored as follows:

1. Phase : Red, Yellow, Blue Color of wire

2.Neutral: Black Color of wire

2. Ground: Yellow Green or Green (One color only to be used for the complete Installation).

Figure 2 - Green/Yellow color - coded wire for grounding (earthing)

Switches

Does it matter which wire goes where on a light switch?

The white (neutral) **wire** connects to the silver screw, or you place it in the back **wire** hole on the same side of the device as the silver screw. ... This **wire** is sometimes red. The green or

bare copper (ground) **wire**, if the device has one, attaches to the green screw terminal on the **switch** or to the electrical box.

Single Switch

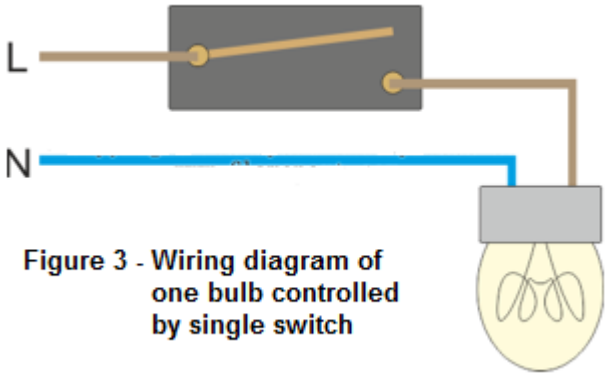


Figure 3 - Wiring diagram of one bulb controlled by single switch

Three-way Switch

Three-way switches are useful in large rooms, hallways or staircases where a light can be controlled from multiple positions. For instance, a three-way switch can control a light in a stairwell from both the top and bottom positions on the stairs.

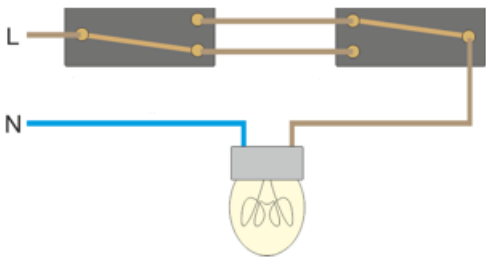


Figure 4 - Wiring diagram of one bulb controlled by 2 three-way switch.

A three-way switch is part of a circuit involving an electrical fixture, be it a light or fan, and two switches. The switch itself has three posts to connect wires. One is for the electrical

current and the other two are for control, or traveler wires. One wire provides current to the fixture. The other wire works in conjunction with the second switch to control whether the light can be turned on or off.

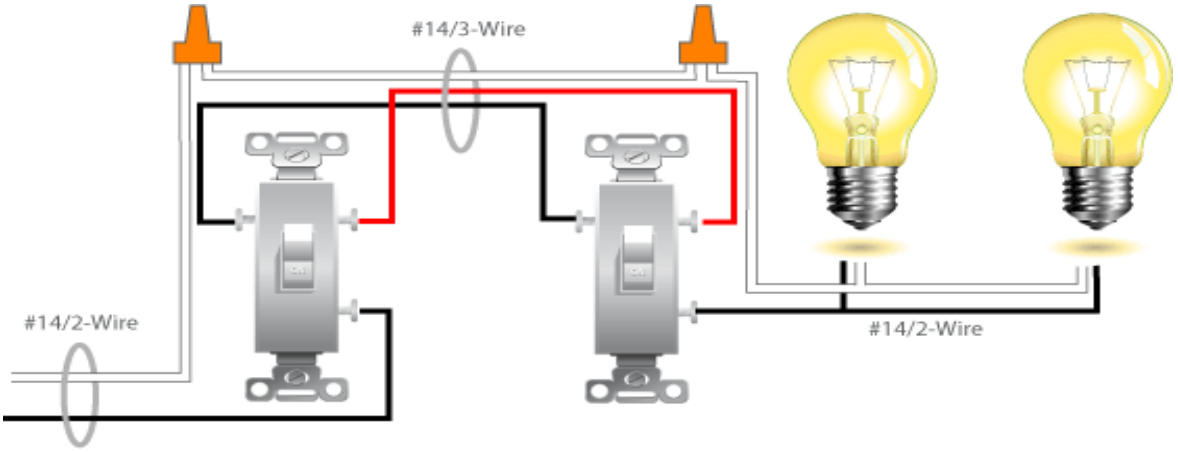


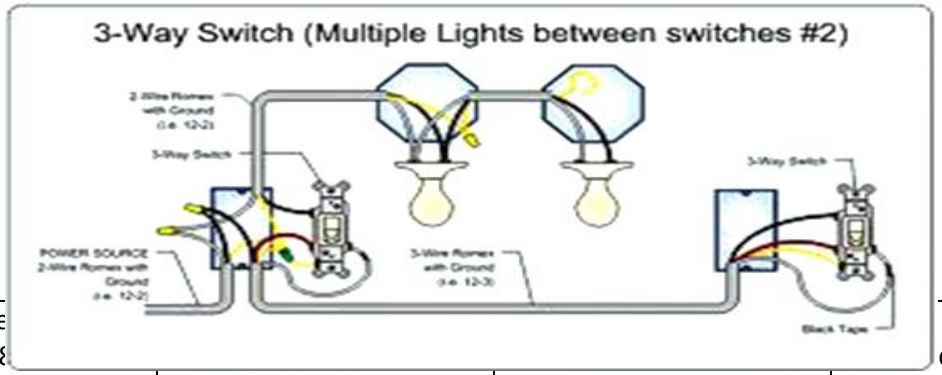
Figure 5 – Wiring diagram of two bulbs controlled by two three-way switches

The basic design of the three-way circuit is that one traveler wires connect to each switch and the other.

traveler links to the fixture. Each switch must be grounded and only one switch needs a wire carrying a

current. The second switch does not need a current and can be tied off to the box

Figure 6 – Wiring connection of two three-way switches and two bulbs on the



junction and utility boxes

4-way switch

L_1

L_2

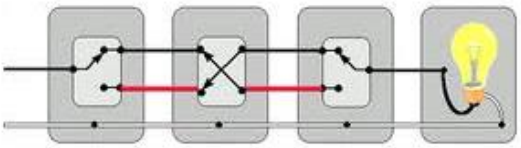


Figure 7 - Schematic Diagram of one bulb controlled in 3 location

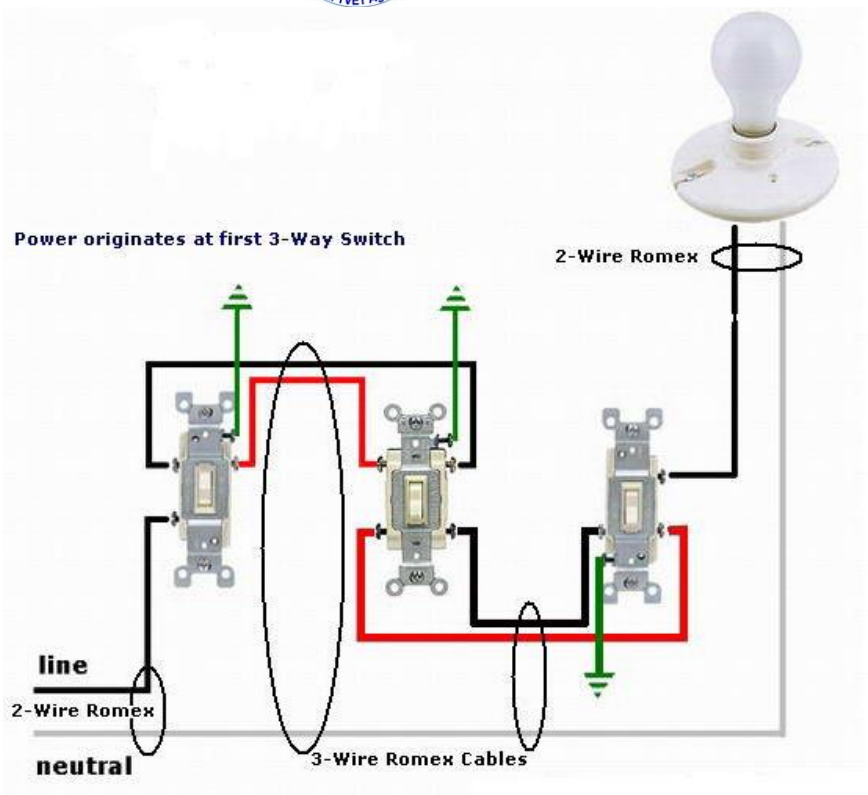


Figure 8a – Wiring diagram of one bulb controlled by two three-way switches and one 4-way switch.

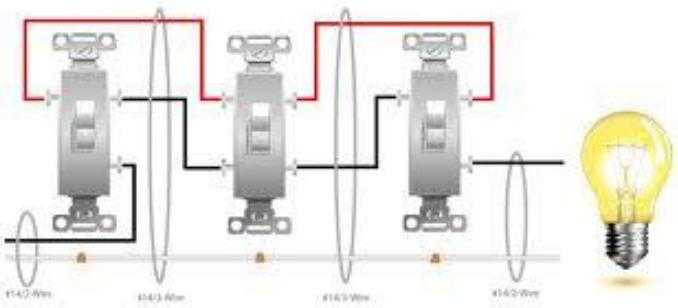


Figure 8b – Wiring diagram of one bulb controlled by two

three-way switches and one 4-way switch.

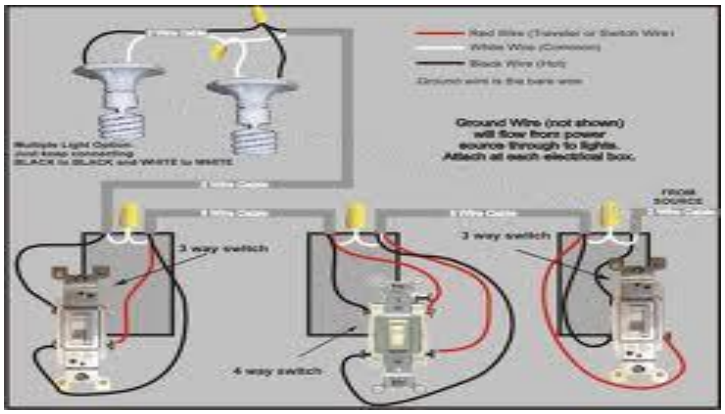


Figure 9 – Wiring connection of two bulbs controlled by two 3-way switches and one 4-way switch on the junction and utility boxes

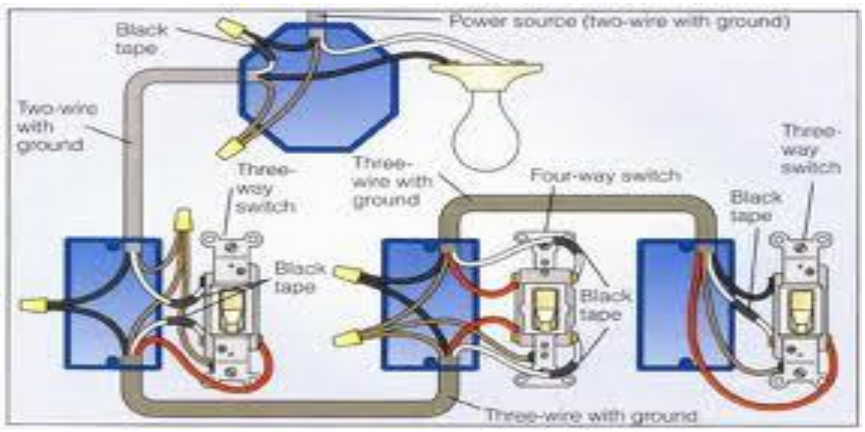


Figure 10 – Wiring connection of two bulbs controlled by two 3-way switches and one 4-way switch on the junction and utility boxes

four way switches have four terminals. This switch works in combination with two three-way switches to control electricity to lights and receptacles from three locations. All of the four terminals are brass colour. They support hot conductors (traveller wires), which receive and

transfer electricity from each of the three-way switches. The toggle on a four-way switch is NOT marked "OFF" and "ON". These markings are the only way to tell the difference between it and a double-pole switch, which is labelled "OFF" and "ON."

It is advisable to use No. 12 wire for residential, indoor wiring. No. 14 wire is acceptable if the circuit is protected at 15 amperes. (Canadian and Philippine code requires the use of #14 wire for interior application.

Self-Check -2	Written Test

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

1. Policies intended to protect people and property from electrical shock and fire hazards(3 point)
    a. Wiring Safety Codes
    b. Electrical Standard
    c. International Standard
    d. Building Construction Code

2. A connection of insulated conductors used to carry electricity and associated electrical devices.(5 point)
    a. Wire connection
    b. Electrical wiring
    c. Residential House wiring
    d. Building Wiring

3. Green/yellow color-coded wire for grounding (earthling).(2 point)
    a. Green
    b. Yellow
    c. Green/yellow
    d. White

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

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Terminating and connecting accessories

3.1 Introduction of termination

A termination is a connector or other treatment at the end of a wire. This can be at a piece or equipment a terminal block or a patch panel.

3.1.1 Terminating Techniques

There are a variety of methods used to terminate conductors.

- **Screw Terminal**

One of the most common types is the screw terminal. Regardless of the type of terminal used it is important that the joint between the conductor and the terminal is electrically and mechanically sound, without putting undue pressure on the conductor or the terminal.

Figure 3.1 shows a termination made off correctly.

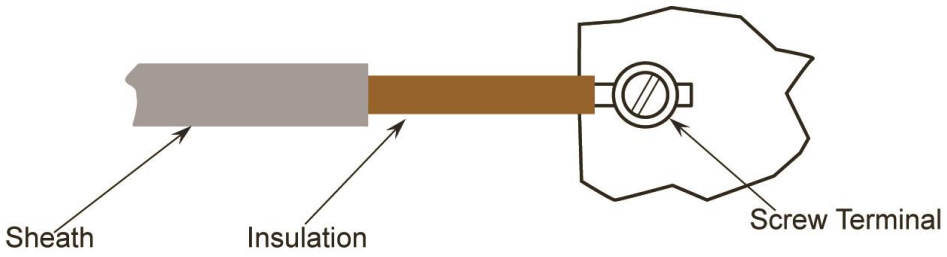
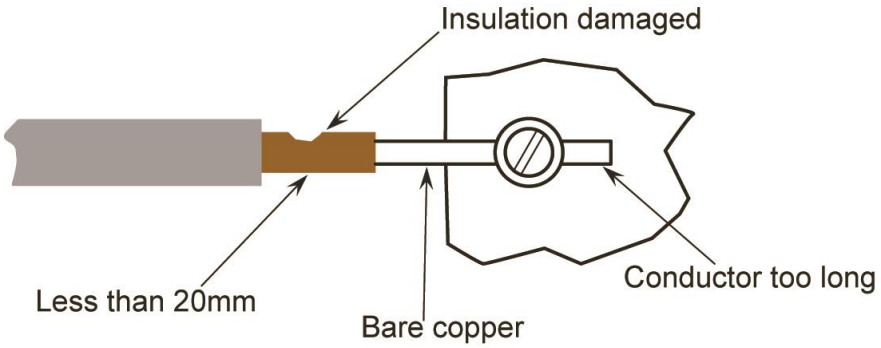


Figure 3.2 shows a termination made off incorrectly



If the conductor is small in relation to the terminal, the conductor must be doubled back fully, neatly on itself.

See Figure 3.3for a correct termination.

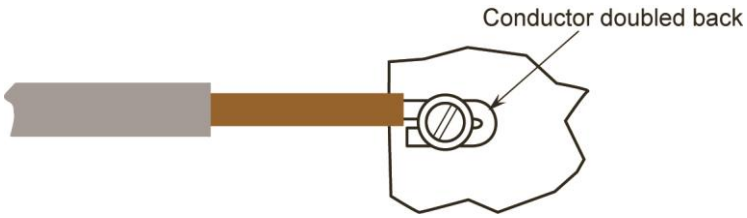
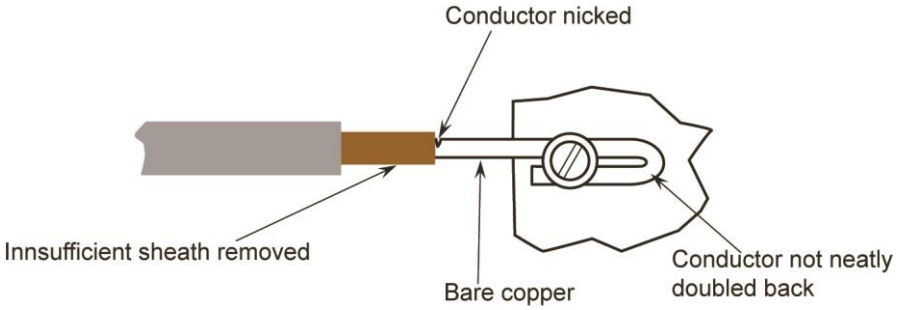
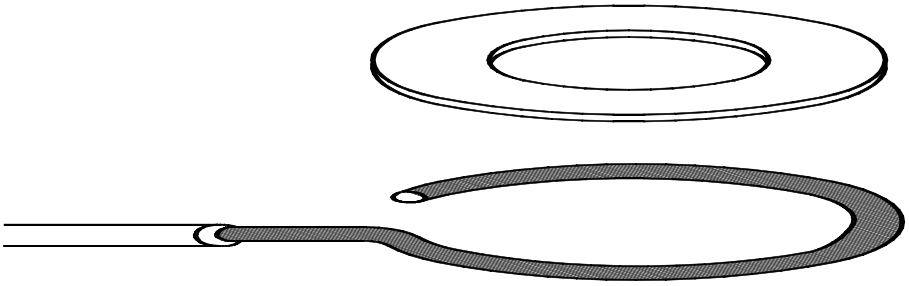


Figure 3.4 shows an incorrect termination.



- ***Screw Head and Nut and Washer Terminals***

When terminating conductors under screw-heads or nuts, it is best to form the conductor into an eye, using round nose pliers. The eye should be slightly larger than the screw diameter, but smaller than the outside diameter of the screw head, nut or washer



- ***Clamp Type Terminal***

These terminals are used in a similar manner to the screw type terminal. They provide heavier clamping, generally for terminating larger conductors. The clamping plate may be ribbed in order to put small indents into the conductor to provide better electrical and mechanical contact.

3.1.2 Criteria for Good Terminations

Every cable termination should be completed and checked using the following headings.

- Solid Conductors – doubled back where possible.
- Stranded and Flexible Conductors – all strands twisted neatly together in the right direction, and doubled back where possible. – all strands present and clamped.
- No damage to conductor e.g. nicked while stripping insulation.
- No damage to insulation e.g. nicked while stripping sheath or pulling in cables.

- Insulation not clamped.
- Conductor insulated right up to the metal of the terminal (no bare copper).
- Sufficient slack available on cable.
- Cable arranged neatly and not fouling moving parts or covers.
- No makeshift terminals used.
- Terminal screw tightened sufficiently

- **Terminals, Clamps and Lugs**

There are a wide variety of conductor terminals. Typical types are as shown in Figure 9.

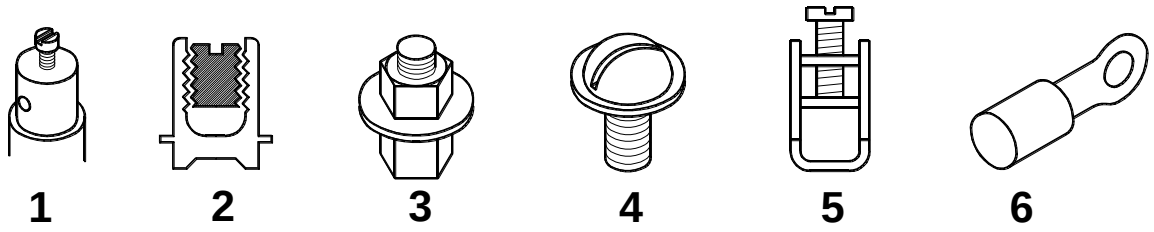


Figure 3.5 Terminals, Clamps and Lugs

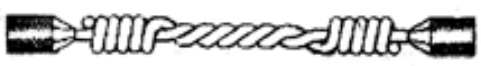
1. The screw terminal will be found in various accessories such as, lampholders, battenholders and plugtops used in domestic premises. A shrouded version of this terminal is probably the most commonly used type. It will be found in switches, sockets, ceiling roses and consumer units.
2. The split terminal will be used in joint boxes to enable joints to be made without having to cut conductors.
3. The post terminal will be used mainly to make connections to earth and also in such places as the mains connection to an electric cooker or an electric motor.
4. The screwhead terminal will also be mainly used to make connections to earth, and is also very popular in older fuseboards.

5. The clamp terminal is now in common use in main switches, MCB's, RCD's and RCBO's.
6. The lug terminal comes in an extremely wide variety of shapes and sizes. They may be bare or insulated. Methods of connecting to the cable vary as follows:
    - Ferrules, which are used on flexible cables to prevent the strands from spreading out and are then connected using a screw or clamp terminal.
    - Large power cables where the lug is compressed onto the cable using a hydraulic type crimptool. The lug is then connected to a post or screwhead te

3.2Identifying Wire Splicesand Joining

1. Joining and splicing of electrical conductor plays a very important role in the field of electricity. Some expert say, "there is no better conductor than the unjoined or unspliced conductor", unfortunately, any wiring installation, any wiring installation is impossible to accomplish without cutting the the conductor for a certain length and then join or splice together afterwards to satisfy the desired connection for the operation of the circuitry. Therefore, an electrician must be equipped with proper technical skills in this activity.
2. The Philippine Electrical Code relative to electrical joints and splices specifies that conductors must be spliced or joined as to both mechanically and electrically secure prior to soldering.
3. The code emphasizes that the joint or splice must be secured mechanically and electrically. Loose connection due to improper joining/splicing of conductor may lead to a big problem a few months after the commissioning, especially if the spliced conductor carries huge amount of electric current. The connection wick generate heat that will cause the joined conductor to expand and thereby increasing the gap between the surfaces which then lead to arcing.

JOINT is the tying together of two single wire conductors so that the union will be good both mechanically and electrically.



SPLICE is the interlaying of the strands of two stranded conductors so that the union will be good both mechanically and electrically.

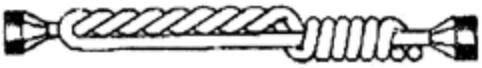
1. **Rat Tail or Pig Tail**– This kind of joint is commonly used to joint two or more conductor inside the junction box. It is suitable for service where there is no mechanical stress as where wires are to be connected in an outlet box, switch or conduit fitting.

2. **Bell Hanger's Joint or Western Union Short Tie**– This joint is commonly used to join continuous run conductor where the tensile stress not too great, such as conductors inside conduit bodies.

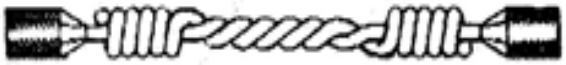
Western Union Long Tie– The modified form of bell hanger's joint, made in the same way as the latter with the exception that a number of twist is to make it more efficient mechanically as

the tensile stress brought on this joint is

considerable.

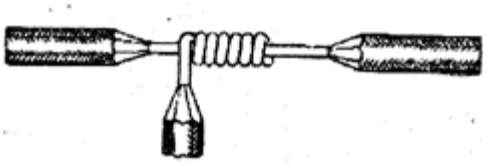


3. **Turn Back Joint or Through Fixture Joint**– This joint is use to connect two continuous run conductor under extreme tension.

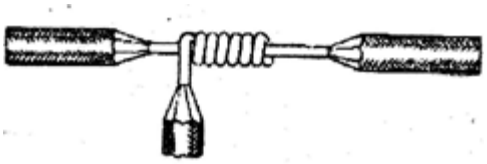


4. **Duplex Joint** – Duplex wire joint is used where twin wire is employed, that is two-wire cables. It consists of two bell hanger's joints spaced so that they do not come opposite each other.

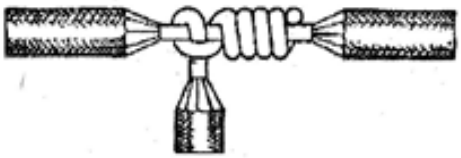
5. **Tap Joint**– Tap is the connection of the end of one wire to some point along the run of another wire. There are various taps to meet different conditions.



6. **Plain Tap Joint**– is use where the tap wire is under considerable tensile stress.

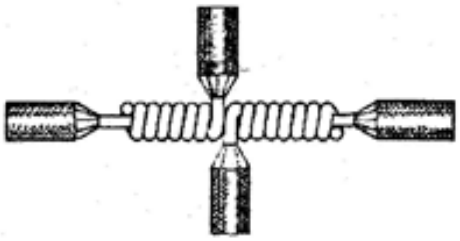


7.Knotted Tap– is used where the tap wire is under heavy tensile stress.

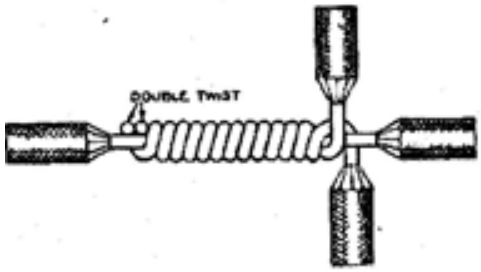


7. **Aerial Tap**– is used as temporary taps usually done in constructions sites. The easy twist will facilitate tap wire movement.

8. **Double Cross Joint**– the same application as plain tap do, the only difference is that this tap a combination of two plain taps place side by side with each other.



9 .Duplex Cross Joint– a two tap wire turned simultaneously and is used where the two tap wire is under heavy tensile stress.



11. Running Butt Splice or Single Wrapped Spliced– Running butts link to splices formed by putting together the end of two cable lengths to extend the run or length of circuit. Running butt splices are classified as Single wrapped splice and multi wrapped splice. This splice is used for large wire (14 mm^2 and

larger) because it is easier to wrapped a single wire at a turn than to wrapped them all at once.

Figure:

12. Multi Wrapped Splice– This method of wrapping is generally used on small cables because the strands are flexible and all can be wrapped in one operation. A three strand cable is selected so as to clearly show the method of wrapping.

Figure:

13.Tap Splices or Ordinary Tap Splice– These are made when the end of one stranded conductor is to be connected at some point along the run of another stranded conductor. They are classified as ordinary split and y-splice

Figure:

14. Split Tap Splice– This splice is used for large wire (14 mm^2 and larger) because it is easier to wrapped to single wire at a turn than to wrapped them all at once.

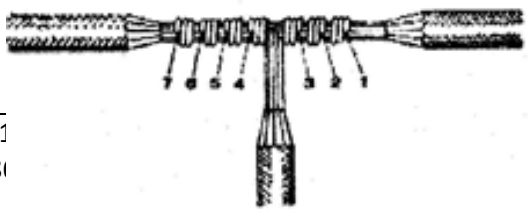


Figure:

15. Y-splice– This method of wrapping is generally used on small cables because the strands are flexible and all can be wrapped in one operation.

Figure:

3.2 Connecting accessories

Electrical material and devices classification of electrical material according to function

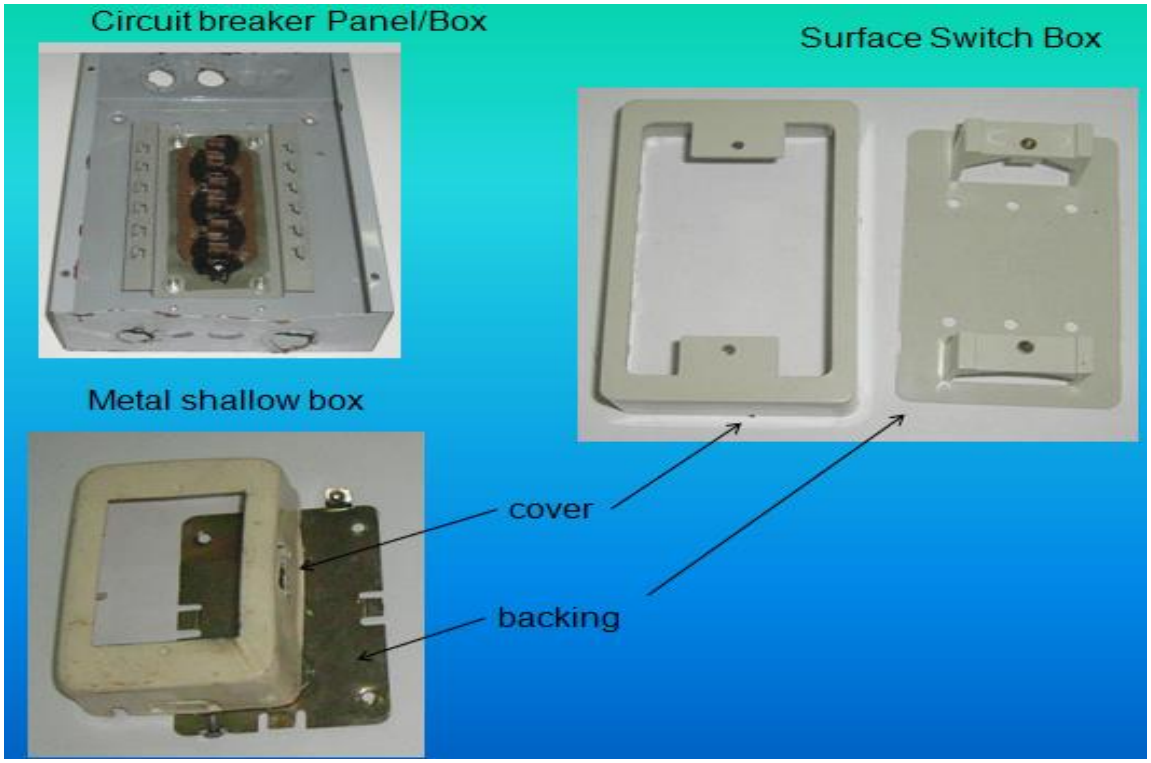
1. Boxes
2. Switches
3. Receptacle/ Convenience outlet
4. Ceiling Lamp receptacles
5. Fittings
6. Supports
7. Male Plugs
11. Grounding Devices/Malts.
12. Wires/conductors
13. Lighting Materials
14. Wiring Methods
15. Adaptors/Connectors
16. Soldering materials

8. Consults
9. Electrical Protective Devices
10. Metering Devices
17. Insulating Materials
18. Switch plate & covers
19. Safety switches

Boxes are made of galvanized sheet metal or polyvinyl chloride (PVC)

Different Sizes:

Boxes



SWITCH:-Used to close or open electrical circuit.

Figure:

KINDS OF SWITCHES ACCORDING TO NUMBER OF POLE AND THROW

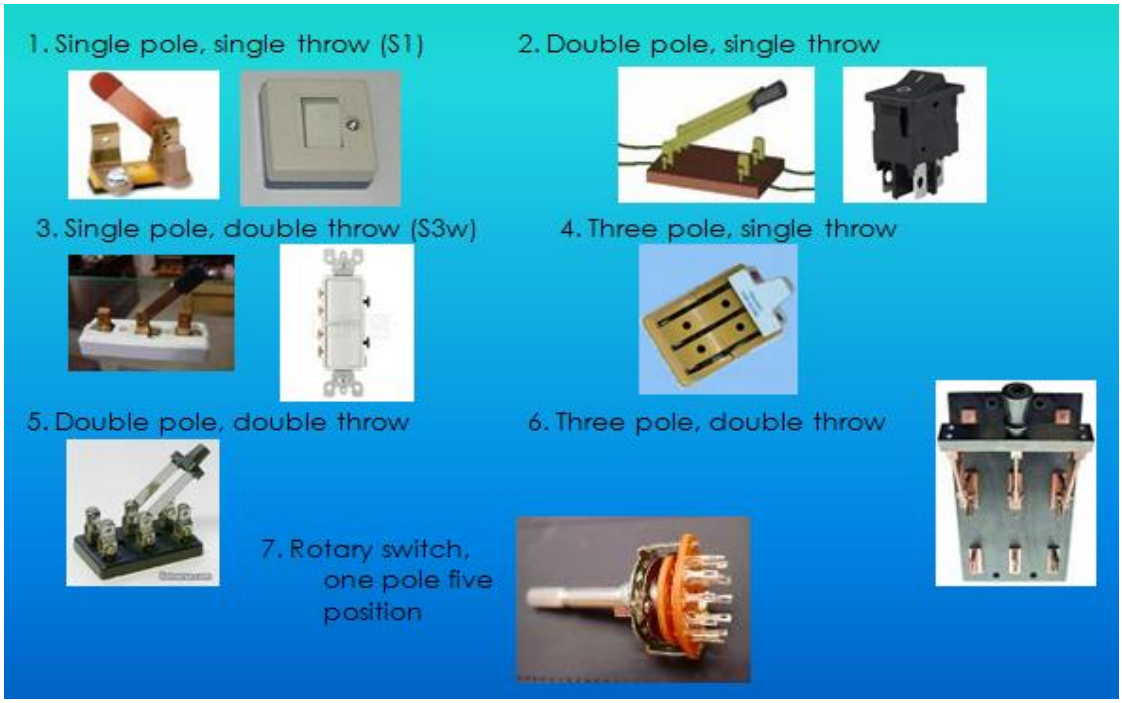


Figure:

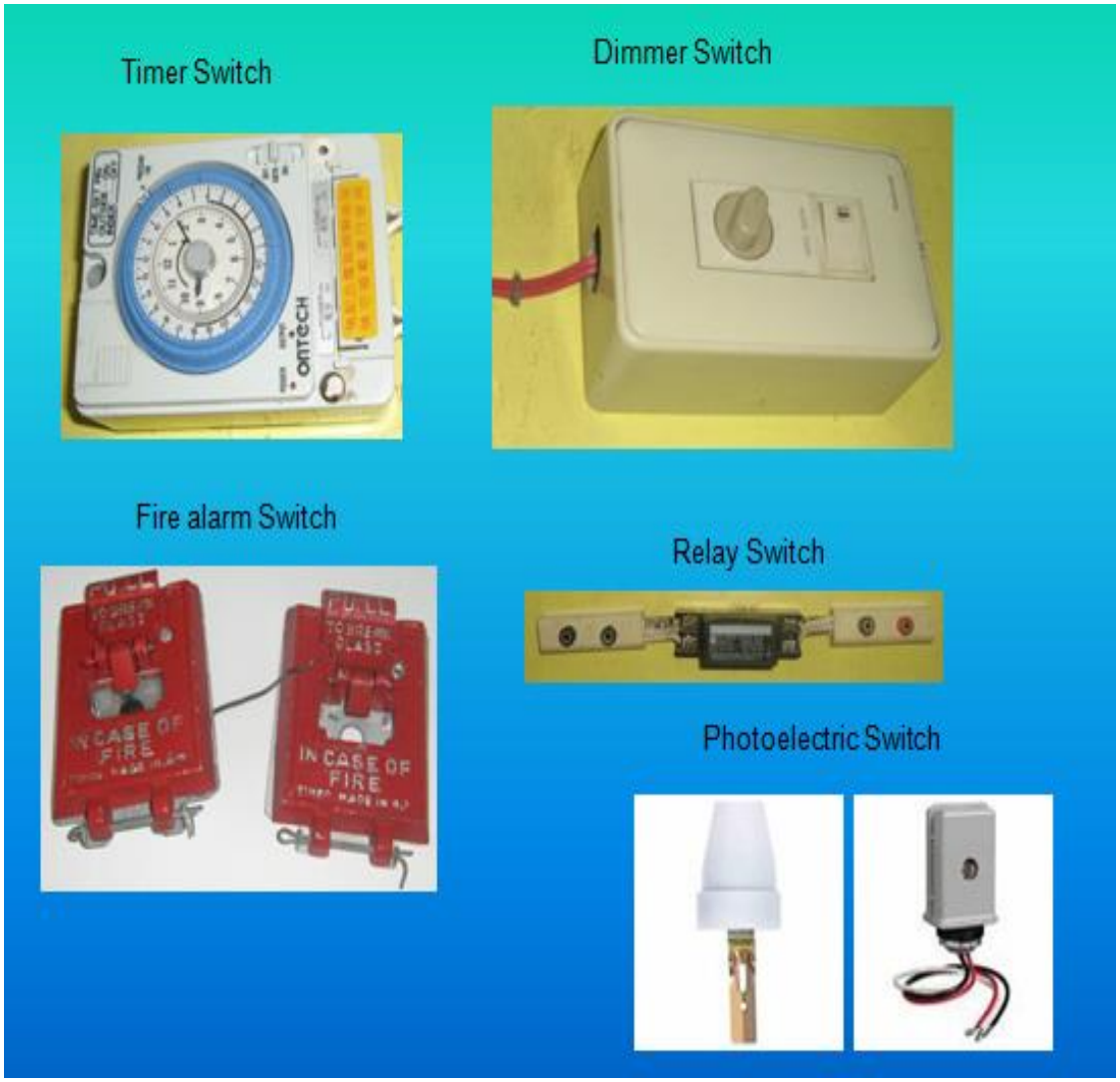
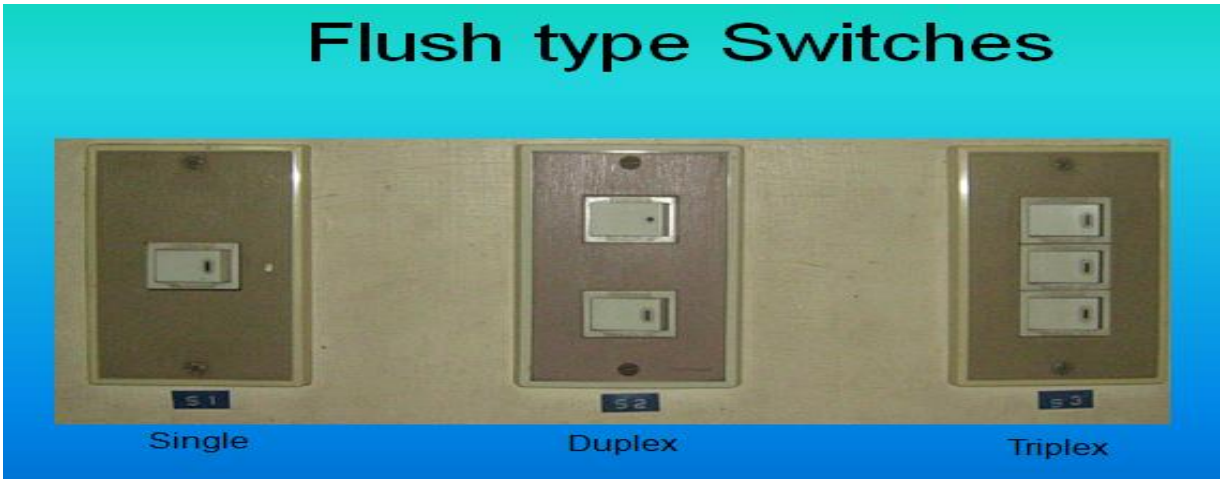
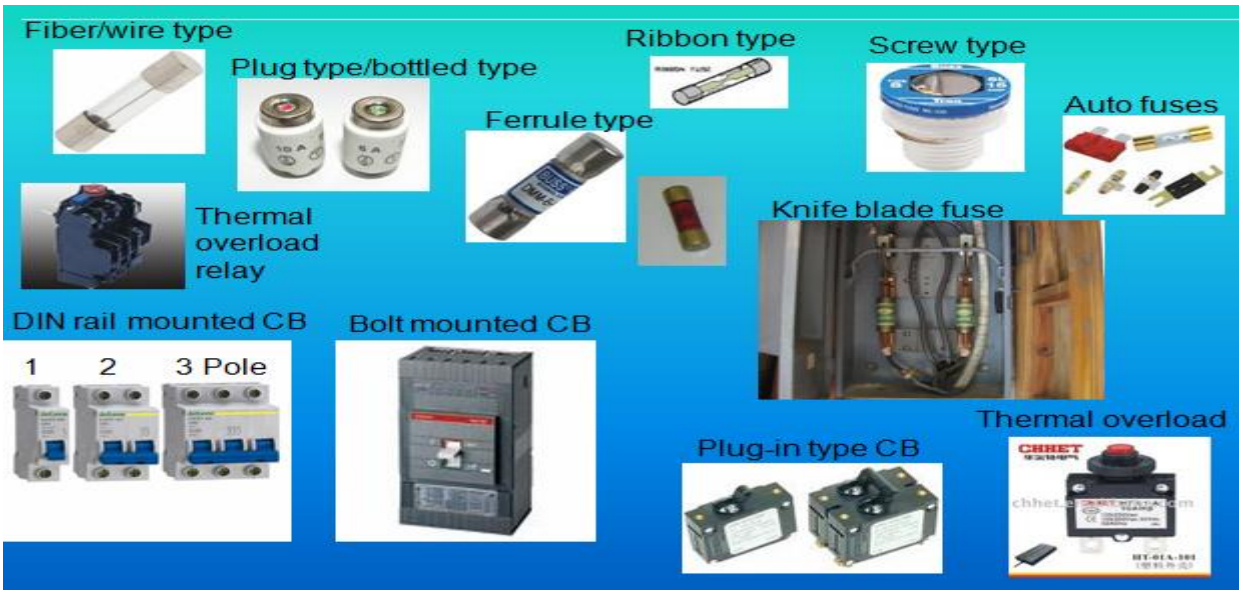

Timer Switch
Dimmer Switch
Fire alarm Switch
Relay Switch
Photoelectric Switch
IN CASE OF FIRE
IN CASE OF FIRE

Figure:



ELECTRICAL PROTECTIVE DEVICES



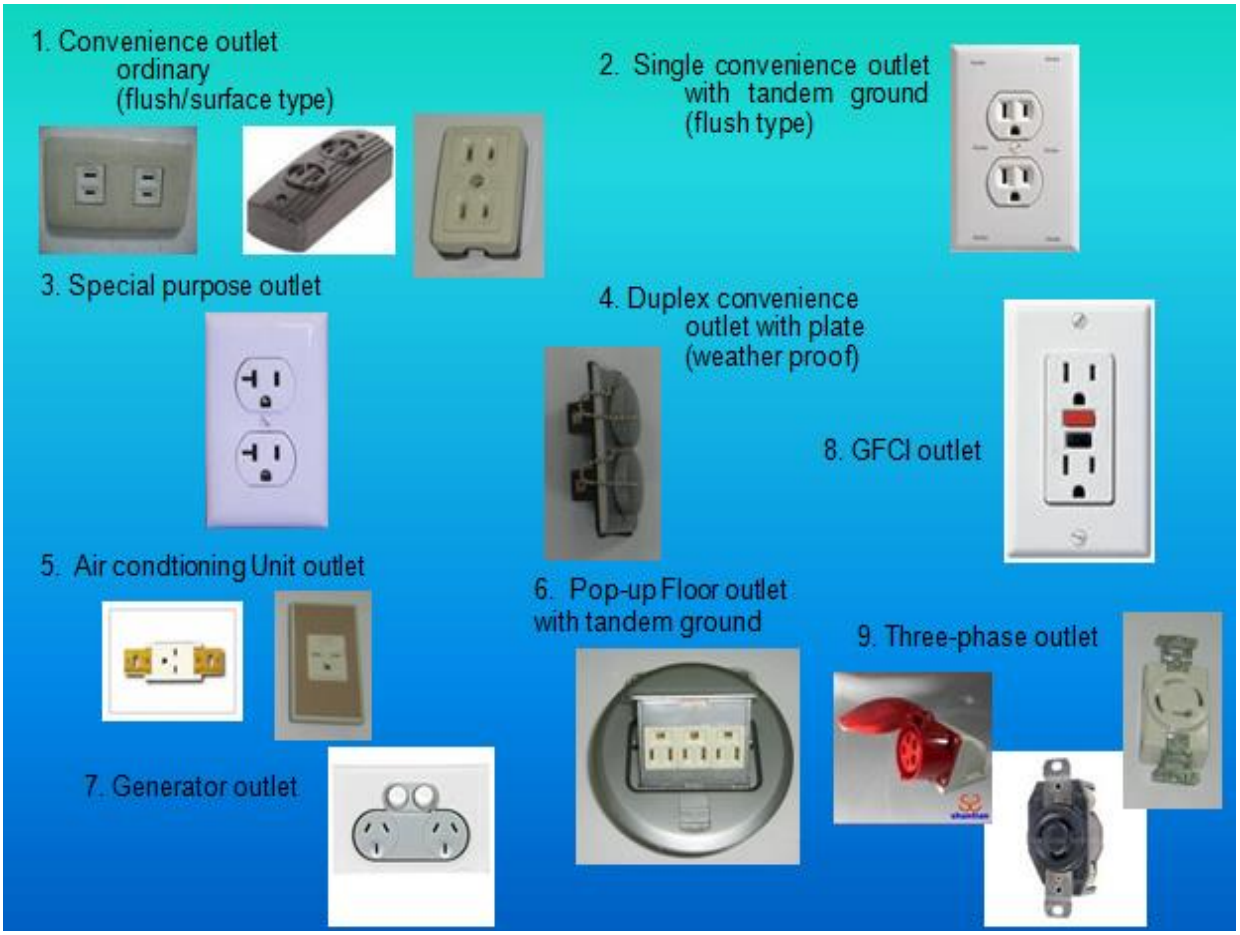
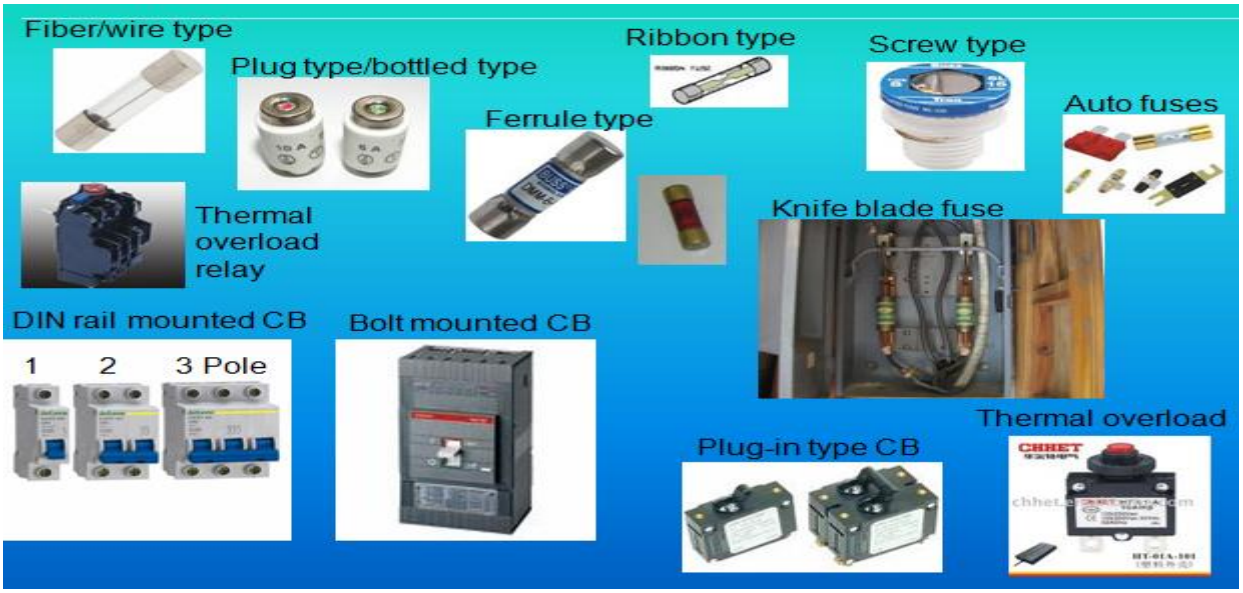


Figure:

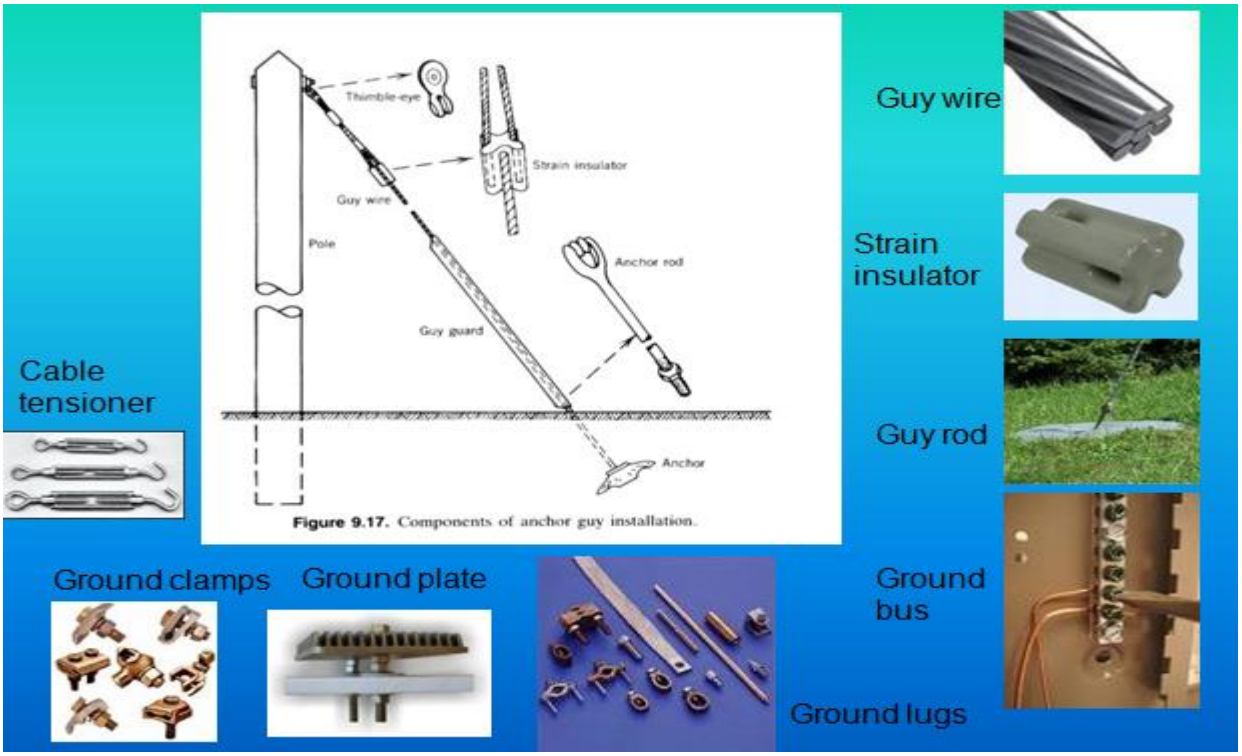
DIN Rail Mounted Circuit breaker


1. Actuator lever - used to manually trip and reset the circuit breaker. Also indicates the status of the circuit breaker (On or Off/tripped). Most breakers are designed so they can still trip even if the lever is held or locked in the "on" position. This is sometimes referred to as "free trip" or "positive trip" operation.
2. Actuator mechanism - forces the contacts together or apart.
3. Contacts - Allow current when touching and break the current when moved apart.
4. Terminals
5. Bimetallic strip
6. Calibration screw - allows the manufacturer to precisely adjust the trip current of the device after assembly.
7. Solenoid
8. Arc divider / extinguisher

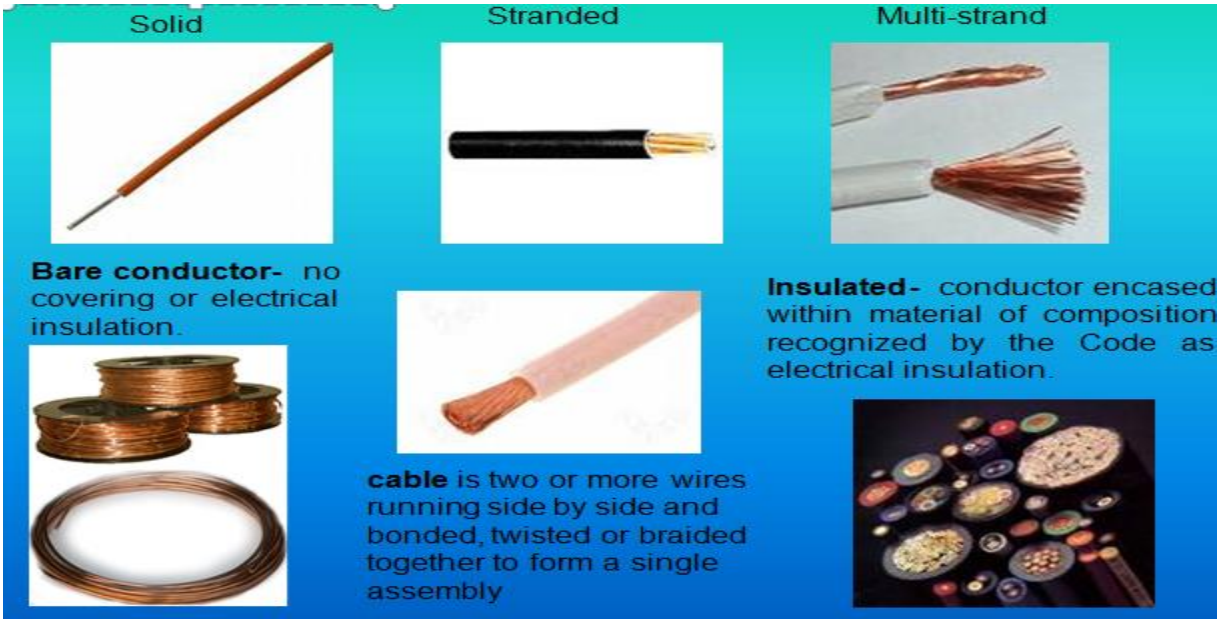

Fiber/wire type
Plug type/bottled type
Ribbon type
Screw type
Ferrule type
Auto fuses
Thermal overload relay
Knife blade fuse
DIN rail mounted CB
1 2 3 Pole
Bolt mounted CB
Plug-in type CB
Thermal overload

METERING DEVICES

Grounding Materials



WIRES/CONDUCTORS



LIGHTING MATERIALS

Meta-clad cable

Mineral insulated cable

Mineral insulated metal-sheathed cable

WIRING METHODS

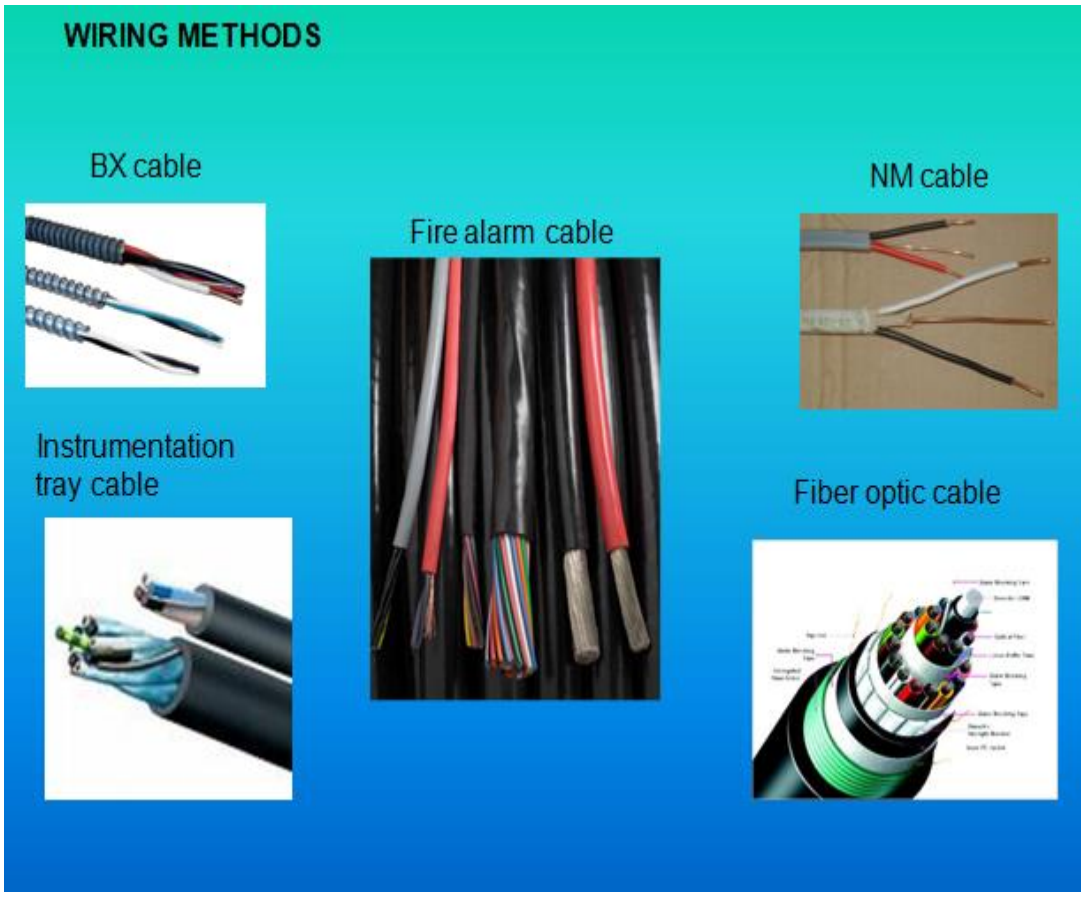
BX cable

Fire alarm cable

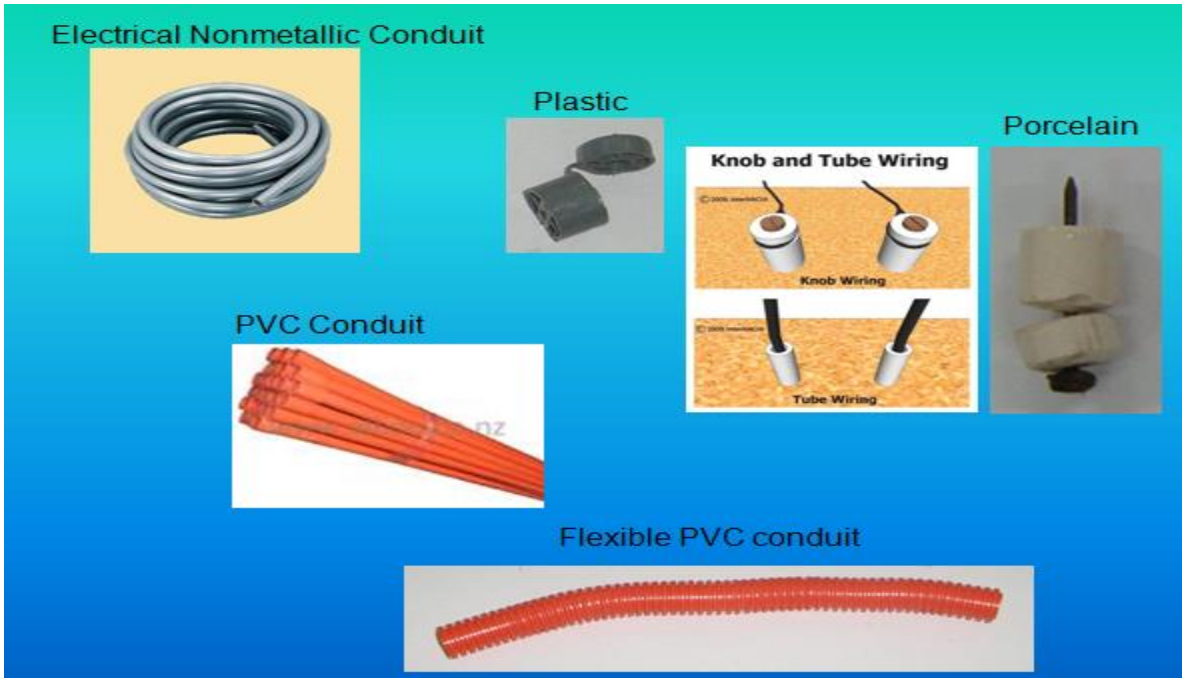
NM cable

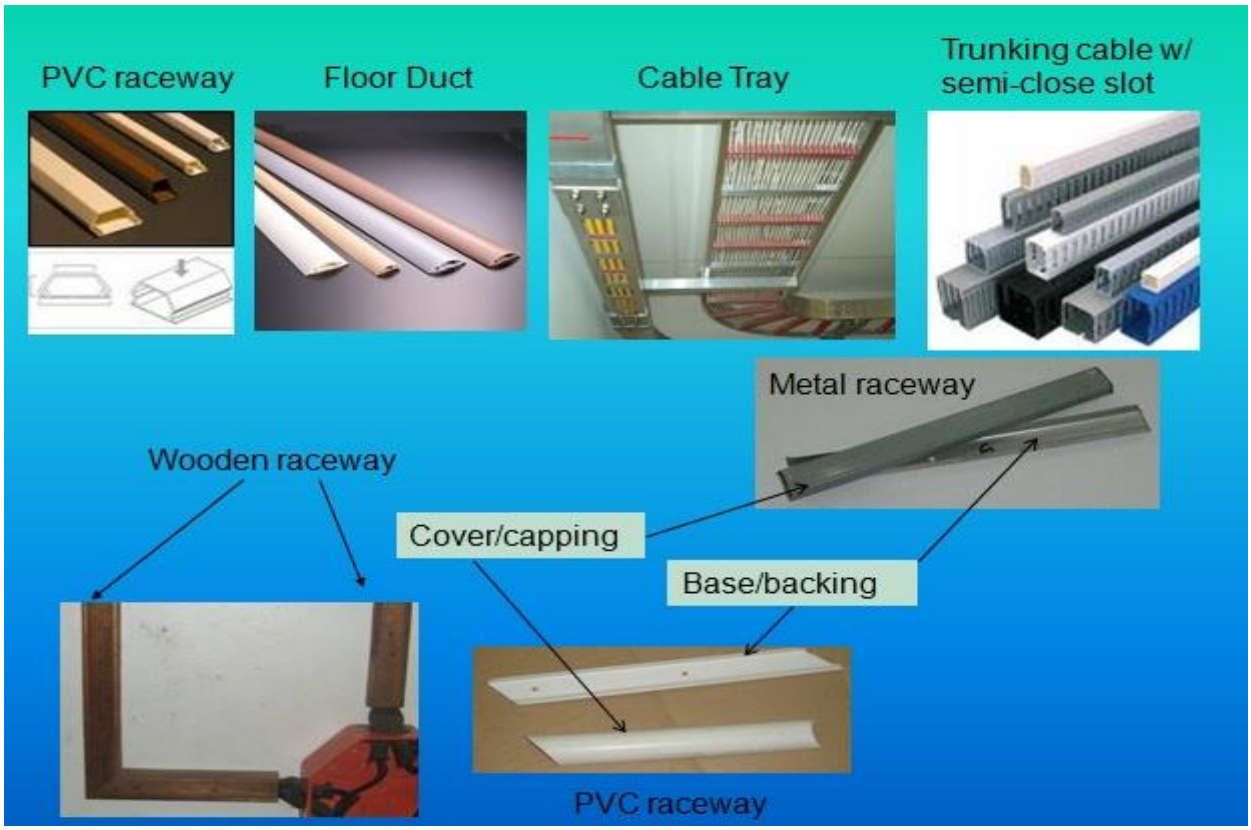
Instrumentation tray cable

Fiber optic cable


WIRING METHODS
BX cable
Fire alarm cable
NM cable
Instrumentation tray cable
Fiber optic cable

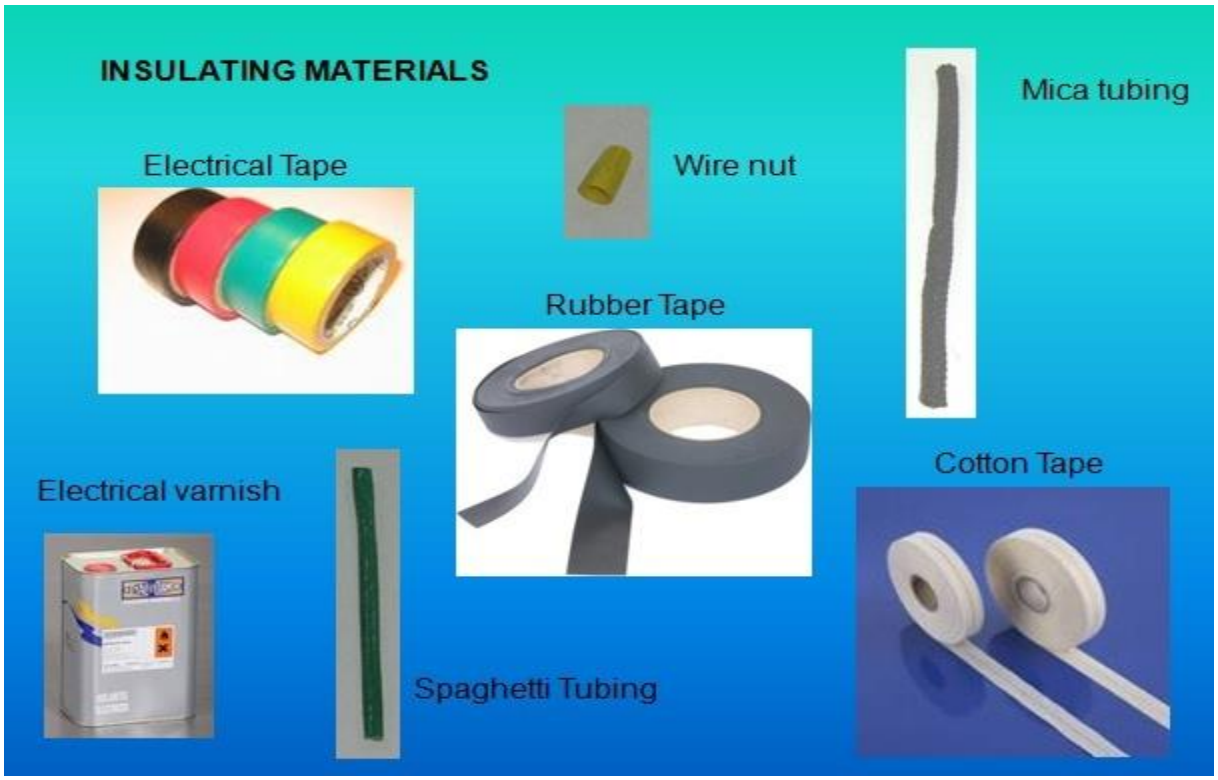

Intermediate Metal Conduit
Flexible metallic conduit
Electrical
Metallic Tubing
Liquidtight nonmetallic
flexible conduit
Liquidtight flexible
metal conduit
Rigid Steel Conduit


Electrical Nonmetallic Conduit
Plastic
Porcelain
Knob and Tube Wiring
Knob Wiring
Tube Wiring
PVC Conduit
Flexible PVC conduit

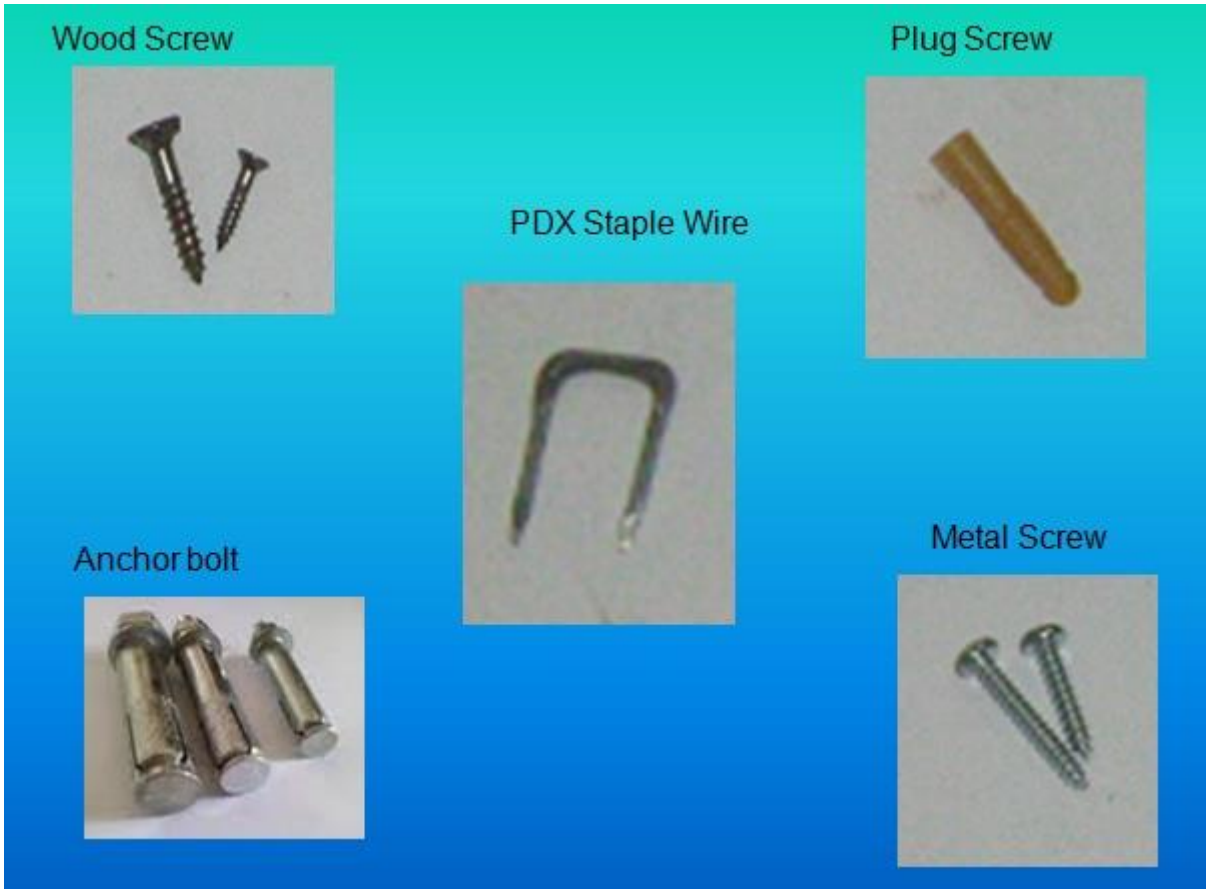


Adaptors/Connectors

SOLDERING MATERIAL


INSULATING MATERIALS
Electrical Tape
Wire nut
Mica tubing
Rubber Tape
Electrical varnish
Cotton Tape
Spaghetti Tubing


PLATES AND COVERS FOR SWITCHES AND OUTLETS
CombinationSwitch and C.O. Plate
1 gang/1device
2 gang/2device
TV Antenna Outlet Cover
3 gang/3device
RJ45 Outlet Cover
4gang/4device


Wood Screw
Plug Screw
PDX Staple Wire
Anchor bolt
Metal Screw

Switch gear

Load center

Panel board

Dry cell

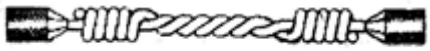
Threading oil

Ground bus

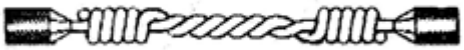
Cable tray

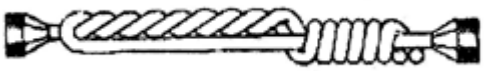
Self-Check -3	Written Test

Directions: Identify the following splices shown below

1. 

2. 

3. 

4. 

Information Sheet-4	Responding to unplanned events or conditions

4.1 Introduction Responding to unplanned events or conditions

In order to know how to respond to unplanned events or conditions, one must first start in assessing or analyzing the situation. The first response should not be making an action right away, but thinking of the situation and possible solutions.

After fully understanding the situation and listing down possible solutions, it's time to take action by trying all possible means to cope with the changes or unexpected events.

If working on a project, it's helpful to create a list of planned vs unplanned events so you can also think of safety measures on how to prevent the unplanned ones even before starting on the project.

Based on these considerations, the potential accidents, malfunctions and unplanned events that were considered by the Study Team for the Sisson Project are

- Loss of Containment from Tailings Storage Facility (TSF);
- Erosion and Sediment Control Failure
- Pipeline Leak;
- On-Site Hazardous Materials Spill;
- Release of Off-Specification Effluent from the installation.
- Failure of a Water Management Pond
- Failure of a Water Management Pond Pump;
- Off-Site Trucking Accident
- Vehicle Collision;
- Uncontrolled Explosion; and
- Fire

4.1.1 Respond to unplanned events or conditions in accordance with established procedures.

- Establish procedures from appropriate personnel In accordance with procedures before any contingencies are implemented.
- Test Devices / systems and/or installation is tested whether it conforms to requirements
- Remove parts or connections for the purpose of testing and pre-test conditions in accordance with established procedures
- Final inspections are undertaken to ensure the installed devices / systems conforms to requirements Trainers Methodology .

Self-Check -4	Written Test

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

1.what is unplanned events or conditions ?(3point)

2.where is occurunplanned events or conditions?(5 point)

3.How can control unplanned events or conditions?(2point)

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

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-5	Obtaining approval from appropriate personnel

5.1 Introduction **Obtaining approval from appropriate personnel**

Electrical wiring needs expertise attention to every building projects. It directly related to the safety of human beings and utilities / equipment people handle. The scope of electrical wiring shall cover supply, installation, testing and commissioning of all conduits and accessories, wiring, switches, socket outlets, spur outlets, junction boxes / pull boxes, GI pull wires, ceiling roses making connections etc. Unless otherwise indicated wiring shall consist of PVC insulated, copper conductor wires installed in heavy gauge steel galvanized conduits.

Inspection requests

You must request inspection prior to covering any electrical work, no later than 3 business days after completing the work or 1 business day after any part of the installation has been energized, whichever occurs first. Failure to request an inspection may result in civil penalties.

A permit is a vital step to a safe installation

A permit will ensure the work done on your property conforms to current safety codes. Your best protection is purchasing an electrical permit and having your electrical work inspected, as required by law.

A permit will ensure the work done on your property conforms to current safety codes. Your best protection is purchasing an electrical permit and having your electrical work inspected, as required by law.

If a permit is not purchased before work is started

You could be subject to civil penalties if you do not obtain a permit before the electrical work is started. By not purchasing a permit, you might incur additional penalties that could:

- Affect your ability to obtain financing or sell your property.
- Prevent you from obtaining insurance or collect on insurance claims.
- Bring a fine of up to $2,000 for each day a violation occurs.

- Result in a disconnection of your electrical power.

  Each day at each location a violation occurs constitutes a separate violation. Additional penalties can be levied for failure to correct any violations noted during an electrical inspection

  When a permit is not required

  Certain projects do not require a permit. They include:

- Travel trailers.
- Plug-in household appliances.
- The like-in-kind replacement of lamps; a single set of fuses; a single battery smaller than 150 amp hour; contactors, relays, timers, starters, circuit boards, or similar control components; one household appliance; circuit breakers; single-family residential luminaires; up to five snap switches, dimmers, receptacle outlets, thermostats, heating elements, luminaire ballasts with an exact same ballast; component(s) of electric signs, outline lighting, or skeleton neon tubing when replaced on-site by an appropriate electrical contractor and when the sign, outline lighting or skeleton neon tubing electrical system is not modified; one ten horsepower or smaller motor.
- For the purposes of this section, "circuit breaker" means a circuit breaker that is used to provide overcorrect protection only for a branch circuit, as defined in NEC 100.
- A list of example electrical work that either requires or does not require a permit and inspection.
- Helpful suggestions about how to protect yourself, your home and your property investment by getting the proper electrical work permits and inspections.
- Detailed instructions and helpful hints about the electrical permit and inspection process

Approved products and materials

Products used in home remodeling projects must be listed by a nationally recognized independent agency. Agency listings include fire rated assemblies, prefabricated fireplaces and stoves, furnaces and heaters, insulation, etc. When you have identified a specific brand and model you want to install, check with your District Inspector to see if it has been

approved for use in the City and County of San Francisco. In most cases, the brand and listing must be shown on the plans to be approved

Electrical Permit Information

The-Electrical-Code

The purpose of the electrical code is to provide practical safeguards to persons and property from hazards arising from the use of electricity. The code contains provisions considered necessary for safety.

What is the ectricalcode?The National Electrical Code covers installations of electric conductors and equipment within or on public and private buildings and structures, installations of conductors that connect to the supply of electricity, and installations of other outside conductors on the premises. Presently, the State Electrical Code consists of the National Electrical Code with Part 8 technical amendments. Provisions for one- and two-family dwellings are included in the Michigan Residential Code.

Are electrical- permits required? A person shall not equip a building with electrical conductors or equipment or make an alteration of, change in, or addition to, electrical conductors or equipment without receiving a permit to do the work described

Do you need a license to do electrical work? To obtain electrical permits, an applicant shall be an electrical contractor or specialty contractor licensed by a municipality or by the State Electrical Administrative Boar dora homeowner performing electrical work in a single family home and accompanying outbuildings owned and occupied, or to be occupied, by the person performing the installation.

Electrical Permit Application Electrical Inspector Region Map

Prior to applying for an electrical permit, it is suggested the applicant review the Statewide Jurisdiction List. This information is updated regularly due to changes in the electrical code enforcement that may be conducted by either the state, county or local unit of government. An electrical permit application must be submitted to the appropriate enforcing

agency. Pre-qualify Electrical Plans Develop a process for pre-qualification of standard plans Pre-qualification of plans typically works as follows:

- An installer has a typical template approach or “plan” for installing a solar panel system.

•The installer meets with local permitting staff to review this plan in terms of system design and components.
•If the permitting staff finds that the plan is compliant with all relevant codes, they approve it.
•If the installer intends to install a system conforming to the approved plan, therefore incorporating the approved system design and using the approved components, they inform the permitting department.
•The permitting department then immediately issues an electrical permit.
•During project inspection, the inspector confirms that the system design and components are the same as originally approved.
It is important to note that the steps outlined above typically apply only to an electrical permit process, not to the building permit process. The building permit process would still be required, since the pre-qualification of the standard plan does not address the specific site or structure the system is located on. The Solar American Boar of Standards (see Solar ABCs) has developed a series of checklists, and sample form sand plans for expediting permitting processesthat are widely recognized around the country.

Self-Check -4	Written Test

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

1.What is the electrical code?(3point)

2.Are electrical permits required?(3point)

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

You can ask you teacher for the copy of the correct answers.

Name: _____ Date: _____

Short Answer Questions

Operation Sheet 1	Perform installation & termination of wiring system

To enable trainees identify the purpose and advantage of install wiring system.

Procedure:

step1 reading drawing
step2 select tools, material and equipment
step3 check tools, material and equipment
step4 placing of tools, material and equipment
step5 Measure the conduit, and wire with specification
step6 Perform installation & termination of wiring system
step7 Measure the output(functional test)

LAP Test 1	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates/guides, workshop, tools and materials you are required to perform the following tasks within 2:30 hours.

Task 1: Using the given template, Report is done to relevant people those necessary variations to the planned programmer of work

Task 2: Using the given template Perform The appropriate action is sought from the relevant people

Task 3: Using a given template, completing OHS procedures and regulations are observed throughout the process of installation

Operation Sheet 2	Two bulbs controlled by 3-way and single switch

Two bulbs controlled by 3-way and single switch

procedure:-

Step 1 Secure working drawing (You have it when you perform rough-in activities using rigid nonmetallic conduit).

Step 2 You will be installing electrical wiring a lamp controlled in two different locations by means of 2 3-way switch. Identify the number of conductors to be inserted in each conduit run by converting the working drawing into wiring diagram

Step 3 Prepare a guide wire and insert to the utility box until it reaches the panel board.

Step 4 Prepare conductors 2.0 mm^2, 1 black, 1 white, and 1 green.

Step 5 Fish it out on the utility box To facilitate easy pulling of fished conductors cover it with electrical tape

Step 6 Then start inserting it to the PVC conduit while being pulled on the other end until the conductors reaches the panel board.

Step 7 Provide an ample length of conductor for termination in the panel board and the utility box for the convenience outlet.

Step 8 The wire allowance for termination in utility and junction boxes at least 150 mm.

Step 9 Insert 1.6 mm^2 for hot and 1 red for return from junction box J1 to the utility box for lamps C, D. and E.

Step 10 Insert 1.6 mm^2 wires, 1 black and 1 red for hot wires from pane rd to junction box J1. Since the distance bet orter

Step 11 Insert 1.6 mm^2, 1- red for hot wire and 2 blue for travel wire from Junction box J1 to 3-way switch. Wires on the Junction box (J1)Wires on the utility box for 3-way switch

Step 12 Insert 1.6 mm^2wire, 1 red for return and 2 blue for travel ox J1 to J2.

Step 13 Insert 1.6 mm^2wire, 1 red for return and 2 blue for traveler wires from J2 to S_3.

Step 14 Insert 1.6 mm^2 wire, 1black and 1 red from J2 to utility box for lamp A and B.

Step 15 Insert 1.6 mm^2 wires, 2 red from J2 to utility box for S_1.

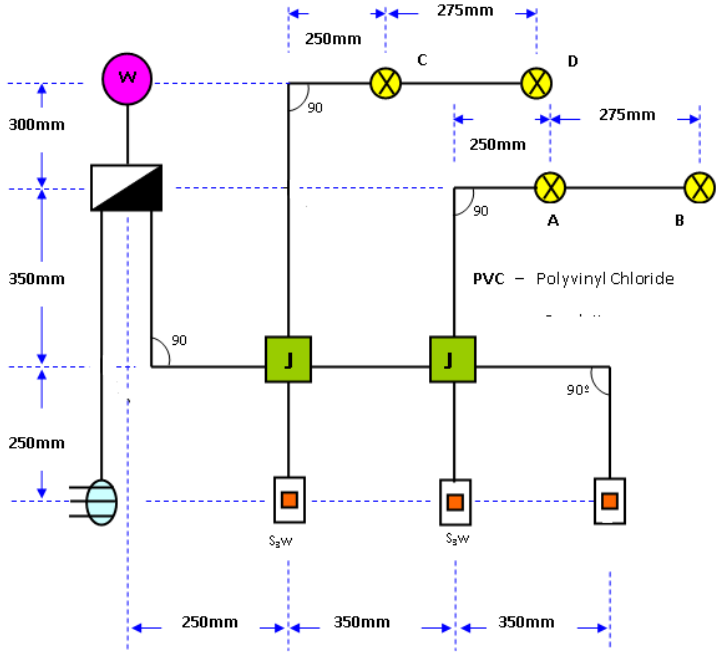
Step 16 On the Junction box J1 strip off at least 30 mm from the end of the 2-black wires from the lamp and panel board and join them using rat tail joint

Step 17 Join the wires using Rat Tail joint from the lamp A and B, 3-way switches and single switch on the junction box J2.

Step 18 Then join the traveler wires (blue) as shown in the figure.

Step 19 After termination and spicing of wires on the two junction boxes and on the panel board check the resistance of the bulbs A, B, C, D, and E. Check the resistance on the panel board and the convenience outlet. If everything is in normal reading, put electrical tape to those expose wires on the two junction boxes then put the junction box cover.

Step 20 Connect the two wires from the panel board to the AC supply line. Switch on the main circuit breaker and test the supply voltage. If the voltage is the same to the supply line then switch ON the circuit breaker for convenience outlet and measure the voltage at the 3-pin convenience outlet, if normal, switch ON the circuit breaker for the lamps test the voltage at the circuit breaker if normal switch ON the 3-way switch and single switch



LAP Test	Practical Demonstration

_____

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: following the necessary templates, tools and materials you are required to perform tasks within 8-12 hours.

task 1 :- Two bulbs controlled by 3-way and single switch

List of Reference Materials

4. Buildingelectricalinstallationhttps://dps.mn.gov/divisions/ojp/forms-documents/Documents/Wilder_Program_Evaluation_8.pdf
5. **Identifying Wire Splicesand Joining**http://www.teamreporterapp.com/information-gathering/
6.
7. Gathering information: Available on: Information Gathering. Available on: http://www.teamreporterapp.com/information-gathering/
8. Medical Advice Disclaimer (2005-2019). The Importance of Using Community Resources in Treatment. Available on
9. **https://www.youtube.com/watch?v=XOdPJDSTvjM**

Ethiopian TVET-System

TTLM

BUILDING ELECTRICAL INSTALLATION

LEVEL II

Learning Guide-#3

Unit of Competence: Install and Terminate Wiring System

Module Title: Installing and Terminating Wiring System

LG Code: EISBEI2 M07LO3-LG-25

TTLM Code: EIS BEI2 M07 TTLM 0919v1

LO 3: Inspect and notify completion of work

Instruction Sheet	Learning Guide #3

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

- Undertaking final inspections
- Preparing work accomplishment report

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**:

- Undertake final inspections
- Prepare work accomplishment report

Learning Instructions:

13. Read the specific objectives of this Learning Guide.
14. Follow the instructions described below 3 to 6.
15. Read the information written in the information “Sheet 1, and Sheet 2,”.
16. Accomplish the “Self-check 1, Self-check t 2,” **in page -104, and 118**respectively.
17. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1,” **in page -118.**
18. Do the “LAP test” **in page – 120** (if you are ready).

Information Sheet-1	Undertaking final inspections

1.1 Introduction Undertaking final inspections

Electrical testing

The electrical contractor is charged with a responsibility to carry out a number of tests on an electrical installation and electrical equipment. The individual tests are dealt with in Part 6 of the IEE Regulations and described later in this chapter.

The reasons for testing the installation are:

- to ensure that the installation complies with the Regulations,
- to ensure that the installation meets the specification,
- to ensure that the installation is safe to use.

Those who are to carry out the electrical tests must first consider the following safety factors:

- An assessment of safe working practice must be made before testing begins.
- All safety precautions must be put in place before testing begins.
- Everyone must be notified that the test process is about to take place, for example the client and other workers who may be affected by the tests.
- ‘ Permits-to-Work ’ must be obtained where relevant.
- All sources of information relevant to the tests have been obtained.
- The relevant circuits and equipment have been identified.
- Safe isolation procedures have been carried out – care must be exercised here, in occupied premises, not to switch off computer system switch out first obtaining permission.
- Those who are to carry out the tests are competent to do so.

The electrical contractor is charged by the IEE Regulations for Electrical Installations to test all new installations and major extensions during erection and upon completion before being put into service. The contractor may also be called upon to test installations and equipment in order to identify and remove faults. These requirements imply the use of appropriate test

instruments, and in order to take accurate readings consideration should be given to the following points:

- ✓ Is the instrument suitable for this test?
- ✓ Have the correct scales been selected?
- ✓ Is the test instrument correctly connected to the circuit?

Many commercial instruments are capable of making more than one test or have a range of scales to choose from. A range selector switch is usually used to choose the appropriate scale. A scale range should be chosen which suits the range of the current, voltage or resistance being measured.

For example, when taking a reading in the 8 or 9 V range the obvious scale

Inspection and testing techniques

The testing of an installation implies the use of instruments to obtain readings. However, a test is unlikely to identify a cracked socket outlet, a chipped or loose switch plate, a missing conduit-box lid or saddle, so it is also necessary to make a visual inspection of the installation .All new installations must be inspected and tested during erection and upon completion before being put into service. All existing installations should be periodically inspected and tested to ensure that they are safe

and meet the regulations of the IEE The method used to test an installation may inject a current into the system. This current must not cause danger to any person or equipment in contact with the installation, even if the circuit being tested is faulty. The test results must be compared with any relevant data, including the IEE Regulation tables, and the test procedures must be followed carefully and in the correct sequence, as indicated. This ensures that the protective conductors are correctly connected and secure before the circuit is energized.

VISUAL INSPECTION

The installation must be visually inspected before testing begins. The aim of the visual inspection is to confirm that all equipment and accessories are undamaged and comply with the relevant British and European Standards, and also that the installation has been securely

and correctly The aim of the *visual inspection* is to confirm that all equipment and accessories are undamaged and comply with the relevant British and European Standards, and also that the installation has been securely and correctly erected.

Regulation 611.3 gives a checklist for the initial visual inspection of an installation, including:

● connection of conductors;

● Identification of conductors;
● routing of cables in safe zones;
● Selection of conductors for current carrying capacity and volt drop;
● Connection of single-pole devices for protection or switching in phase conductors only;
● Correct connection of socket outlets, lamp holders, accessories and equipment;
● Presence of fire barriers, suitable seals and protection against thermal effects;
● Methods of 'Basic protection ' against electric shock, including the insulation of live parts and placement of live parts out of reach by fitting appropriate barriers and enclosures;
● Methods of 'Fault Protection ' against electric shock including the presence of earthling conductors for both protective bonding and supplementary bonding.

- prevention of detrimental influences (e.g. corrosion);
- presence of appropriate devices for isolation and switching;
- presence of under voltage protection devices;
- choice and setting of protective devices;
- labeling of circuits, fuses, switches and terminals;
- selection of equipment and protective measures appropriate to external influences;
- adequate access to switchgear and equipment;
- presence of danger notices and other warning notices;
- presence of diagrams, instructions and similar information;
- appropriate erection method

The checklist is a guide, it is not exhaustive or detailed, and should be used to identify relevant items for inspection, which can then be expanded upon.

For example, the first item on the checklist, connection of conductors, might be further expanded to include the following:

- Are connections secure?
- Are connections correct? (conductor identification)
- Is the cable adequately supported so that no strain is placed on the connections?
- Does the outer sheath enter the accessory?
- Is the insulation undamaged?
- Does the insulation proceed up to but not *into* the connection?

1.1.2 **Summary of the condition of the installation**

The summary should adequately describe the general condition of the installation in terms of electrical safety, taking into account the specific observations made. It is essential to provide a clear summary of the condition of the installation having considered, for example:

• The adequacy of the earthling and bonding arrangements

• The suitability of the consumer unit and other control equipment

• The type(s) of wiring system, and its condition

• The serviceability of equipment, including accessories

• The presence of adequate identification and notices

• The extent of any wear and tear, damage or other deterioration

• Changes in use of the premises that have led to, or might lead to, deficiencies in the installation.

Minimal descriptions such as ‘poor’, and superficial statements such as ‘recommend a rewire’, are considered unacceptable as they do not indicate the true condition of an installation. It will often be necessary or appropriate to explain the implications of an electrical installation condition report in a covering letter, for the benefit of recipients who require additional advice and guidance about their installation.

Self-Check -1	Written Test

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

1. The reasons for testing the installation are:(5point)

   A. to ensure that the installation complies with the Regulations,
   B. to ensure that the installation meets the specification,
   C. to ensure that the installation is safe to use
   D. all

2.Checklist for the initial visual inspection of an installation,(5 points)

A. identification of conductors;

B. routing of cables in safe zones;

C. selection of conductors for current carrying capacity and volt drop

D. all

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

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet- 2	Preparing work accomplishment report

2.1 Introduction of Prepare work accomplishment report

Every work must be Prepare work accomplishment report to an employer and minor accidents reported to a supervisor, safety officer or first aider and the details of the accident and treatment given suitably documented.

- The report should also include the following information:

- your name
- the address of the property to be inspected
- reason for the inspection
- the date of inspection
- the scope of the inspection
- a list of any area or item that wasn't inspected, the reasons why it wasn't inspected and if necessary, a recommendation for further investigation
- a summary of the overall condition of the property
- a list of any significant problems that need fixing
- if necessary, a recommendation that a further inspection or assessment be carried out by a suitably accredited specialist, e.g. pest inspector, electricity supply authority, water supply authority, structural engineer, geotechnical engineer, surveyor or solicitor.
- *The summary*
  The summary is possibly the most important part of the report. It should give you a brief summary of the major faults found in the property and its overall condition considering its age and type

2.2 Type of Prepare work accomplishment report

1. An Electrical Installation Condition Report (EICR)
2. Accident reports

1. An Electrical Installation Condition Report (EICR) will provide a full summary of the condition of the electrics in your home and determine whether it complies with the current .It will record a number of observations in line with BS 7671 and make various recommendations where improvement may be necessary or beneficial to improving safety in your home. Once the EICR is completed the registered contractor will provide you with a certificate outlining the overall condition of the electrical installation. Generally, an EICR will provide coding against the condition of the installation. The classification codes are as follows:

✓ Code C1 - This code should indicates that danger exists, requiring immediate remedial action. The persons using the installation are at immediate risk.

- ✓ Code C2 - This code indicates that, whilst an observed deficiency is not considered to be dangerous at the time of the inspection, it could become a real and immediate danger if a fault or other foreseeable event was to occur in the installation or connected equipment.
- ✓ Code C3 - This code indicates that, whilst an observed deficiency is not considered to be a source of immediate or potential danger, improvement would contribute to a significant enhancement of the safety of the electrical installation. You are under no obligation to have any of the issues fixed, though it is recommended that corrective action to rectify any C1 and C2s is completed as soon as possible. If you do

The purpose of a condition report

An electrical Condition Report is a periodic test and inspection of an electrical installation. The purpose of the report is to check the condition of an installation, detecting and recording any factors that might affect safety. One of the reasons a report of this kind is necessary is to determine that the installation has not deteriorated or been damaged over time. An electrical condition report will determine the following aspects:

- how safe the installation is for the protection of people against electric shocks and burns
- the potential for fire and heat damage arising from electrical defects.
- check that the installation has not become unsafe through deterioration or damage
- check for defects or evidence of non- compliance with current regulations which may be dangerous

The NICEIC recommend that the installation of domestic properties are periodically inspected and tested every 10 years, however there may be other reasons why an inspection would need to be carried out more often, including:

- The age of the installation (over time, the condition of an electrical installation can deteriorate)
- Environmental factors (external locations for example, can affect the speed of deterioration and lead to corrosion of electrics)
- Damage to the installation (through vandalism for example)
- Type of property (caravan parks and swimming pools for example, should be tested annually)
- Use of property (change of occupancy for rental for example)
- Changes in legislations
- general concerns the occupant may have regarding the install

2. Accident reports

Every accident must be reported to an employer and minor accidents reported to a supervisor, safety officer or first aider and the details of the accident and treatment given suitably documented. A first aid logbook or accident book such as that shown in containing first aid treatment record sheets could be used to effectively document accidents which

occurring the workplace and the treatment given. Failure to do so may influence the payment of compensation at a later date if an injury leads to permanent disability. To comply with the Data Protection Regulations,

If the accident results in death, serious injury or an injury that leads to an absence from work of more than 3 days, then your employer must report the accident to the local office of the HSE. . They will require the following information:The name of the person injured.

- ●A summary of what happened.
- ●A summary of events prior to the accident.
- ●Information about the injury or loss sustained.
- ●Details of witnesses.
- ●Date and time of accident.
- ●Name of the person reporting the incident.

The Incident Control Centre will forward a copy of every report they complete to the employer for them to check and hold on record. However, good practice would recommend an employer or his representative make an extensive report of any serious accident that occurs in the workplace. In addition to recording the above information, the employer or his representative should

2.3 Factors affecting the report

There are certain conditions you should be aware of that will affect the final report. These include:

- problems that are difficult to detect due to weather or other conditions such as rising damp and leaks
- the information you provide to the consultant
- the specific areas of the consultant's 'expertise' as specified in the report
- problems that may have been deliberately covered up to make an area appear problem free.

It may be difficult to detect leaks and other problems if services, such as water, have not been used for some time. For example, if the shower has not been used recently, leaks or dampness may not be obvious

Self-Check -2	Written Test

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

1. _____Type of Prepare work accomplishment report (3 points)

B. An Electrical Installation Condition Report (EICR)

C. Accident reports

D. all

2.EICR means(3point)

A .Electrical Installation Condition Report.

B. Electrical Installation Report Condition.

C. Electrical Condition Installation Report.

D. Electrical Condition Report Installation.

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

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Operation Sheet 1	Inspect & notify completion of work

OPERATION TITLE:

PURPOSE: To enable trainees develop skill how to Inspect & notify completion of work project and how to preparing the requirement of project

Procedure:

step1. select tools, measuring instrument and equipment

step2. check tools, material and equipment

step3. placing of tools, material and equipment

step4. Identify un planning condition

step5. Report un planning condition for supervisor

step6.Check the output

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates/guides, workshop, tools and materials you are required to perform the following tasks within 2:30 hours.

Task 1: Using the given template, Report is done to relevant people those necessary variations to the planned programmer of work

Task 2: Using the given template Perform The appropriate action is sought from the relevant people

Task 3: Using a given template, completing OHS procedures and regulations are observed throughout the process of installation

List of Reference Materials

1. Type of Prepare work accomplishment report https://www.youtube.com/watch?v=XOdPJDS TvjM
2. Signals, Lighting & ITS Systems Installation and Inspection Traininghttps://dps.mn.gov/divisions/ojp/forms-documents/Documents/Wilder_Program_Evaluation_8.pdf
3. Electrical wiring www.eaton.uk.com/electrical.
4. Accident reports Available on: http://www.sustainablejersey.com/actions certification/actions/?type=1336777436&tx_sjcert_action%5BactionObject%5D=90&tx_sjcert_action%5Baction%5D=getPDF&tx_sjcert_action%5Bcontroller%5D=Action&cHash=d8896df5ca9909fc37fd61db1c3b38da

Ethiopian TVET-System

TTLM

BUILDING ELECTRICAL INSTALLATION

LEVEL II

Learning Guide-#4

Unit of Competence: Install and Terminate Wiring System

Module Title: Installing and Terminating Wiring System

LG Code: EISBEI2 M01 LO4-LG-26

TTLM Code: ELS BEI2 M07 TTLM 0919v1

LO 4:Clean up

Instruction Sheet	Learning Guide #1

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

4.1.Clearing Work area and disposing of, reusing or recycling materials

4.2 Cleaning, checking maintaining and storing plant, tools & equipment

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**:

4.1 Clear Work area and dispose of, reuse or recycle materials

4.2 Clean, check maintain and storing plant, tools & equipment

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2,and Sheet 3 ”.
4. Accomplish the “Self-check 1, Self-check t 2,and Self-check 3” **in page -127, 131, and 135**respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ”**in page -.**
6. Do the “LAP test” **in page –** (if you are ready).

Information Sheet-1	Clearing Work area and disposing of, reusing or recycling materials

1.1 Introduction of Disposing and storing waste materials

1.1.1 Storing Materials

The Contractor shall supply, erect, maintain and clear away on completion, suitable workshops, storerooms, offices and sheds as necessary for the sub-contract works. All materials are to be stored in a manner to avoid damage and/or deterioration thereto.

1.1.2 Waste Disposal

The regular collection, grading and sorting of scrap contribute to good housekeeping practices. It also makes it possible to separate materials that can be recycled from those going to waste disposal facilities.

Allowing material to build up on the floor wastes time and energy since additional time is required for cleaning it up. Placing scrap containers near where the waste is produced encourages orderly waste disposal and makes collection easier. All waste receptacles should be clearly labeled (e.g., recyclable glass, plastic, scrap metal, etc.)

1.2 The Importance of Proper Waste Disposal

- Home → environmental cleanup → The Importance of Proper Waste Disposal

Proper waste disposal is critical due to the fact that certain types of wastes can be hazardous and can contaminate the environment if not handled properly. These types of waste also have the potential to cause disease or get into water supplies. There are rules and regulations in place for how specific types of waste should be disposed of. Following them allows for toxic waste to be safely discarded without the risk of environmental contamination.

- Proper Waste Disposal and the Government

The majority of the laws associated with waste disposal are regulated and enforced by the Environmental Protection Agency (EPA). The general health of the public . This Act is what gave the EPA the necessary authority to monitor hazardous waste disposal.

- Proper Waste Disposal and Environmental Health

Hazardous wastes that are not properly disposed of can leak and contaminate soil and water, which can lead to issues with both the environment and human health. Burning the wrong types of waste can release gases into the atmosphere. When waste is properly discarded, special liners are used to prevent toxic chemicals from leaking out and precautions are taken so that any methane related to burning trash is safely contained.

- Proper Waste Disposal and Public Health

When waste is disposed of properly, it helps to prevent additional pollution which can improve public health. Polluted air increases the risk of respiratory illness. Waste that is properly disposed of has a lesser chance of getting into the water supply and causing illness. In the 1980s, there was an incident in New Jersey in which unregulated dumping led to a chromium poisoning epidemic in a local school

1.3 **PRINCIPLES OF Disposing and storing waste materials**

Proper waste disposal begins with good waste management by the researcher, including

- ✓ minimum waste generation
- ✓ reusing surplus materials, and
- ✓ recycling of appropriate (*i.e.*, uncontaminated) waste.

The generated waste must be properly collected and stored, paying close attention to labeling, segregating according to chemical compatibility, and accumulating in a well-ventilated location. This location should be well labeled. Other laboratory waste items such as sharps and glass must also be disposed of with care in appropriately labeled and compatible containers.

1.4 PROCEDUREOF Disposing and storing waste materials

1. Waste Management

1. Users should make an effort to keep waste to a minimum. The best way to do so is by reducing the scale of operation, which minimizes the quantity of waste generated. Whenever possible, chemicals used should be substituted with less hazardous chemicals.
2. Chemical quantities should be kept to a minimum. Store only what will be used in the near term.
3. Besides preventing or minimizing waste generation, chemicals should be recycled or recovered for reuse.
4. When waste is generated, it must be disposed of properly. Sink disposal may not always be appropriate and may end contaminating drinking water. Alternative methods of disposal should be considered including incineration, treatment, and land disposal. The institute's EHS office should be consulted to determine the proper disposal method for different waste types.

2. Waste Collection and Storage

1. When generating or managing any chemical waste, appropriate personal protective equipment (PPE) must be worn, and engineering controls should be implemented as necessary.
2. Collect and store chemical waste at or near the point of generation in a designated satellite accumulation area. This accumulation area should be well marked for easy identification.
3. Chemical waste must be stored in compatible containers with closed and properly fitted caps.
4. Waste containers must be labeled mentioning chemical compositions, the accumulation start date, and hazard warnings as appropriate. The institute's EHS office typically provides these required labels.
5. Incompatible waste types should not be mixed and should be kept separate in order to avoid any reaction, heat generation, and/or gas evolution.
6. Waste containers should be stored in secondary containers in a ventilated, cool, and dry area.

7. In the central accumulation area, waste containers should be grounded to avoid fire and explosion hazards.
8. Trained laboratory researchers who are most familiar with the waste generated should work with EHS to ensure proper waste management.

3. Sharps Disposal - Syringes and Needles

1. Chemically contaminated needles, syringes, and razor blades should be disposed of inside a proper sharps container.
2. Syringes or needles must never be disposed of in a laboratory waste bin or a general waste container.

4. Glass Recycling

1. Recycling glass is friendly to the environment as it reduces pollution caused by the waste ending up in landfill sites. Every laboratory should have a separate recycling bin dedicated to glass.
2. Clean empty glass bottles and broken glassware may be recycled. To clean an empty glass bottle, it must be "triple rinsed" with water or another suitable solvent and air-dried before disposal.
3. Chemically contaminated laboratory glassware such as sample tubes, droppers, and glass wool must be disposed of as controlled waste.

1.5 Six Waste Disposal Methods

1. Preventing or reducing waste generation: Extensive use of new or unnecessary products is the root cause of unchecked waste formation.

2. Recycling: serves to transform the wastes into products of their own genre through industrial processing. Paper, conduit, wires, and plastics are commonly recycled. It is

environmentally friendly to reuse the wastes instead of adding them to nature. However, processing technologies are pretty expensive.

3. Incineration: Incineration features combustion of wastes to transform them into base components, with the generated heat being trapped for deriving energy lines

4. Composting: It involves decomposition of organic wastes by microbes by allowing the waste to stay accumulated in a pit for a long period of time

5. Sanitary Landfill: This involves the dumping of wastes into a landfill. The base is prepared of a protective lining, which serves as a barrier between wastes and ground water, and prevents the separation of toxic chemicals into the water zone. Waste layers are subjected to compaction and subsequently coated with an earth layer. Soil that is non-porous is preferred to mitigate the vulnerability of accidental leakage of toxic chemicals.

6. Disposal in ocean/sea: Wastes generally of radioactive nature are dumped in the oceans far from active human habitats. However, environmentalists are challenging this method, as such an action is believed to spell doom for aquatic life by depriving the ocean waters of its inherent nutrient.

Self-Check -1	Written Test

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

1.The important o f disposing and storing waste material.(3 points)

A .environmental cleanup C. Proper Waste Disposal and the Government

B. Proper Waste Disposal and Environmental Health

D. all

2.List out the *procedure of* disposing and storing waste material.(**5 points)**

3.the principles of Disposing and storing waste materials(2point)

A. recycle ling of appropriate B refusing of surplus material C .all

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

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet- 2	Cleaning, checking maintaining and storing plant, tools & equipment

2.1 Concepts of Maintaining plant, tools & equipment

2.1.1 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 areas as diverse as

2.1.2 Plant and equipment maintenance

Maintenance on plant and equipment is carried out to prevent problems arising, to put faults right, and to ensure equipment is working effectively.

Maintenance may be part of a planned programmed or may have to be carried out at short notice after a breakdown. It always involves non-routine activities and can expose those involved (and others) to a range of risks.

2.1.3Maintaining plant, equipment

Maintenance of Electrical Equipment In Buildings (photo credit: Critical Power Testing and Maintenance, LLC. - cptam.com)

While it is appreciated that breakdown of plant may result in costly interruption of normal building operation, it must also be borne in mind that stopping plant for maintenance canalso cause a loss in production**.**

Equipment on continuous and arduous duty, e.g. switchboards, motor control centers (MCCs), air-handling units, chiller plant etc., require more attention than that which is lightly loaded and rarely used

2.2 Important maintenance of plant and equipment

An effective maintenance programmed will make plant and equipment more reliable. Fewer breakdowns will mean less dangerous contact with machinery is required, as well as having the cost benefits of better productivity and efficiency.

Additional hazards can occur when machinery becomes unreliable and develops faults. Maintenance allows these faults to be diagnosed early to manage any risks. However, maintenance needs to be correctly planned and carried out. Unsafe maintenance has caused many fatalities and serious injuries either during the maintenance or to those using the badly maintained or wrongly maintained/repaired equipment

2.3 Steps **of maintenance of plant and equipment**

1. Standardization of Equipment

The use as far as possible of standard items such as switchgear will help both in buying, stockholding and replacement of components on the most economic and convenient basis

2. Establishment of Records on Breakdown

Initially this may be on a simple log book or card system. This information should give some idea of which plant requires attention and at what intervals. It may also lead to improvements to the plant itself which will reduce the frequency of future failures.

3. Frequency of Maintenance

This requires careful organization to ensure that it fits in with operational requirements. All planned maintenance should therefore have been agreed with the relevant operation manager-prior-to-implementation.

4. Economic of Routine Maintenance

It may not be economic or practical to include some equipment in a scheduled routine although safety inspections will still need to be carried out

5**.** Upgrading to More Efficient Plant

Energy saving can be achieved by changing the type of equipment in use, for example:

1. Replacement of less efficient lamps with more energy efficient lamps.
2. Replacing electro-mechanical control devices to electronic systems.
3. Installing new high efficiency motors to replace old motors particularly where extended duty operations prevail.
4. Retrofitting VSDs for flow control of fans or pumps.

The economics of changing inefficient existing systems, which are continuing to provide a satisfactory operational performance, obviously requires careful consideration. Not only the

costs of new equipment need to be understood, but also equipment life can have a significant impact on the overall financial viability of any proposed changes

6.Emergency Maintenance

The emergency maintenance can hardly be regarded as maintenance in the sense that, in many cases, it consists of an urgent repair to, or replacement of, electrical equipment that has ceased to function effectively

7.Planned Maintenance

In the use of electrical plant and equipment there are obviously sources of danger recognized in the Electricity (Wiring) Regulations.

These regulations are mandatory and serve to ensure that all electrical plants and equipment are adequately maintained and tested to prevent any dangerous situation arising that could harm the users of such equipment or the building occupants

2.1.1 **type of Maintenance**

- Time Based Maintenance (TBM)
- Failure Finding Maintenance (FFM)

- Risk Based Maintenance (RBM)
- Condition Based Maintenance (CBM)
- Predictive Maintenance (PDM)

Self-Check -2	Written Test

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

1 .Electrical maintenance covers(2point)

A .testing B .fixing

C. replacing D. all

2.Maintanance of electrical equipment in building (2point)

A .photo credit B. critical power testing

C. maintenance of LLC D. all

3.Explain the steps of maintenance of Maintaining plant, tools & equipment(2point)

4.What is Important maintenance of plant and equipment?(2point)

5 Why is maintenance of plant and equipment important**?(2point)**

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below5points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Operation Sheet 1	Clean up

PURPOSE: To enable trainees develop skill how to clean up the work Project

PROCEDURE:

step1. supply first of all safety requirement

step2. Supply materials and tools cleaning

step3. Supply materials and tools in the in the bill of quantity

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates/guides, workshop, tools and materials you are required to perform the following tasks within 2:30 hours.

Task 1: Using the given template, Report is done to relevant people those necessary variations to the planned programmed of work

Task 2: Using the given template Perform The appropriate action is sought from the relevant people

Task 3: Using a given template, completing OHS procedures and regulations are observed throughout the process of installation

No.	Name of participants	Region	College	Job	Phone.no.	Remark
1	Zelallem Taye Gedifew	Amhara	ANRST TVETD office	Team leader of curriculum	0918021238	
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4	Salahadin Hussien	Addis abeba	Kirkos manufactur ing	Instructor	0923067374	
5	Elias Getachew	Addis abeba	Misrak poly Technic	Instructor	0913811386	
6	Mesfin Bekele	Addis abeba	Addis ketema	Instructor	0916843021	
7	Rahel Ouma	Somalia	Jijiga poly technic	Instructor	0913343840	
8	Getinet Melkie	Somalia	Jijiga poly technic	Instructor	0911802534	
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