

Building Electrical installation

Level-II

Based on June 2022, Curriculum Version 1



Module Title: - Electrical Apparatus installation

Module code: EIS BEI2 M09 0822

Nominal duration: 80 Hour

Prepared by: Ministry of Labor and Skill

August, 2022

Addis Ababa, Ethiopia

Acknowledgment

Ministry of Labor and Skills wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry experts who donated their time and expertise to the development of this Teaching, Training and Learning Materials (TTLM)

Table of contents	page
Acknowledgment.....	i
Table of contents	ii
LIST OF FIGURE	iii
Acronym and Abbreviation	iv
Introduction to the Module	5
Unit one : Electrical apparatus.....	5
1. Introduction to Electrical apparatus	6
1.1.1. Types of electrical apparatus.....	6
1.2. Checking and testing electrical apparatus.....	22
1.2.1. Checking working condition of apparatus	22
1.2.2. Testing of electrical apparatus.....	23
1.3. Safety requirements on electrical apparatus installation.....	24
1.4. Installing location of apparatus.....	25
Self check -1	26
Unit two: Installing Electrical apparatus	27
2.1. Electrical apparatus installing procedure	27
2.2. Termination and connection of electrical apparatus.....	29
2.2.1. Soldering	29
2.2.2. Insulation Displacement Connections.....	29
2.2.3. Crimping	30
2.3. Faults and remedy in electrical apparatus	31
2.3.1. Most common types of electrical faults	31
2.3.2. Methods to fix each electrical fault	33
Self-check-2.....	34
Unit three: Completion of installation work	35
1.1 Inspection and testing of electrical apparatus installation	35
Self-check-3.....	45
Unit Four: Cleaning methods of electrical apparatus	46
4.1. Cleaning of electrical apparatus.....	46
4.2. Storing tools and equipment	49
Self-Check 4.....	51
References	52

LIST OF FIGURE

Figure 1. 1 Room heater.....	7
Figure 1. 2 different types of water heater	7
Figure 1. 3 refrigerator	8
Figure 1. 4 cloth dryers	8
Figure 1. 5 cooking appliance	9
Figure 1. 6 electric Oven and plate stove	9
Figure 1. 7 electric AC motor	10
Figure 1. 8 different types of lamps	10
Figure 1. 9 different types of generator	11
Figure 1. 10 solar panel without storage battery	12
Figure 1. 11 solar panel with storage battery	12
Figure 1. 12 different types of transformers	13
Figure 1. 13 construction of transformers	14
Figure 1. 14 a wiring diagram with ON and OFF switch.....	14
Figure 1. 15 toggle switch.....	17
Figure 1. 16 pull switch	17
Figure 1. 17 knife switch	18
Figure 1. 18 socket with three outlets	19
Figure 1. 19 different types of socket outlet	19
Figure 1. 20 socket outlet with switch and pilot lamp	20
Figure 1. 21 Bayonet cap lamp holder	20
Figure 1. 22 Edison screw cap lamp holder.....	21
Figure 1. 23 pin type socket lamp holder	21
Figure 1. 24 The location of the sockets in the kitchen	25

Acronym and Abbreviation

EBCS	Ethiopian Building Code Standard
IEC	International Electro technical Commission
IEEE	Institute of Electrical and Electronics Engineers

Introduction to the Module

This module is designed to meet the industry requirement under the Building Electrical Installation level II occupational standard, particularly for the unit of competency: **Installing Electrical apparatus** which covers the knowledge, skills and attitude required the knowledge, skills and altitude needed for Installation of electrical apparatus by a worker to Identify, install and testing electrical apparatus functionality.

This module covers the units:

- Electrical apparatus
- Installing Electrical apparatus
- Completion of installation work
- Cleaning methods of electrical apparatus

Learning Objective of the Module

- Introduction to Electrical apparatus
- Safety measures in apparatus installation
- Testing and Checking working condition of apparatus
- Installing location of apparatus

Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” giver at the end of each unit and
5. Read the identified reference book for Examples and exercise

Unit one : Electrical apparatus

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

- 1.1. Introduction to Electrical apparatus
- 1.2. Checking and testing electrical apparatus
- 1.3. Safety requirements on electrical apparatus installation
- 1.4. Installing location of apparatus

This unit will also assist you to attain the learning outcomes stated in the contents and topics. Specifically, upon completion of this learning guide, you will be able to:

- Introduce Electrical apparatus
- Describe safety measures in apparatus installation
- Test and Check working condition of apparatus
- Identify Installing location of electrical apparatus

1. Introduction to Electrical apparatus

Electrical apparatus means any appliances, fittings, lamps or other apparatus designed for operation by or in connection with electricity, and any articles or fittings of any kind for use in connection with any such apparatus.

Electric apparatus shall mean any condenser, conductor, transformer, adapter, electrical generator, electrical appliance or any article through which or by means of which electricity is carried, consumed or created.

A home appliance, also referred to as a domestic appliance, an electric appliance or a household appliance, is a machine which assists in household functions such as cooking, cleaning and food preservation.

1.1.1. Types of electrical apparatus

A. Electric energy consuming apparatus

Consuming apparatus means an apparatus which is intended to consume electricity, some of them are mentioned below

❖ Heaters

By far the biggest user of energy in homes are heaters, accounting for **31.3%** of a home's total energy consumption. Here then is where the greatest focus should be applied for reducing energy



Figure 1. 1 Room heater

❖ **Water Heaters**

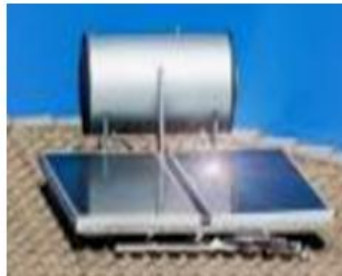
Using **13.6%** of a home's energy, water heaters are the second-biggest consumer. A necessity for year-round use, finding energy-efficient solutions is a priority when looking to reduce consumption. One way is to install a tankless water heater, due to the fact that they only heat water as and when it is needed, as opposed to continuously heating water throughout the day. Another option that uses renewable energy is a solar water heater.



Conventional water heater



instant water heater



solar water heater



immersion water heater

Figure 1. 2 different types of water heater

❖ **Cooling Appliances**

To cool a house requires significantly less energy than to heat it, with 10.7% of the total. However, it is still number 3 on the list and therefore one of the areas where focus on energy efficiency efforts should be made.

❖ Refrigerators

The refrigerator in a home consumes 4% of the total energy. As mentioned, newer appliances use up less energy, so switching to a smart fridge is recommended. Smart fridges also alert owners if there is a problem. As always with new appliances, Energy Star-rated ones are best for lowering energy usage.

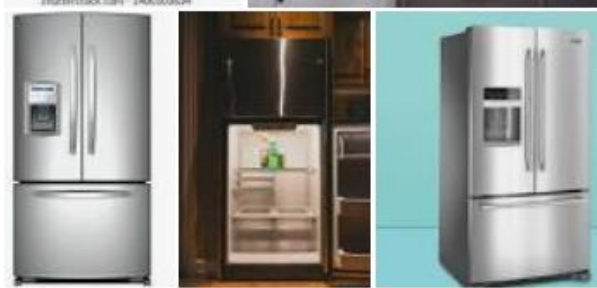


Figure 1. 3 refrigerator

❖ Clothes Dryers

As with refrigerators, a clothes dryer is another appliance that can be replaced with a newer, Energy Star-rated version. Clothes dryers use up 3.2% of a home's energy, so cutting down on dependence on them helps. People should take advantage of line drying whenever possible.



Figure 1. 4 cloth dryers

❖ Cooking Appliances

Cooking appliances in the kitchen use up 1.3% of the total home energy usage. Although not a staggering amount by itself, it can still be reduced quite simply by adjusting habits accordingly. Some examples are using the correct sized pots and pans, choosing the right appliance, and keeping the appliances clean.



Figure 1. 5 cooking appliance



Electric Oven



electric stove



Figure 1. 6 electric Oven and plate stove

❖ Computers

Computer and computing equipment uses 1.1% of the energy consumed at home. Shutting computers off completely at night will help reduce this amount. There are also computers which are more energy-efficient than others, meaning it's wise to shop around when it's time to buy a new one.

❖ Electrical Motor

An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft. Electric motors can be powered by direct current (DC) sources, such as from batteries, or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators.

Applications include industrial fans, blowers and pumps, machine tools, household appliances, power tools, vehicles, and disk drives. Small motors may be found in electric watches.



Figure 1. 7 electric AC motor

❖ Lighting

Lighting a home uses **2.8%** of the total energy consumption. Although it may not be a huge amount on its own, combining energy-saving efforts with other appliances will have a greater impact. Switching to smart lighting that detects when a person leaves a room will help save energy.



Figure 1. 8 different types of lamps

B. Power generating apparatus

❖ Generator

An electric generator is mechanically identical to an electric motor, but operates with a reversed flow of power, converting mechanical energy into electrical energy

Generators work by rotating a coil of wire in a magnetic field, causing a current to flow in the wire. A generator may be a huge spinning turbine powered by water, wind, steam, gas, or nuclear reactions, which sends electricity out through power lines to thousands of customers.



Figure 1. 9 different types of generator

❖ Solar panel

Solar panels (also known as "PV panels") are used **to convert light from the sun**, which is composed of particles of energy called "photons", into electricity that can be used to power electrical loads.

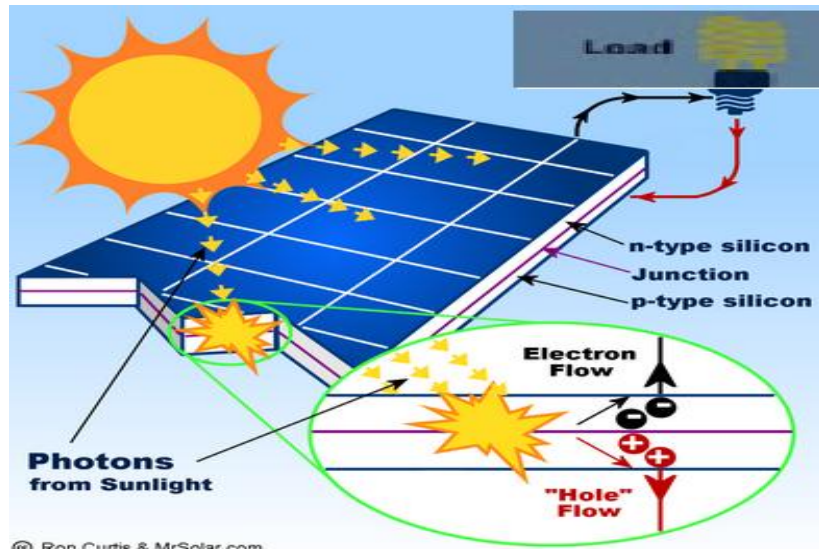


Figure 1. 10 solar panel without storage battery



Figure 1. 11 solar panel with storage battery

C. Power transmission apparatus

❖ Transformer

A transformer basically is very simple static (or stationary) electro-magnetic passive electrical device that works on the principle of **Faraday's law of induction by converting electrical energy from one value to another.**



Electronics apparatus transformer



distribution transformer

Figure 1. 12 different types of transformers

❖ Construction of transfer

The construction of transformer is iron core laminated with steel bands. Core laminations are constructed from insulated metal thin metal strips. These laminations are separated and wound around the limb using a sheet of coat or parchment. The winding consists of two types, main and secondary winding.

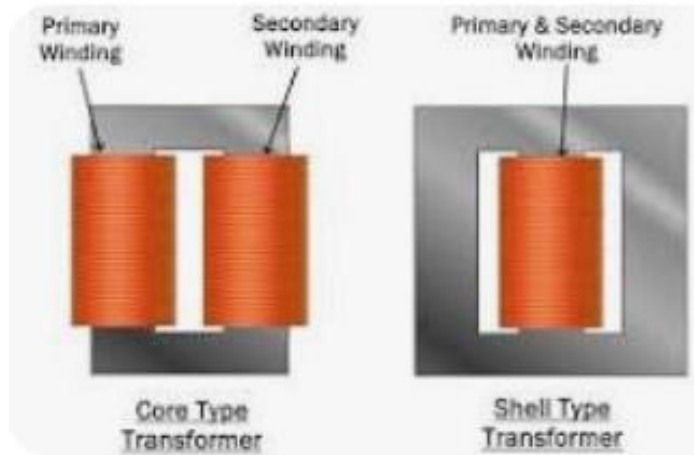


Figure 1.13 construction of transformers

D. Outlet Fittings

❖ Switch

A Switch is a device which is designed to interrupt the current flow in a circuit. In simple words, a Switch can make or break an electrical circuit. Every electrical and electronics application uses at least one switch to perform ON and OFF operation of the device. So, switches are a part of the control system and without it, control operation cannot be achieved.

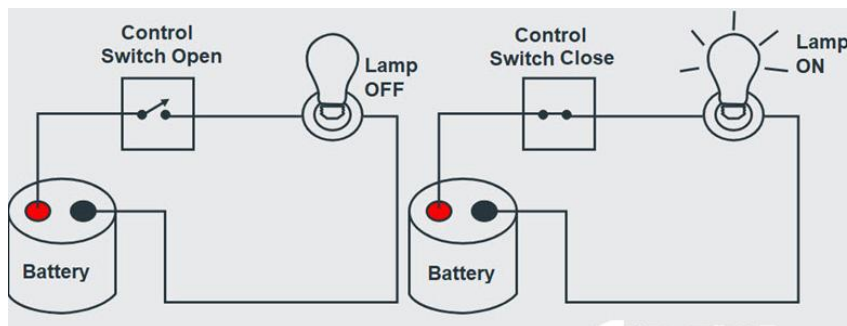


Figure 1.14 a wiring diagram with ON and OFF switch

There are numerous applications of switch, found in wide variety of fields such as homes, automobiles, and industrial, military, aerospace and so on. In home and office applications, we use simple rocker switches to turn ON and OFF appliances like lights, computers, fans etc. In some applications, multi way switching is employed (like building wiring), where two or more

switches are connected to control an electrical load from more than one location, like a Two Way and four way switch.

➤ **Characteristics of a Switch**

- The two important characteristics of a switch are its Poles and Throws. A pole represents a contact and a throw represents a contact-to-contact connection. Number of poles and throws are used to describe a switch.
- Some standard numbers of poles and throws are Single (1 pole or 1 throw) and Double (2 poles or single throw switch) and single pole double throw switch (two-way switch)
- Another important characteristic of a switch is its action i.e., whether it is a Momentary or Latched action. Momentary Switches (like push buttons, for example) are used to make momentary contact (for a brief time or as long the button is pressed).
- Latched Switches on the hand, maintain the contact until it is forced to the other position.

➤ **Types of Switches**

Basically, Switches can be of two types. They are:

- Mechanical
- Electronic

Mechanical Switches are physical switches, which must be activated physically, by moving, pressing, releasing, or touching its contacts.

Electronic Switches, on the other hand, do not require any physical contact in order to control a circuit. These are activated by semiconductor action.

- Mechanical Switches

Mechanical switches can be classified into different types based on several factors such as method of actuation (manual, limit and process switches), number of contacts (single contact and multi contact switches), number of poles and throws (SPST, DPDT, SPDT, etc.), operation and construction (push button, toggle, rotary, joystick, etc.), based on state (momentary and locked switches), etc.

➤ **Switch classification based on number of poles and throws**

- A Single Pole Single Throw (SPST) switch is a switch that only has a single input and can connect only to one output. This means it only has one input terminal and only one output terminal
- Single pole double throw switch is a single input with two different output switches is called Single Pole Double Throw switch (SPDT). Using this we can control two different circuits with the same single input
- A double pole single throw switch controls two circuits (poles) and has 2 states an “on” (closed) state and an “off” (open) state. A double pole single throw has four terminals in total, two inputs and two outputs which are all controlled by the same switch
- A changeover switch is designed to transfer a house (or business) electricity from the commercial power grid to a local generator when n outage occurs. Also known as “transfer switches,” they connect directly to the generator, commercial power supply or line, and the house

➤ **Switch classification based on operation and construction**

Toggle switch

- A toggle switch is manually actuated (or pushed up or down) by a mechanical handle, lever or rocking mechanism. These are commonly used as light control switches.
- Most of these switches come with two or more lever positions which are in the versions of SPDT, SPST, DPST and DPDT switch. These are used for switching high currents (as high as 10 A) and can also be used for switching small currents.
- These are available in different ratings, sizes and styles and are used for different type of applications...



Figure 1. 15 toggle switch

Pull Chain / Pull Cord Switch

A Pull Chain or Pull Cord switch is often used in ceiling fans, basement lights and also in garages. It consists of a chain or cord and pulling the chain once activate the light and pulling the chain a second time turns off the light.

The chain is usually made up of a non-conductive beads or cloth rope and is very useful in damp environments

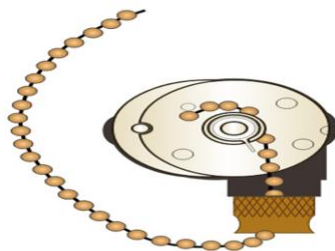


Figure 1. 16 pull switch

Knife switch

A knife switch is a type of switch used to control the flow of electricity in a circuit. It is composed of a hinge which allows a metal lever, or knife, to be lifted from or inserted into a slot or jaw. The hinge and jaw are both fixed to an insulated base, and the knife has an insulated handle to grip at one end

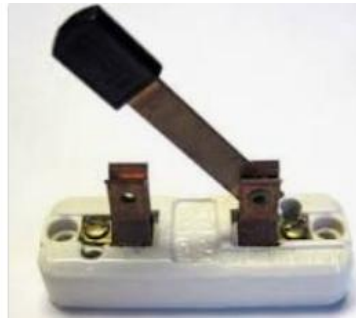


Figure 1. 17 knife switch

❖ Socket out let

AC power plugs and sockets connect electric equipment to the alternating current mains electricity power supply in buildings and at other sites. Electrical plugs and sockets differ from one another in voltage and current rating, shape, size, and connector type.

An electrical outlet works as a bridge between electrical equipment and electricity supply. It's a device that looks like a socket and is installed in the walls. On some occasions, you may find them in the floor and ceiling too, for powering up setups like neon signs and door openers. There are different types of electrical outlets for various functions. Sometimes, it is possible to convert between the types and adjust the voltages by using adapters.

➤ Are Electrical Outlets and Receptacles the Same?

These terms are interchangeable and refer to the same device. You may hear the names plugs or plug-ins too, but these are correct for a male cord end. The outlet or receptacle is a female end that houses the prongs of a male connector. You can describe it as an opening, or a series of openings, that draw power from a wired source and supply it to the connected electrical equipment and components.



Figure 1. 18 socket with three outlets

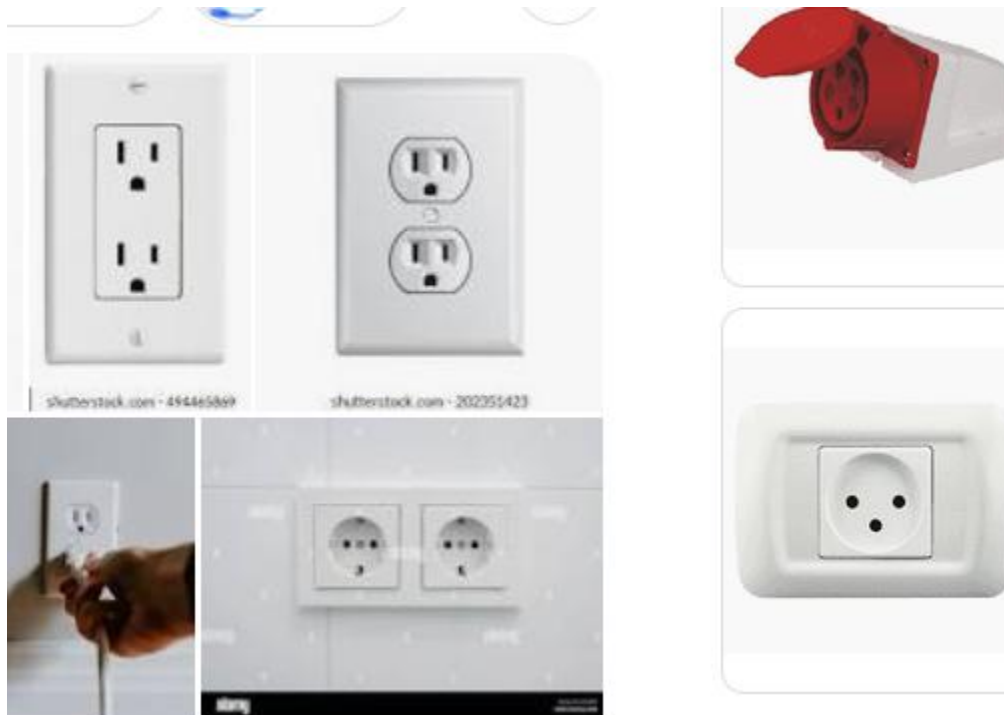


Figure 1. 19 different types of socket outlet

➤ Switched Outlets

It's an outlet with a switch, which you can use to keep the power on and off. It lets you control the electricity supply and turn it on and off whenever you want. It comes handy when you want a device to keep plugged but not switched at all the time



Earth Socket (British Type) with Switch and Pilot Lamp
13A - 250V~

Figure 1. 20 socket outlet with switch and pilot lamp

❖ **Lamp holder**

- A lamp holder is the device which holds a light bulb or lamp. It's important that the lamp holder is compatible with the type of bulb we want to use, with the wrong base selection will not fit in the lamp or fixture.
- Light bulb sockets are normally defined by a **letter-number-letter** (Third Letter is optional).
- The first letter indicates the shape of the base.
- The Second numbers indicates either the width of the base or the distance between the pins.
- The Third Letter indicates the number of pins or contacts on the lamp. The numbers are normally in millimeters.

Type of lamp holder Sockets:

➤ **Bayonet Cap (B / BC / SBC):**



Figure 1. 21 Bayonet cap lamp holder

- The “B” refers to the style of Base which is a Bayonet, and the 22 means it has a 22 mm base width.
- **Application:** All Regular type of Bulbs including specialist low voltage halogen lamps

➤ Edison Screw Cap (E / ES):

- Named as inventor Thomas Edison, the Edison Screw or “ES” lamp fitting is used in a vast range of applications.

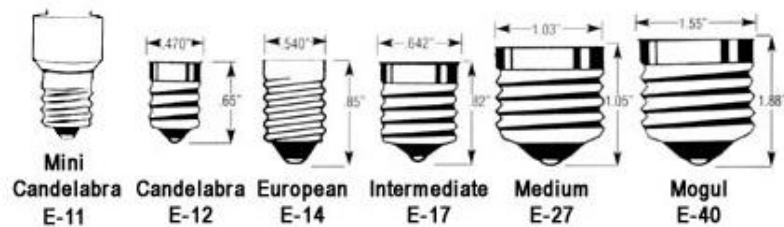


Figure 1. 22 Edison screw cap lamp holder

- Type of Connection:** “Screw” Action.
- The Second number indicates the width of the base (normally in millimeters).
- Example:** E26 base.
- The “E” refers to the style which is an Edison screw-in, and the 26 means it has a 26 mm base width.
- Application:** Large chandeliers Some Decorative Lamps.
- The most commonly used screw fittings are shown in the table below. Other, less frequently used, sizes include E11, E17 and E26.

➤ Bi pin type socket

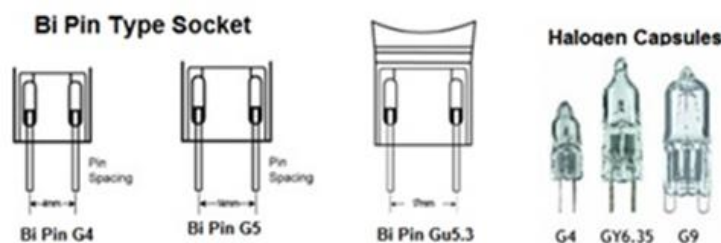


Figure 1. 23 pin type socket lamp holder

- The “G” type of lamp base is used to as a “pinned” base. This may be several Numbers of different Types of pins.
- Type of Connection:** “Pin” Type
- Application:** Halogen, Compact Fluorescent ,LED Types Bulbs

1.2. Checking and testing electrical apparatus

1.2.1. Checking working condition of apparatus

All apparatus/devices to be installed needs to be check first for damages, defects, functionality, brand, quality and beauty before installing them.

1. Check the apparatus physical condition
2. Check all the parts, some might be missing
3. Test the functionality of the apparatus, by using multi-tester
4. Plug-in the apparatus to the power supply
5. Switch on

➤ Equipment accessibility

- Equipment parts shall be so arranged that they are readily accessible for inspection, adjustment or removal without disturbance or removal of adjacent equipment
- Location of cables and looms Cables and cable looms shall be run clear of apparatus in order to not impede access for maintenance.
- Cables and looms shall be clear of high temperature and electrical arcing areas. Heat or arc barriers shall be provided where it is not possible to avoid such areas.
- Cables and cable looms shall not run over or be located near sharp edges. Allowance for the possibility of displacement in service shall be accommodated.
- Cable trays, cable trucking, conduits or any surfaces that may contact cables are to be cleared of any metallic swarf to prevent possible damage to cables
- Where cables pass through partitions, suitable bushes or other suitable protection shall be provided to assure the protection of the cables
- Cables shall be joined at terminals. Cables shall not be joined within a cable run.

➤ Break of cable gauge

- All cables shall have the capacity to perform their function without deterioration of their insulation in normal operation and under fault conditions. This requires the associated protection device for a given circuit to protect the smallest size, lowest capacity cable.

➤ Labels and rating plates

Page 22 of 54	Ministry of Labor and Skills Author/Copyright	Electrical apparatus installation	Version -1 August 2022
---------------	--	-----------------------------------	---------------------------

- Machines, equipment and devices shall be labelled for identification. Installation and mounting positions for all machines and equipment shall be labelled

➤ **Equipment labelling**

All machines shall carry a rating plate with the following information, as is appropriate to the equipment type;

- serial number
- manufacturer's type number
- current, voltage and power ratings and whether continuous or otherwise
- speed at rated current
- maximum speed

➤ **Position labelling**

The mounting position for apparatus shall be labelled so that the position is clearly identified with or without the apparatus in place.

1.2.2. Testing of electrical apparatus

➤ **Formal Inspections & Combined Inspections and Tests**

All electrical inspection and testing should be performed by a person who is competent in the safe use of the test equipment and who knows how to interpret the results obtained'

The following steps shall be undertaken:

Equipment being employed to undertake electrical equipment inspection and testing must be suitably maintained and calibrated according to the manufacturer's guidelines.

Before the equipment is tested it is subjected to a preliminary visual inspection. This visual inspection is the most important activity carried out on a piece of equipment,

. Testing will involve the following:

- Earth continuity test (Class I – earthed equipment only)
- Insulation resistance test. (Class I and Class II with unearth metal)
- Protective conductor / touch current measurement (if required)
- Functional check.
- Operation of RCD (where fitted).

1.3. Safety requirements on electrical apparatus installation

A. The common safety violations that lead to electrical accidents are:

1. NOT guarding live parts of 50 volts or more.
2. NOT having reliable equipment grounds run with the circuit supply conductors.
3. Using extension cords in place of permanent wiring.
4. Custom equipment that has not been reviewed for safety.
5. Failure to de-energize equipment before working on it.

B. Basic Safety Procedures:

1. Never bypass a fuse.
2. be sure all current carrying electric lines are well insulated.
3. Always check a circuit for voltage before servicing.
4. Know where all emergency shutdown switches are located.
5. Work on live circuits only when absolutely necessary.
6. Watch for burned wires on electrical devices.
7. Never touch a conductor without first testing.
8. Look for loose conductors in electrical systems.
9. Do not make any adjustment or repairs to any electrical equipment until all power has been disconnected or the circuit breaker has been turned off.
10. All electrical equipment and tools should be properly grounded to prevent any injury to the operator.
11. Do not operate electrical parts with wet gloves or wet clothing.

Caution: To prevent harmful body shocks, keep hands, feet and clothing dry. Use a dry board or rubber mat when water, moisture or perspiration cannot be avoided.

12. Never work alone when working with more than 50 volts.

C. Safety Practices around Live Circuits:

1. Use a reliable circuit tester or voltmeter to identify live circuits.
2. Stand on dry surface.
3. Use only one hand if possible.
4. Never keep tools lying around live conductors.
5. Wear suitable insulated hand covering.
6. Return all tools to pouch when through with them

1.4. Installing location of apparatus

The National Electrical Code specifies that each room in a house should have at least one switch to operate lights in the room, but it doesn't say anything about how high the switch should be. Many builders position switch boxes so the bottom of the box is 48 inches above the floor. To satisfy the accessibility requirements of the Fair Housing Act, however, the switch itself should be no more than 48 inches from the floor. To be accessible from a wheelchair, switches over cabinets should be lower.

When installing switches in a workshop, some woodworkers put them 52 inches from the floor so they can stand sheets of plywood against the wall without covering the switches.

The standard height for wall outlet boxes is about **12 inches from the top of the floor covering to the bottom of the receptacle box** (or 16 inches to the top of the box).

According to the European standard sockets are installed at a height 0,3 m, and switch the unit must be at a height of not less than and not less than, than 0,9 meters from the subfloor

Mounting height of distribution board

Heights commonly recommended are **between 1 meter (less in some countries) and 1.80 meters from the floor** (1.30 meters in situations where handicapped or elderly people are concerned

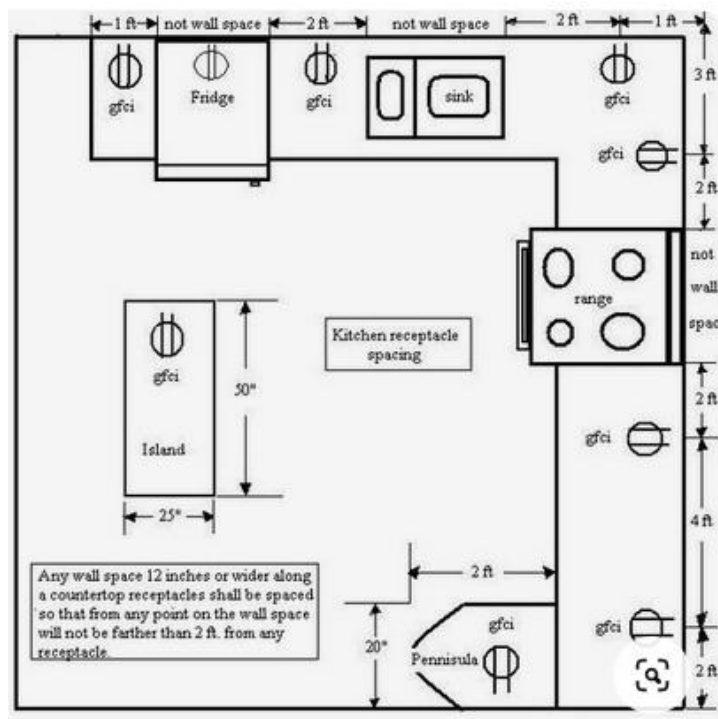


Figure 1. 24 The location of the sockets in the kitchen

Self check -1

Part-I Matching

❖ Part-I Matching

Instruction: select the correct answer for the given choice. You have given 1 Minute for each question. Each question carries 2 Point.

_____1. Convert mechanical energy to electrical energy A.
Transformer

_____2. Convert electrical energy to mechanical energy B. motor

_____3. A bridge between electrical equipment and electricity supply D. Generator

_____4. A switch often used in ceiling fans E. Pull Chain or Pull Cord

_____5. Change the voltage level F. socket outlet

G. solar panel

❖ Part-II give short and briefed answer for the following questions

1. Write at least four energy consuming apparatus. (8pts)
2. Describe the classification of switch based on numbers of poles and throws (8pts)
3. Mention **Safety Practices around Live Circuits** (5pts)
4. _____ is an apparatus that converts sun light to electric energy (2pts)
5. **Write the types of lamp holder based on their contact and base width.** (3pts)

Unit two: Installing Electrical apparatus

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

- Electrical apparatus installing procedure
- Termination and connection of electrical apparatus.
- Probable fault and remedy for electrical apparatus
- Installing electrical apparatus with earth protection

This unit will also assist you to attain the learning outcomes stated in the coverage contents and topics. Specifically, upon completion of this unit, you will be able to:

- Identify Electrical apparatus installing procedure
- Terminate and connect of electrical apparatus.
- Identify Probable fault and remedy for electrical apparatus
- Install electrical apparatus with earth protection

2.1. Electrical apparatus installing procedure

- The first step in installing an outlet, as with all electrical work, is to shut down the power at the source.
- Next, you need to install a switch in the circuit box to control your new outlet.
- Look for two open slots in a row to ensure room to install a double-wide circuit breaker switch,
- Then install it following the manufacturer's instructions.
- You'll need to install a connector into the side of the circuit box as well so that you can connect the electrical cable inside the box.
- If you feel unsure at this or any other point and need help, just ask.
- An electrician will be able to make sure that your stove outlet installation is done safely and effectively.
- Next, run the cable through the wall to the area where you want to locate the outlet for your electric stove.
- You may need to drill holes in the home's frame to allow the cable to reach the kitchen without interfering with other wiring or utility systems.

- When everything is lined up, strip away the insulation at the end of the cable and connect it to your new outlet. Screw the outlet into the wall and you're almost ready to go.

❖ **Plugging in Your Electric Stove**

- Finally, you need to run the cable through the connector that you installed in the circuit box, and then wire it into the circuit breaker.
- Don't forget to hook up the grounding terminal as well.
- When you're confident that everything is wired correctly, turn the new outlet's breaker to the off position and switch the main power to the house back on.
- Turn on the new breaker and test the outlet with a voltmeter to ensure that it's receiving the proper amount of power.

❖ **Installing kitchen socket**

- Even with careful handling of kitchen appliances, water is often sprayed or spilled, plus, wet cleaning is much more often done in the kitchen?
- Modern devices themselves have a fairly high protection against moisture ingress, but still installing sockets in the kitchen involves the use of waterproof models, at least those that will stand near the dishwasher or not far from the water supply.
- The kitchen is a place where the most powerful electrical appliances are collected, therefore, not only the layout of the sockets in the kitchen, but also the total power of the devices should be carefully considered.

This will allow you to calculate the exact number of outlets, what can be “put on one wire and how many such groups will have to be made for the safe use of all devices.

Some of the sockets needed in the kitchen are generally supplied for one specific device. For example, this is necessary when installing ovens, some models of which consume more than 5 kW.

When buying outlets, do not be greedy and choose inexpensive "weak" models for 10 Amperes, especially since the characteristics of most devices offered on the market are already 16 Amperes.

The height of the sockets in the kitchen is selected. These are the standards of the USSR, according to which the installation height of the sockets was prescribed strictly 90 cm from the floor. The same applies to the trend, which was fashionable at one time, to place them at about 30 cm - everyone did it, but nobody knew why.

Page 28 of 54	Ministry of Labor and Skills Author/Copyright	Electrical apparatus installation	Version -1 August 2022
---------------	--	-----------------------------------	---------------------------

The location of sockets and switches - installation is prohibited closer than 50 cm from the gas pipe and 60 cm from the sink.

To decide how to properly position the sockets in the kitchen, first of all, a floor plan is drawn up, which will show the location of furniture and all electrical appliances.

2.2. Termination and connection of electrical apparatus

A wire termination is **the work performed to the end of a wire that allows it to connect to a device** (connector, switch, terminal, etc.). There are many types of terminations in the aircraft industry, but we can boil them down into two basic categories: crimp and solder.

Wire Termination Uses and Methods

2.2.1. Soldering

Soldering is a process used for joining metal parts to form a mechanical or electrical bond. It typically uses a low melting point metal alloy (solder) which is melted and applied to the metal parts to be joined and this bonds to the metal parts and forms a connection when the solder solidifies.

Soldering offers flexibility, durability and corrosion-resistance. Connections can be made and removed easily, which simplifies prototyping and fieldwork.

Flame soldering units can be used to automate the process. In a flame soldering application, the object is placed over a tiny flame, heated for a specified time and a precise amount of solder is applied.

Some applications require the terminal to be soldered after it is crimped onto the end of the wire, Miller says. This might be to fight corrosion or to add mechanical strength for reliability in critical applications. Fast processing times make these systems suitable for automated equipment.



Figure2. 1 soldering termination

2.2.2. Insulation Displacement Connections

Page 29 of 54	Ministry of Labor and Skills Author/Copyright	Electrical apparatus installation	Version -1
			August 2022

Insulation displacement connectors (IDC) are probably the fastest way to terminate wires. IDCs were first used in the telecom industry on small, stranded wire. The process can quickly and efficiently terminate the hundreds of wires in large patch panels. There is no need to strip the wires when using IDC. IDC tools are inexpensive and virtually error-proof. There are no chemicals to deal with and no insulation slugs to clean up.

IDC applications are usually reserved for small, stranded wire up to 22 AWG. Some companies make IDC connectors for larger wires, but the majority of connectors are made for 22 to 30 AWG wires.

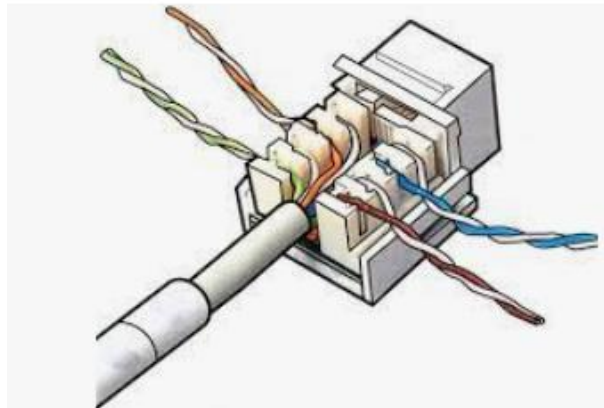


Figure2. 2 **Insulation Displacement Connections**

2.2.3. Crimping

Theory. Crimp-on connectors are attached by inserting the stripped end of a stranded wire into a portion of the connector, which is then mechanically deformed by compressing (crimping) it tightly around the wire. The crimping is usually accomplished with special crimping tool such as crimping pliers

Crimping is the most commonly used method of wire termination, and is most efficient for high-volume wire termination. The terminations are fast, clean and mechanically strong.

For low volume or fieldwork, loose terminals are applied with a plethora of handheld and benchtop crimping devices. These devices come with interchangeable die sets to eliminate adjustments to the tool to ensure a good crimp.

A tool that uses an interchangeable die system offers the most flexibility.



Figure2. 3 crimping tools



Figure2. 4 crimping cable lugs

2.3. Faults and remedy in electrical apparatus

2.3.1. Most common types of electrical faults

It is something that can happen. Suddenly an electrical fault leaves us without electricity for a while, and it seems as though the world has come to a complete halt. We are going to list **the most common electrical faults** and, most importantly, what to do about them.

- **A power surge.** This is something we all know. At home we have a maximum contracted electrical power. When this power is exceeded, there is an increase in the electrical voltage, the fuses are triggered, the power supply is no longer sufficient and it is cut off. This happens when we plug in more electrical appliances at the same time than we should to do everything at the same time, or if we switch on electrical appliances with a higher power. The ICP (Power Control Switch) will be down.
- **A fault in electric boilers.** These are very common faults, which cause the differential switch in the electrical panel to trip, cutting off the electricity supply. One of the most common faults is due to water coming into contact with the heating element.

- **Problems with distribution cables.** This is due to the network cables deteriorating or ageing. These cables transport electricity from the point of generation to the points of consumption.



Figure2. 5 damaged distribution cable

- **Loss of insulation.** Once again, the deterioration of the materials is the cause of this electrical fault, which is also quite common. In this case it is the current-insulating materials, which no longer protect the electrical installation as they should. The cause is ageing or lack of maintenance, and can often occur in older appliances. A sign of this is the famous spark that can occur when touching a plug or an electrical appliance.
- **Short circuit.** This is a strong and unexpected increase in the intensity of the electric current, which can cause fires or affect the installation. This can be caused by an electrical storm, damaged wiring or overheating in a multiple socket if several things are plugged in.
- **Network electrical fault.** In this case the fault is general, and can be due to many causes beyond our control, such as bad weather or a traffic accident. You have to be patient and wait for the technicians to find a solution.
- **Scheduled outages.** This is not an electrical fault per se, but a power cut for a specific period of time, controlled by the company, to improve the service or to make necessary adjustments. Normally they will let us know about it.

2.3.2. Methods to fix each electrical fault

A power surge is easy to fix. You will need to switch off or unplug some of the electrical appliances with the highest consumption, turn down the circuit breakers and wait a few seconds before switching them on again, from right to left, with the last one being the main switch. If, after doing this, the power has not returned, you should contact a qualified electrician who will check everything properly. Moreover, if the electricity comes back but the ICP trips, often the logical thing to do is to increase the contracted power.

In the event of a short circuit or faults in the electrical system or wiring, you should **trace and find the shorted part the circuit** to prevent further damage. We have said it many times before, but an electrical fault can lead to a house fire. The professional who visits us will have to check the electrical installation, to see if there is a need to change a cable, several cables, or the whole network. You can also check the appliance that you suspect may have tripped the fuses. Any of these actions are complex and require electrical knowledge, so don't take any chances.

2.3.3. Proper Grounding

- Grounding is provide for the purpose of discharging fault currents to the ground
- Properly grounded electrical equipment provides a pathway to ground for stray current that may otherwise go through operator's body.
- Loose wires that touch the case of housing in electrical equipment can cause an electrical shock to anyone who touches the equipment if it has not been properly grounded
- A faulty current to the housing will travel directly to ground. A worker touching the equipment is not likely to suffer a serious shock because the ground is a better current path than the human body.
- Loose connections can be detected by heat on conductors, a burning odor, carbon tracking and conductors that are discolored.
- Always check electrical equipment for proper grounding before working on them.
- Proper grounding allows ground fault current to clear over current device providing safety of operation

Self-check-2

Part I Choose the best answer (2point each)

- _____ is a place where the most powerful electrical appliances are collected
A. Living room B. washing room C. kitchen D. Bed room
- A process used for joining metal parts to form a mechanical or electrical bond by using low melting point metal is called ____
A. Crimping B. soldering C. insulation displacement connection D. splicing
- the most commonly used method of wire termination is
Crimping B. soldering C. insulation displacement connection D. splicing
- The strong and unexpected increase in the intensity of the electric current, which can cause fires raised by
A. short circuit B. over load C. power schedule D. open circuit
- The type of termination mostly applicable in small telecommunication cable is
A. Crimping B. soldering C. insulation displacement connection D. splicing

Part II Short answer questions

- Write at least four types of electrical faults in apparatus circuit (8pts)
- Describe the purpose of grounding metal parts of electrical apparatus (2pts)
- What type switch we use for single phase appliance installation (2pts)

Unit three: Completion of installation work

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

- 3.1 Inspection and testing
- 3.2 Functional testing and commissioning.

This unit will also assist you to attain the learning outcomes stated in the coverage contents and topics. Specifically, upon completion of this learning guide, you will be able to:

- Inspect and test the installation system
- Conduct functional test
- Commission the installation work

1.1 Inspection and testing of electrical apparatus installation

3.1.1. inspection of electrical installation

This testing includes examination of electrical appliances and equipment. **Visual examination, earth continuity testing, insulation test between current carrying parts and the outside metal** etc. tests are carried out in PAT testing by a certified electrician or someone who has sound knowledge in electrical testing

A STEP-BY-STEP GUIDE TO FORMAL VISUAL INSPECTION OF ELECTRICAL EQUIPMENT

Why Inspect?

The Health and Safety at Work etc. Act 1974 and the Electricity at Work Regulations 1989 require that electrical equipment used at work is maintained in a safe condition.

The Health and Safety Executive advises that for offices and low risk environments it is generally sufficient for this 'maintenance' to take the form of a visual inspection of the equipment. Supplementary electrical testing should also be carried out at less frequent intervals or if a problem is suspected. (See 'Maintaining portable electrical equipment in offices and other low-risk environments IND(G)236L HSE Books).

Equipment that is rarely moved and is not at risk of damage (e.g. computers) is likely to be low risk and requires less frequent inspection than equipment that is frequently moved, might be used in a damp environment (e.g. kettles, water baths) or may be

Page 35 of 54	Ministry of Labor and Skills Author/Copyright	Electrical apparatus installation	Version -1 August 2022
---------------	--	-----------------------------------	---------------------------

subject to damage. High risk equipment includes equipment such as portable electrical hand tools.

By following the simple steps laid out below most staff should be able to carry out visual inspections of electrical equipment both safely and competently. As the title visual inspection implies, all you really need to do is look closely at the equipment. More than 95% of equipment faults can be found by visual inspection.

Step 1 - before you start inspecting

SWITCH OFF THE POWER AND UNPLUG THE EQUIPMENT

Never open the casing of the equipment. If you suspect there is a fault inside the casing you should seek help from someone appropriately qualified.

Step 2 - the electrical cable

Run the cable slowly through your hands and feel for any lumps, cuts or rough areas. At the same time inspect all round the cable whilst working down it a little section at a time. Watch out for any areas that are dis colored, this might indicate an area of damage.

Be particularly vigilant with any part of the cable that may be prone to having equipment sat on it or that may be habitually curved or twisted. These are sections that are likely to become damaged.

Uncover any areas of cable that have been covered (e.g. with tape or a label) as they may be obscuring joints or areas of damage. Cables should not generally have any joints that are made by means other than standard connectors. Be suspicious of any joints if they are not formed by fully enclosed, solid, standard connectors. Have them checked by someone suitably qualifies

Step 3 - the plug

this illustration below shows a correctly wired plug:

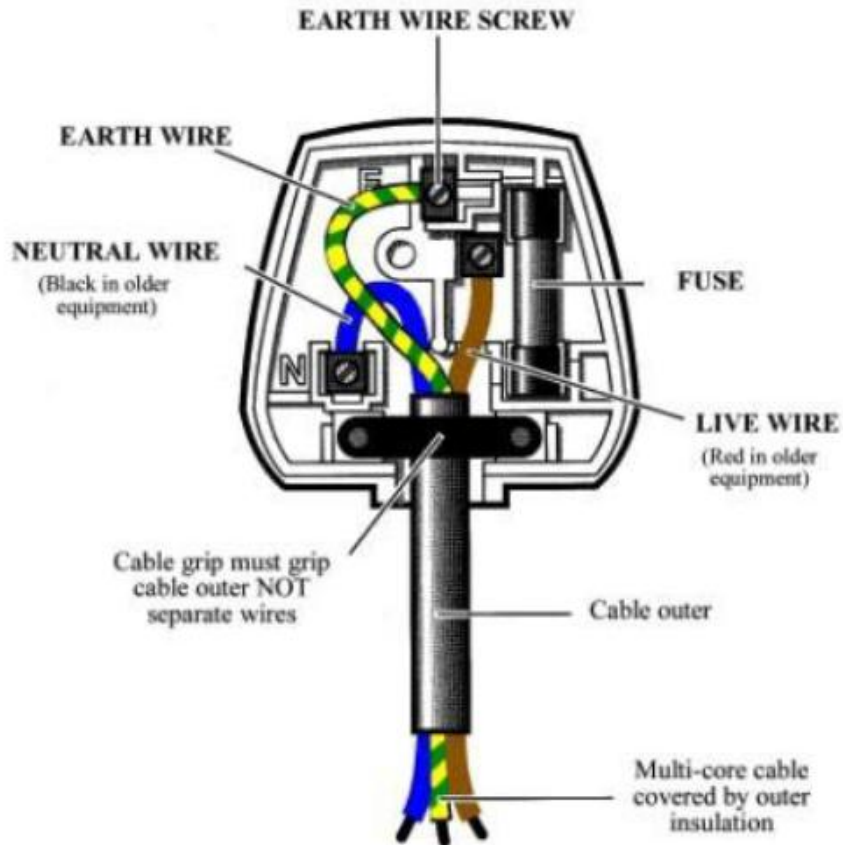
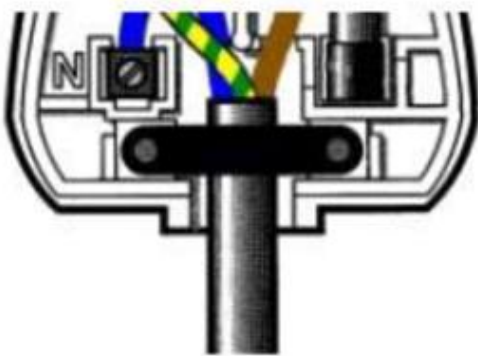


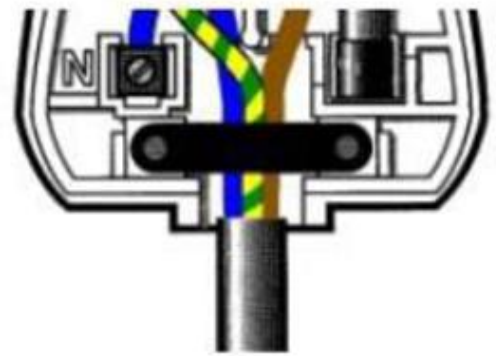
Figure 3. 1 correctly wired plug

Cable entry to the plug

Begin your inspection of the plug by looking at the point where the cable enters it. The outer insulation of the cable should be tightly gripped by the plug cable grip and none of the thinner internal wires should be visible from the outside of the plug



Correct cable entry



Correct cable entry

Figure 3. 2 cable entry to the plug

The wires within the plug

Make sure that the BROWN wire (RED in older equipment) is connected to the LIVE terminal (usually labelled L), that the BLUE wire (BLACK in older equipment) is connected to the NEUTRAL terminal (usually labelled N) and that the GREEN and YELLOW wire (GREEN in older equipment) is connected to the EARTH terminal (often labelled E, this is at the top of the plug).

Ensure that there are no damaged parts on any of the cables and make sure that there is no excess cable that may snag or be trapped when the plug is re-assembled. If any of the smaller cables are too long you may see rub or pinch marks on the outer insulating surface.

You should check the point where the inner wires are connected to the plug terminals and ensure that there is not an excessive amount of bare wire exposed. Ideally the insulating outer should cover the inner conducting wire entirely and no conducting wire should be visible. In practice this is often difficult to achieve and it may be necessary to have a gap of about one to two millimeter of conductor showing between the insulating material and the terminal.



Figure 3. 3 gap between screw and insulation of

Finally check the connections at each terminal. Ensure that the conducting wire is securely housed and that no stray wires are sticking out. Make sure that the terminal screws are securely tightened.

Is there more than one plug on the cable?

In some cases the cable may not be permanently fixed into the equipment but may have a plug or connector for that purpose. In this case you should also examine this for any sign of damage and to ensure that the outer cable is securely held in such a way that the inner cables are not visible. It is usual for this type of connector to be sealed and as a result no internal inspection is possible.

Step 4 - the fuse

any plug that is designed to make a connection between a piece of equipment and a mains socket should be fitted with a cartridge fuse. In the case of sealed plugs this fuse is located in a compartment that can be opened from outside the plug. This compartment is located on the face of the plug from which the pins protrude. In unsealed plugs the fuse is located inside the body of the plug and is connected to

the LIVE terminal next to the BROWN wire. When you open an unsealed plug to inspect the cables and connections the fuse should be readily visible.



Figure 3. 4 wire connection in fuse box

It is also necessary to make sure that the fuse is of the correct type (rating). As a general rule, most office equipment should be fitted with a 5 amp fuse. Heaters, kettles etc. and appliances that use more power often require a 13 amp fuse.

The following table gives an indication of the fuse that should be used in some of the more common office equipment.

Equipment type = Equipment Type	Fuse rating Suggested Fuse Rating (Amps)
Desk lamp	3
Kettle	13
Computer	5
Vacuum Cleaner	13

It is possible to calculate the fuse rating required for equipment if you know how much electricity the equipment uses.

Most equipment has a small plate or label (usually on the base or rear panel) giving the energy usage. This is expressed as a certain number of WATTS (the initial W is frequently used as an abbreviation) for example a desk lamp may say 100W maximum.

If you know the energy usage then the correct fuse rating can be calculated using the table below

'Wattage' of Equipment	Fuse Rating
Up to 600 Watts	3 Amps
Between 600 Watts and 1000 Watts (1KW)	5 Amps
Between 1KW and 3KW (3000 Watts)	13 Amps

Step 5 - Putting the equipment back into service

No faults observed

If you have found no faults it is now a simple matter to reassemble the plug. Before putting the equipment back into use you should label the plug to show that an inspection has been carried out. This label should give details of the date of inspection and who carried out the inspection. Proprietary labels may be purchased, but it is perfectly acceptable to use self-adhesive labels so long as they remain attached to the plug until the next inspection.

A possible label layout for showing that equipment has been inspected

Electrical Appliance Inspection

Date: _____

Inspected by: _____ .

If you found one or more faults:

If you found any of the following simple faults you are likely to be competent to correct the by yourself:

Incorrect fuse

Missing fuse

Connections inside the plug are loose

Outer cable is not gripped tightly by the cable grip.

After a little practice most people are able to rewire a plug if they have the correct equipment. If you do not have the correct equipment to do this job, or if you feel it is beyond your ability you should seek assistance.

If the cable is damaged you should not attempt to repair this and should seek assistance.

If you have identified faults during the inspection the equipment should be taken out of service until and the fault reported. This can be achieved by removing it to a secure storage area. If this is not possible the plug should be removed to prevent use. In all cases the equipment should be labelled to indicate that it should not be used

Step 6 - Keeping records

the department should keep a record of all of the equipment inspected. This record should include a description of the equipment, dates of each inspection and information about who carried out the inspection. You may also find it useful to record the size of fuse the equipment

should have in its plug and to keep a record of any major faults and the steps taken to repair these.

3.1.2. Testing of electrical apparatus installation

A. Insulation Resistance Test

- The completed installation shall be tested by applying resistance between the earth and the whole system of conductors, with all fuses in place and all switches closed.
- Except in earthed concentric wiring, all lamps in position or poles of the installation shall be tested with direct current pressure of not less than twice the working pressure. The test results must not exceed 500 volts for medium voltage circuits.
- The working pressure shall be assumed to be that which is maintained between the phase conductor and the neutral, where the supply is derived from a three-wire D.C. or a poly phase A.C system.
- The insulation resistance shall also be tested between all the conductors connected to one pole and all the conductors connected to the neutral or phase conductors of the supply with all the lamps in position and switches in the "off" position..
- In the case where an entire installation is tested, a lower value than that given by the formula, subject to a minimum of 1 mega ohm variation, is acceptable.
- A similar test may be carried out before the lamps, bulbs, etc., are installed, and in this event, the insulation resistance to earth should not be less than 25 mega ohms for the wiring with PVC insulated cables subject to a minimum of 2 mega ohms.

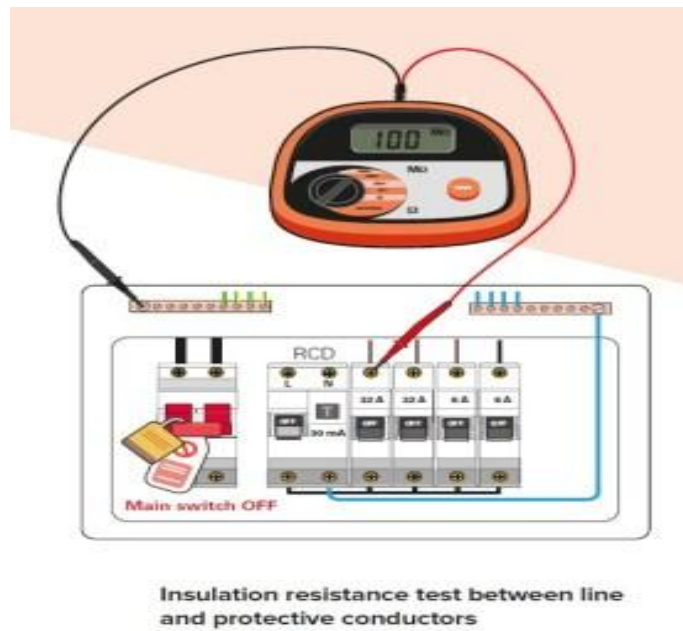


Figure 3. 5 Insulation Resistance Test

B. Polarity Test of Switch

- A test shall be carried out in a two-wire installation to verify that all the switches in the circuit are fitted in the same conductor throughout the supply.
- In a three-wire or a four-wire installation, a test shall be carried out to verify every non-linked single pole switch is fitted in a conductor labeled or marked for connection to one of the phase conductors of the supply.
- The installation shall be connected to the supply for testing. A test lamp shall test the terminals of all switches, one lead of that is connected to the earth.
- Glowing the test lamp to its full intensity when the switch is in the "on" position irrespective of the appliance is in position or not shall indicate that the switch is connected to the right polarity.

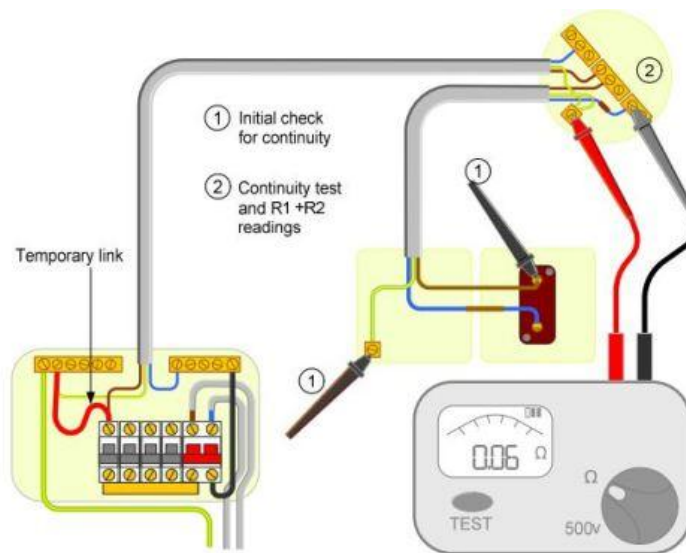


Figure 3. 6 Polarity Test of Switch

C. Earth Continuity Test

- The earth continuity conductor, including metallic envelopes of cables and metal conduits, shall be tested for electric continuity.
- The electrical resistance of the circuit and the earthing lead is measured from the connection with the earth electrode to any point in the earth continuity conductor. This shall not exceed 1 ohm.

D. Earth Electrode Resistance Test

- Besides the test electrode, two auxiliary earth electrodes are placed at a suitable distance from the test electrode (see figure).
- A measured current is passed between the electrode 'A' to be tested and an auxiliary current electrode 'C.' The potential difference between the electrode 'A' and the auxiliary potential 'B' is measured.
- The resistance of the test electrode 'A' is then given by the formula:

Self-check-3

Part I Direction: write true if the statement is correct and false if the statement is wrong (2pt each)

1. For flexible single phase cable the brown wire is connected to live terminal.
2. For an electrical equipment with power rating 600W the required fuse rating is 13A
3. The purpose of insulation resistance is to check the continuity of the earth wire.
4. The inspection of a new installation is conducted by testing instrument.
5. The colour of ground conductor is green-yellow strip

Part II matching

A	B
____ 1. Insulation resistance testing instrument	A. test lamp
____ 2. Purpose of polarity test	B. multi meter
____ 3. Earth wire continuity tester	C. megger
____ 4. Visual observation the switch	D. To check line connected to
____ 5. Cooking appliance	E. kettle
	F. Inspection

Unit Four: Cleaning methods of electrical apparatus

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

- 4.1. Cleaning methods of electrical apparatus
- 4.2. Storing tools and equipment

This unit will also assist you to attain the learning outcomes stated in the coverage contents and topics. Specifically, upon completion of this learning guide, you will be able to:

- Identify cleaning methods of electrical apparatus
- Placing tools and apparatus in proper way

4.1. Cleaning of electrical apparatus

Electrical equipment should be kept clean for maximum efficiency and service longevity. Keeping electrical equipment clean is an important part of any electrical preventive maintenance program, but using the wrong cleaning methods could be costly.

Initial Considerations

Determine the cleaning method by observing the type of contamination to be removed and the time allowed until the equipment needs to be returned to service.

Sufficient dry time is required when using liquid solvents or water to clean electrical equipment

❖ Methods of Cleaning Electrical Apparatus

Rags and Brushes

Wiping off dirt with a clean, dry, lint-free cloth or soft brush is usually satisfactory if the apparatus is small, the surfaces to be cleaned are accessible, and only dry dirt is to be removed.

Don't use waste rags when cleaning electrical equipment because lint will adhere to the insulation, acting as a further dirt-collecting agent, which can cause tracking. Cloth rags should be clean and free of oil, grease, and metallic deposits.

Use care to avoid damage to delicate parts. Rags can easily catch on edges other and sharp objects, which could damage small plastic or moving parts.

❖ Liquid Solvents and Water

Accumulated dirt, oil, or grease might require a solvent to be removed. A rag barely moistened (not wet) with a nonflammable solvent can be used for wiping. Solvents used for cleaning of electrical equipment should be selected carefully to ensure compatibility with materials being cleaned.

Page 46 of 54	Ministry of Labor and Skills Author/Copyright	Electrical apparatus installation	Version -1 August 2022
---------------	--	-----------------------------------	---------------------------

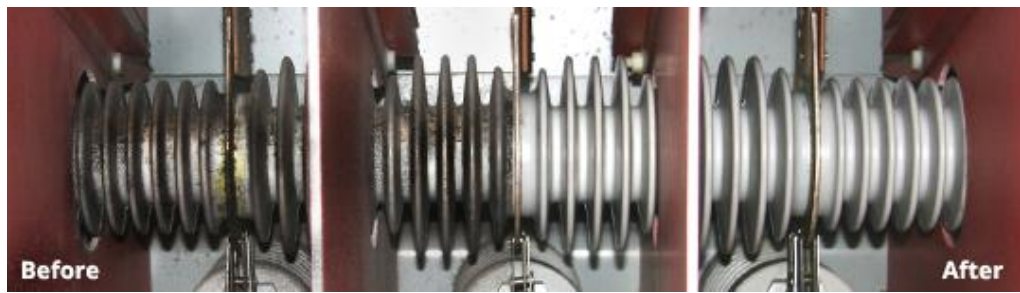


Figure 4. 1 cleaning methods using solvent and water

- Accumulated dirt, oil or grease might require liquid solvents or other alternative methods to be removed. Photo Credit: Wickens Dry Ice Blasting
- Do not use any liquid cleaners, including spray cleaners, unless specified by the equipment manufacturer, because of the risk of residues causing damage, interfering with electrical or mechanical functions, or compromising the integrity of insulation surfaces.
- Allow sufficient time for drying after cleaning equipment with a liquid solvent or water!
- Observe all material data sheets prior to using chemical cleaners. Wear the required personal protective equipment (PPE) such as goggles, gloves, aprons, and respirators when working with potentially hazardous solvents.

❖ **Vacuum Cleaning**

Loose dust, dirt, and particles can be removed using a vacuum-type cleaner with non-metallic attachments and hoses. Blowing equipment out with compressed air is likely to spread contamination and damage insulation.

Equipment enclosures and substation room filters should be cleaned at regular intervals and replaced if they are damaged or clogged. Loose hardware and debris should be removed from the enclosures. New or unusual wear or loss of parts occurring after the cleaning can be detected during subsequent maintenance.

❖ **Sweeping and Mopping**

If the sweeping of a substation room is required, use a sweeping compound to limit the amount of dirt and dust becoming airborne. When mopping, keep the mop bucket as far as practical from the switchgear to prevent damage from spillage.

❖ **Compressed Air Methods for Cleaning Electrical Equipment**

Page 47 of 54	Ministry of Labor and Skills Author/Copyright	Electrical apparatus installation	Version -1 August 2022
---------------	--	-----------------------------------	---------------------------

Where dirt cannot be removed by wiping or vacuuming, compressed air blowing might be necessary.

CAUTION: Cleaning with compressed air can create a **hazard to personnel** and cause **equipment to fail** or malfunction. If compressed air is used, *protection should be provided against injury to workers' faces and eyes* from flying debris and to their lungs from dust inhalation.

The use of compressed air should comply with OSHA regulations in 29 CFR 1910.242(b), "*Hand and Portable Powered Tools and Other Hand Held Equipment*," including limiting air pressure for such cleaning to less than a gauge pressure of 208.85 kPa (30 psi) and the provision of effective chip guarding and appropriate personal protective equipment.

Use care when working with compressed air to avoid contaminants from become airborne, which can contaminate insulation surfaces, cause injury to personnel, or affect the mechanical operation of nearby equipment. Compressed air should be dry and directed in a manner to avoid further blockage of ventilation ducts and recesses in insulations.

Protection might also be needed against contamination of other nearby equipment if the insulation is cleaned in place with compressed air. Removed the apparatus to a suitable location for cleaning, or other exposed equipment should be covered before cleaning starts to keep the debris out.

❖ Sandblasting and Shot Blasting

Electrical equipment might require cleaning by nonconductive sandblasting. Shot blasting should not be used.

Abrasive blasting operations should comply with OSHA regulations in 29 CFR 1910.94(a), "Occupational Health and Environmental Control — Ventilation." Use personal protective equipment to protect the **face and eyes** from abrasives and flying debris, and the **lungs** from dust inhalation.

CLEAN: Electrical apparatus and equipment rooms should be kept clean and free of excessive dust and dirt accumulations.

Obviously, consideration is given to the normal environment for the location and the type of equipment installed. Equipment rooms are not to be used for storage and access should be

Page 48 of 54	Ministry of Labor and Skills Author/Copyright	Electrical apparatus installation	Version -1 August 2022
---------------	--	-----------------------------------	---------------------------

limited to on authorized operations and maintenance personnel. Proper lighting should be maintained in order to ensure that operations and maintenance can be accomplished correctly and safely

4.2. Storing tools and equipment

- Importance of proper storage of tools and equipment
- it is an important factor for safety and health as well as good business
- Improves appearance of general-shop and construction areas
- Reduces overall too cost through maintenance.
- This also ensures that tools are in good repair at hand
- Teaches workers principles of (too) account ability
- Pointers to follow in storing tools and equipment
- Have a designated place or each kind of tools.
- Label the storage cabinet or place correctly for immediate finding.
- Store them near the point of use
- Wash and dry properly before storing
- Store knives properly when rot in use with sharp edge down
- Put frequently used item in conveniently accessible location
- Gather and secure electrical cords to prevent entanglement or snagging.
- Cutting boards should be stored vertically to avoid moisture collection.
- Metal equipment can be stacked on one another after drying such as storage dishes and bowls.
- Make sure the areas where you are stoning the equipment are clean, dry and not overcrowded

Self-Check 4

Give short answer for the following questions

1. Mention the cleaning methods of electrical apparatus (6pts)
2. Write at least four points about storing and handling of hand tools (4pts)

References

- [NFPA 70B: Recommended Practice for Electrical Equipment Maintenance 2](#)

Participants of this Module (training material) preparation

No	Name	Qualification (Level)	Field of Study	Institution	Mobile number	E-mail
1	SAMUEL BEKELE	A(MSC)	Electrical control and automation	Haremya	0910082977	samuelbekele460@gmail.com
2	TIRUSEW BAYE	BSC	Building construction	Debretabor PTC	0918092865	tirusew2014t@gmail.com
3	BACHA WAKE	MSC	Electrical control and automation	Hawasa TTC	0910780182	bachawakejima2012@gmail.com
4	GIRMA BELETE	MSC	Electrical Power engineering	Hawassa PTC	0938935026	girmabelete7@gmail.com
5	SALADIN ABIDELA	BSC	Electrical Technology	Dredewa PTC	0920689179	Sala0767@gmail.com