POLITEKNIK MALAYSIA
TUANKU SYED SIRAJUDDIN

ELECTRICAL WIRING

Safety, Accessories, Tools, & Wiring System

Vol. 1

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Lastly, we would like to thank to all persons who had involved in this eBook either directly or indirectly. They had been a great helper to us.

Preface

This Vol. 1 of ELECTRICAL WIRING: Safety, Accessories, Tools & Wiring System is based on the polytechnic syllabus for Electrical Wiring course. This eBook gives a detailed summary of electrical safety, wiring accessories & tools, and wiring system in electrical wiring installation. Chapter 1 begins with the electrical supply systems according to the Electricity Supply Act 1990. The electrical hazard in wiring installation and workplace are also covered in this chapter. It offers instructions on how to handle electricity. The causes and risks of electric shock, which can cause death or serious injury are also discussed. It offers advice on how to safely handle waste management in the workplace.

Tools and accessories for electrical wiring are covered in Chapter 2. It explains how electrical installation accessories work. This covers how to install switches, lamp holders, and ceiling rose. Also detailed are plugs, sockets, and kWh meters. Additionally described are safety equipment used for short circuit and overload protection, such as distribution boards and Earth Leakage Circuit Breakers (ELCBs). It then goes over how to install wiring using simple tools.

Chapter 3 covers the the concept of consumer circuits includes the wiring and schematics diagrams in electrical wiring. The domestic electrical installation was then described. There is also discussion of the electricity cost based on Malaysia's domestic tariff rates.

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Chapter 1
ELECTRICAL SAFETY

Learning Outcomes

Apply the concept and principle of electrical safety and regulation in performing electrical wiring according to MS IEC 60364

1-2 Electrical Hazards

What You Should Know

1. Remember electrical supply system
2. Remember electrical hazards
3. Remember dangers of electrical shocks
4. Understand working environment safety
5. Apply working practices safety

Electrical Supply System

TWO main categories of power supply:

DC Power Supply
AC Power Supply

A power supply is what provides electricity to an electrical load. In order to power the load, the power supply's primary job is to transform electric current from a source into the appropriate voltage, current, and frequency.

Power sources include outlets for electricity, energy storage devices including batteries, fuel cells, generators, and solar power converters.

Electrical Supply Specifications

Types of power supply

A linear power supply produces a steady current or voltage and has a single output voltage.

A switching power supply produces a high-frequency oscillation to provide numerous voltage levels and increased power supply efficiency.

Voltage (Volts)

The amount of electrical pressure required to produce an electrical current is known as voltage.

The majority of AC/DC power supplies for homes are made to work with circuits that are either 120 or 240 volts.

Current Rating

The highest electrical current that a specific model of AC/DC power supply can safely supply is indicated by its current rating.

The selection of AC or DC power supply depends on the minimum and maximum values required by the connected components.

Frequency

Frequency, which is commonly measured in Hertz (Hz), is the number of times per second that an alternating current changes direction.

This value is calculated based on the total load requirements of any device to be connected.

Output Capacity

The number of watts that a particular model can deliver at once without overheating or becoming damaged is indicated by its output capacity.

For AC/DC power supplies to work effectively with a range of loads from various electronic devices, they must be able to handle a variety of frequencies within their specified range.

Output Voltage

Efficiency

Efficiency compares the amount of energy lost as heat during operation to the amount that is actually transformed into usable output. A higher efficiency rating results in more economical long-term costs because less electricity is wasted.

Panning of Electrical Wiring Task

01 Site Visit

Purpose of site visit:
- Electrical equipment suitable for use
- Maximum load demand
- Type of incoming supply (Single or Three Phase)
- Type of wiring
- Equipment arrangement.

02 Determine the Consumer Load Requirement

Building floor plans are used to determine installation requirements including proposed load, electrical equipment placement, and installation design plans

03 Calculate the maximum load demand

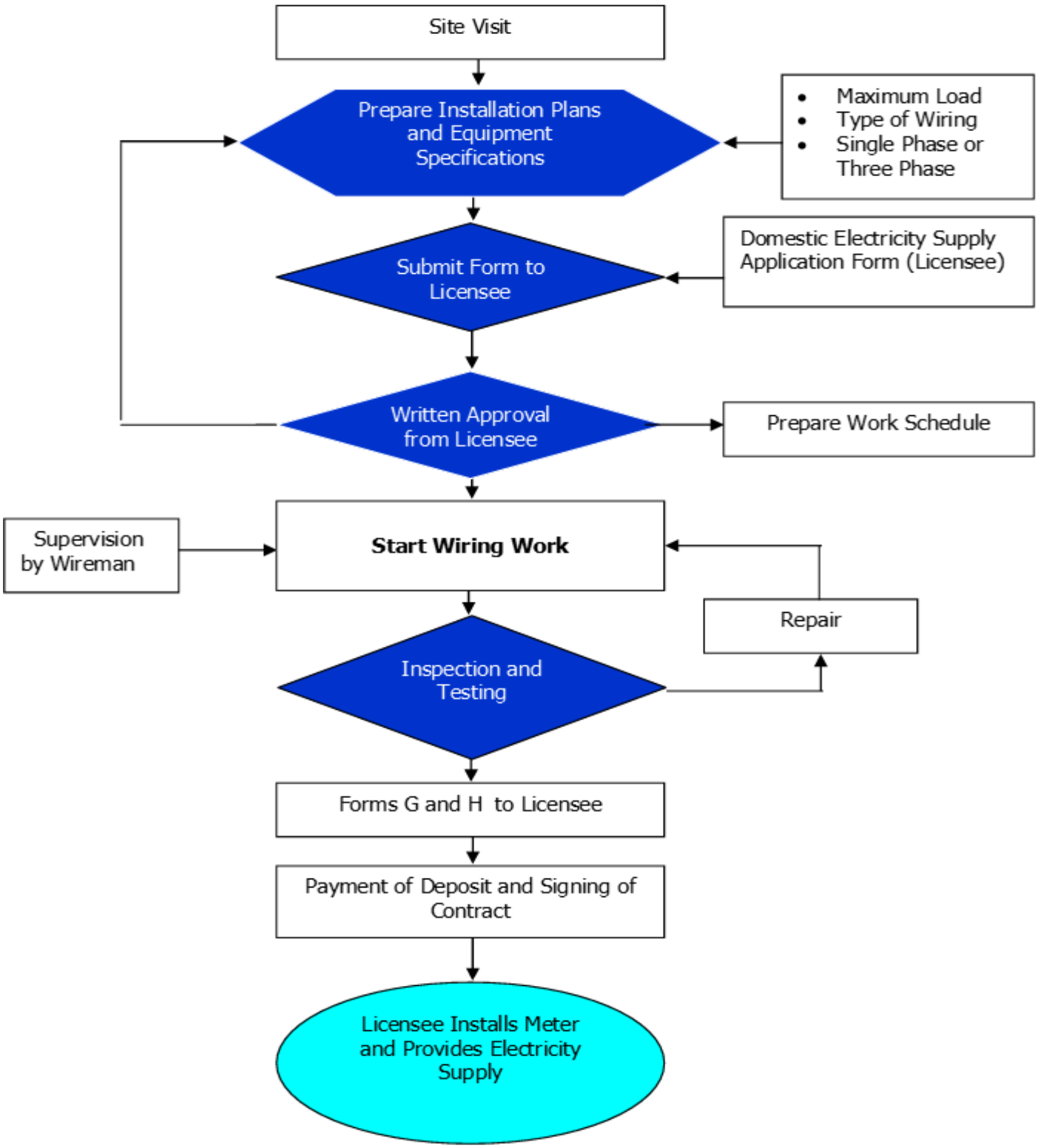
The estimation of the maximum load demand is used to develop the electrical installation plans and determine the specifications of the wiring equipment.

04 Submit the plans, drawings and specifications

Regulation 65 of the Electricity Regulations 1994 states that the eligibility to submit plans is as follows:

i. Wireman with Single Phase Restriction – Low voltage single phase up to 60 amperes.
ii. Wireman with Three Phase Restriction – Low voltage up to 60 amperes.

The Planning Flow Chart for Single Phase and Three Phase Supply Building Wiring Installations



Essential requirements for domestic electrical wiring installation

LAWS OF MALAYSIA

ONLINE VERSION
OF UPDATED TEXT OF REPRINT

Act 447

ELECTRICITY SUPPLY
ACT 1990

As at 1 July 2016

1. Electrical Wiring
   - Legal Requirements
   - Planning of Wiring Work
   - Features of Electrical Wiring
   - Schematic Wiring for Lighting Circuits and Socket Outlets

2. Control & Protection System
   - Selection of Control and Protection System for Electrical Wiring
   - Isolation and Switching
   - Protection

3. Selection of Cables
4. Electrical Accessories
5. Earthing of Electrical installation

6. Electrical Inspection & Testing
   - Legal Requirements
   - Testing

Electrical Hazards

The term "electrical hazards" describes the possible risks and dangers connected to electrical systems.

When handling electricity, the primary risks are electric shock, arc flash, burns, electrocution, and other severe injuries.

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

Hazards In Electrical Installation

1

Overloaded sockets

- Do not overload the extension lead by plugging in several appliances that exceed the maximum electrical current level stated for the extension lead. Never plug an extension lead into another extension lead.

2

Using electrical equipment near water or with wet hands

- Water can significantly increase the chance of electrocution so electrical equipment should not be used near a source of water or operated with wet hands.

3

Incorrect use of replacement fuses

- If you're fitting or replacing a fuse, you must use the right fuse for the appliance so that it doesn't overheat.
- Check the manual or the label on the appliance to find out the wattage and the correct fuse required.

4

Improper grounding

- All electrical equipment and devices must be earthed or grounded.
- If not, you're at risk of electrocution. Make sure that electrical equipment is periodically checked and certified by a qualified person.

Hazards of Faulty Electrical Parts

1

Damaged equipment and power tools

- Using damaged electrical equipment, can be very dangerous.
- Broken tools and equipment should not be used until they are fixed and certified by someone qualified to do so.

2

Frayed, loose or exposed electrical cables

- Electrical cords on equipment contain securely insulated live wires.
- If the cable becomes frayed or cracked, the live wire can be exposed and lead to electrical fires or electric shock.

3

Smoke and smells from equipment

- A smell of hot plastic, sparks or smoke coming from plugs, appliances or sockets are signs of an electrical hazard so keep an eye out for these danger signs.

4

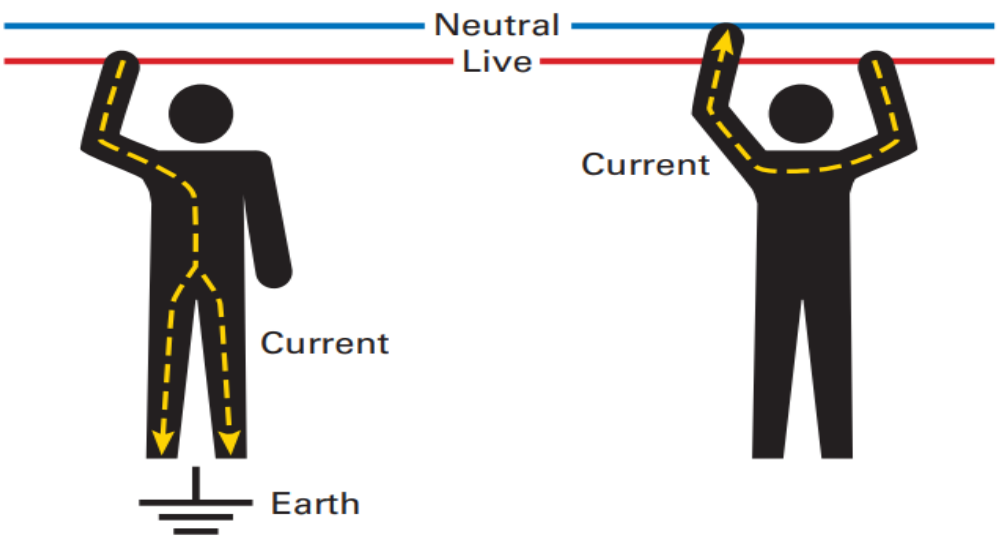
Overhead power lines

- The high voltage in overhead electrical lines can result in significant burns and electrocution.
- If you have workers working near overhead power lines, it is recommended that a minimum distance of 10 feet from the lines and nearby equipment is maintained.

Dangers Of Electric Shock

DIRECT CONTACT of electrical shock

Direct contact occurs when someone touches an exposed live part, such as a bare wire. The current flow when direct contact occurs is seen in the figure below.



The user gets a shock by touching the live conductor directly.

For example holding a damaged cable (without insulation), touching an exposed part of the live conductor.

INDIRECT CONTACTS of electrical shocks

Indirect contact occurs when someone touches a part which is not normally live. It becomes live due to a fault in the electrical installation or appliance.

An electric shock that occurs due to contact of something connected to an electrical installation but not direct contact with a live conductor, may be due to damage to equipment or installations.

This shock may occur due to contact that occurs between the user with installations or equipment that are not directly connected to the electrical supply but become a source of life in the event of damage.

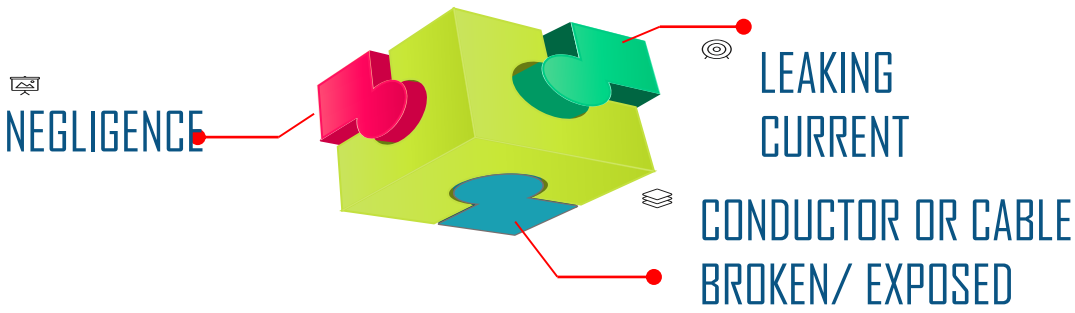
Examples of indirect contact:

- ✓ Touching electrical equipment with wet hands
- ✓ Using electrical equipment outside when it is raining
- ✓ Cleaning or repairing equipment that is plugged in
- ✓ Drying wet clothes above an electric heater

Danger of Electrical Shocks

Current rating	Danger to the user who touches it
1mA	No danger
10mA – 15mA	Stiff & numb
25mA – 30mA	More pronounced stiffness to paralysis
Above 50mA	Stopping the heartbeat can be fatal.

Cause of Electrical Shocks



Negligence

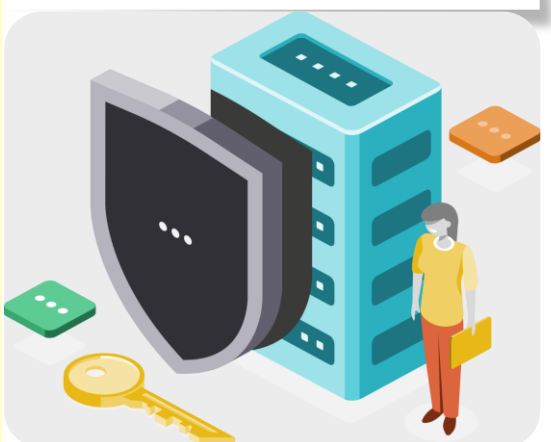
- If the work is done without full concentration, negligence in handling the work will occur.

Leaking Current

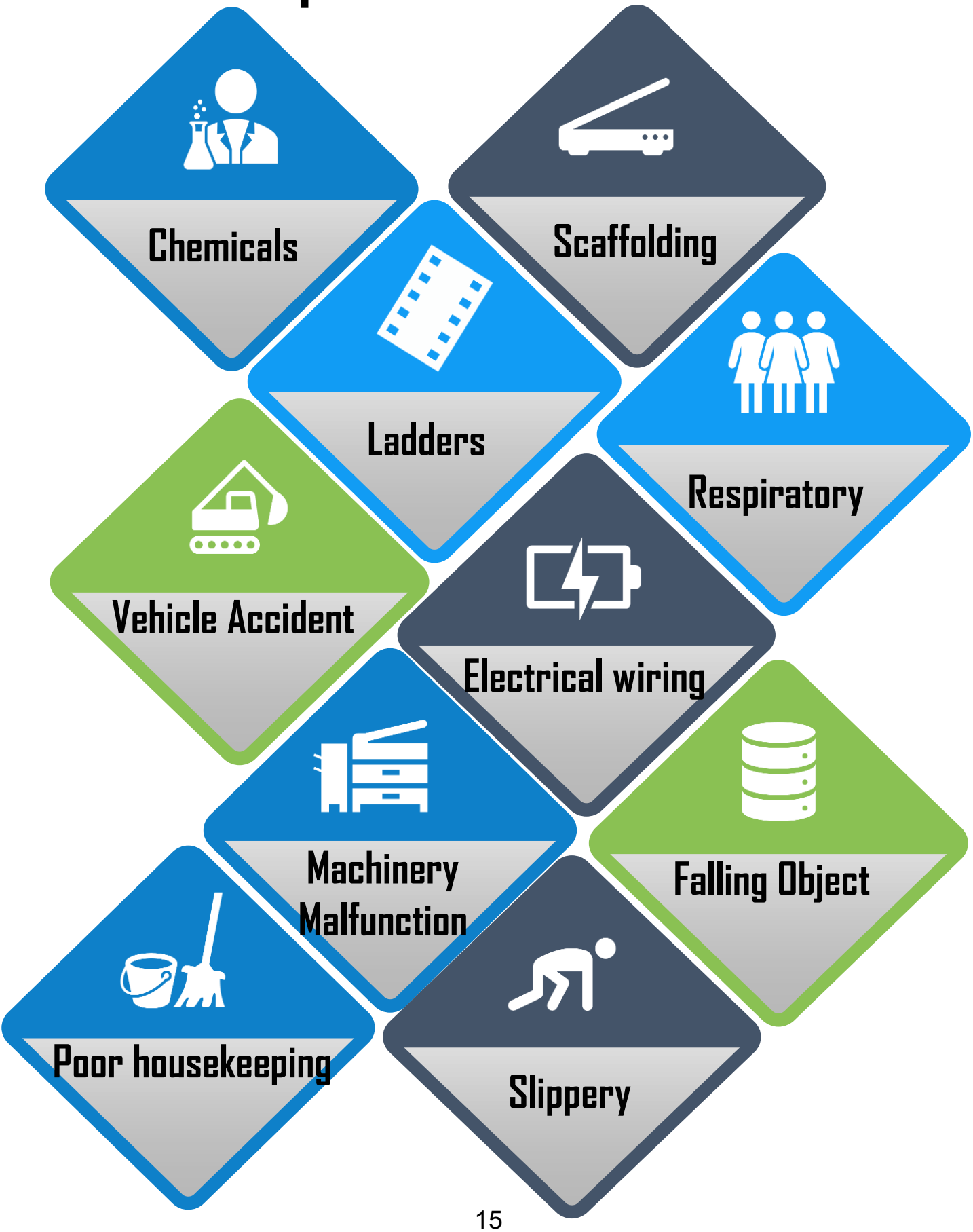
- Leaking currents can cause the metal frame to come to life and can pose a danger of electric shock when the user holds the metal frame.

Conductor or Cable Broken/ Exposed

- Conductors or cables are cut off and live or exposed is dangerous.
- Avoid holding the cable and must report to the responsible parties immediately.



10 Top Most Common Hazards in the Workplace



SAFE WORKING ENVIRONMENT

RULES AND PERSONAL SAFETY

- Proper dressed and short –haired
- Wear appropriate safety shoes when in the workshop.
- Eg; Rubber soles.
- Prohibited from wearing jewelry.
- Use special gloves appropriate to the task.
- Always be calm in carrying out tasks.
- No smoking

SAFETY IN THE WORKSHOP

a) Personal safety.

- Use appropriate gloves according to the work movement done.
- Do not do things outside the instructor's instructions.
- Clean the workplace and tools after finishing work.
- If there is something dangerous report it to the instructor.
- Smoking is not allowed in the workshop because it will cause neglect to make something work.

b) Clothes in the workshop.

- Clothing must be appropriate for the task being performed.
- Wear shoes with thick soles and sewn around them and resistant to external pressure.

SAFE WORKING ENVIRONMENT

c) Conditions in the workshop.

- Tools used must be stored properly in their original place after use.
- The floor in the workshop should be clean especially from dirt and greasy.
- The workshop should have an emergency door which when in the event of an emergency can be opened easily.
- Electrical control main switches, fire extinguishers and even switch mirrors and fire warning bells are in good condition.
- Always practice the nature of helping each other.

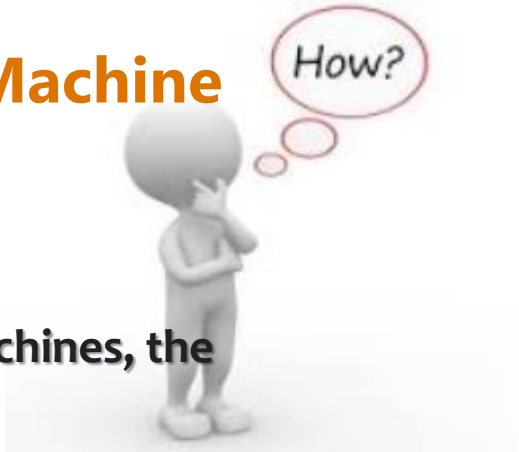
d) Running the machine.

- Before a machine is run, be sure to get a briefing from the instructor.
- Trainees should know the location of the emergency switch as well as the switch starter and power cutter switch.
- In case of damage determine the machine is not currently operating fix it.
- Put a label that indicates the machine is being repaired

e) Self -control during an accident.

- To prevent injury or damage to damage can be used by taking simple steps as before lifting the full attention span.
- The route area for lifting loads should be clean of oil spills, high sections that roll and litter or a smooth round object.
- Make sure the conditions around the workplace are safe.
- Do not panic or be anxious when an accident happens.

Safety When Working with Machine and Tools



To ensure safety when using tools and machines, the following steps must be followed:-

1. Do not use a tool or machine without knowing the correct way how to use it.
2. Do not use tools or machines without permission from the teacher or supervisor.
3. Tools or machines that are damaged or slightly damaged should be repaired before use.
4. Work equipment should be stored in the right place so that it is easy to find when needed.
5. Clean the tool after use and store it in its original place.
6. Do not leave the machine running unattended.
7. Wear goggles, face, ears or nose in the workplace that needs it.
8. Follow the rules of its use even if you are familiar with it.
9. Do not close or remove instruction or warning signs found on devices or machines as other users may not be aware of them.
10. Do not attempt to repair tools or machines without the knowledge of the teacher or supervisor.

WASTE MANAGEMENT PRACTICES

Video on waste management practices.

https://youtu.be/_NkqwMitQ8o

SAFE WORKING PRACTICES

7 Ineffective Safety Practices and What To Do Instead

What's Wrong	What to Do Instead
Focusing on lagging indicator : Reactive safety management only takes action when there is a problem	**Focus on leading Indicators:** Proactive – safety management keeps an eye on what can be done to prevent accidents.
Injury based inventive systems: Misplaced reinforcement – reinforce non-reporting injury through sheer luck	**Behavior-Based Reinforcement system**: Reinforce correct behavior- Identify and strengthen high impact safety behaviors to ensure sustainable safety improvement
Awareness Training: Necessary but Not Sufficient – only training will not change behavior, it rarely solves safety problem.	**Need-Based Training :** Better analysis leads to a correct solution- Train to fluency to change the consequences.
Motivational Signs: Little to no impact – signs are often ignored and have a short –term effect.	**Motivational Consequences:** Actions speak louder than words- Demonstrate commitment to safety through actions and consequences not signs
Blame and Discipline: Destructive to engagement - discipline is often misused and that leads to wrong actions.	**Analysis and action :** create forward looking accountability – rather than blaming, build joint accountability for corrective actions
Discouraging near – miss reporting: Reactive-safety management only takes action when there is a problem.	**Encouraging Near –** Miss Reporting: Approach misses as learning opportunities –leads to problem solving and willingness to report incidents
Safety Cop: Focus on what is wrong – safety tours that focuss on pointing what is wrong undermines engagement.	**Safety coach :** Build on what is right – Shaping improvements through positive reinforcement strengthens safe behavior and builds engagement

https://create.kahoot.it/details/7635477e-9ca4-4d75-b4dc-2ee9531e6405

Chapter 2

ACCESSORIES & TOOLS IN ELECTRICAL INSTALLATION

What You Should Know

Remember the function and installation method of the accessories for electrical installation.

Understand the usage of the electrical installation tools

Domestic Installation Accessories

Ceiling Ros

Lamps Holder

Switch

Switch Socket Outlet

Plug

kWh meter

Distribution Box (DB)

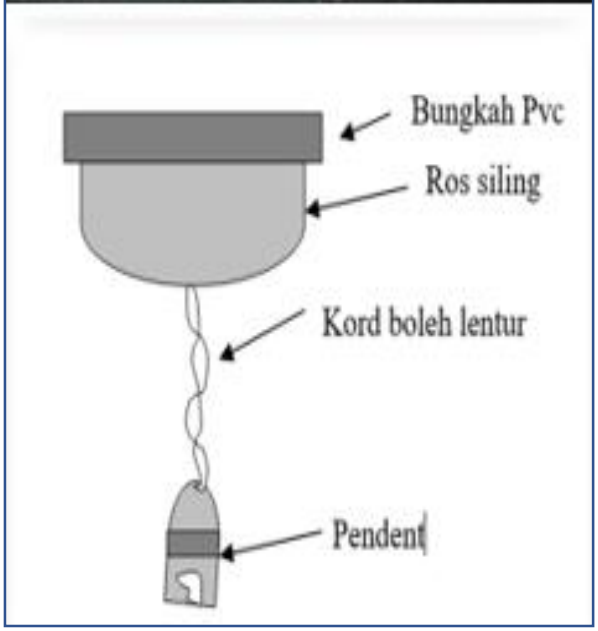
Circuit Breaker

Main Switch

Earth Leakage Circuit Breaker

Miniature Circuit Breaker

1. Ceiling Rose

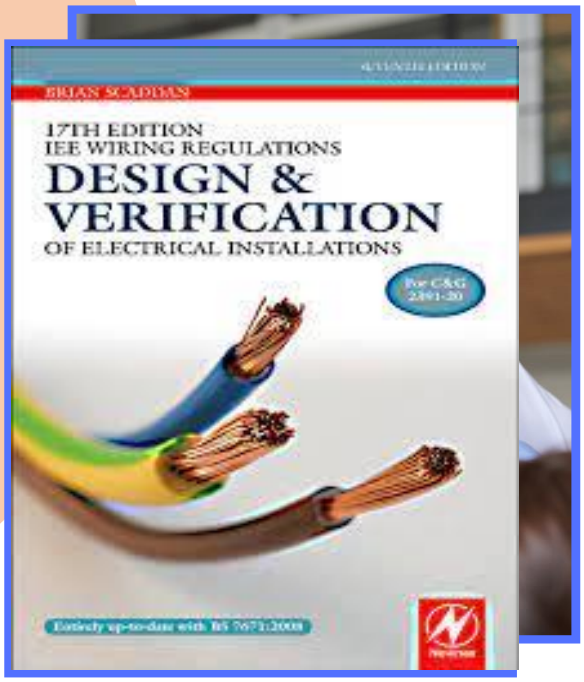


- The ceiling rose is the finishing connection point for fixed wiring

- From the Ceiling Rose will be connected to a flexible cord for connection to loads such as lights, fans and etc

IEE Regulation

Ceiling Rose



Ceiling roses shall not be installed in any circuit operating at a voltage not normally exceeding 250 only.

The earth source of the ceiling rose shall be connected to the earth continuity conductor for each and sub circuit.

Ceiling roses cannot be used for the installation of more than one product unless they are specifically designed for multiple products.

Permanent phase twists should not be used on fixed wiring unless it is not easily touched.

2. Lamp Holders

Bayonet

Used to hold the lamp and can facilitate the connection of the lamp to the supply.

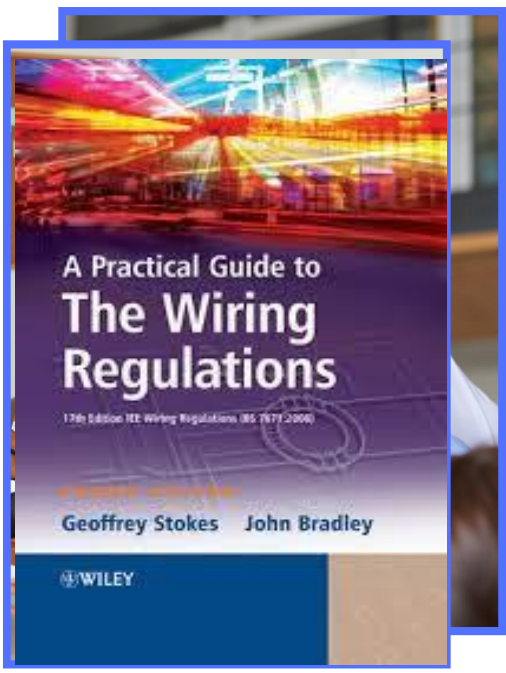
It is designed so that the lamp can be removed and replaced quickly.

Screw

The lamp holder has two terminals namely for the phase conductor connection source and neutral to connect to the lamp.

Types of Lamp Holder:

1. Bayonet – up to 150W
2. Edison screw – up to 200W
3. Goliath screw – more than 200W



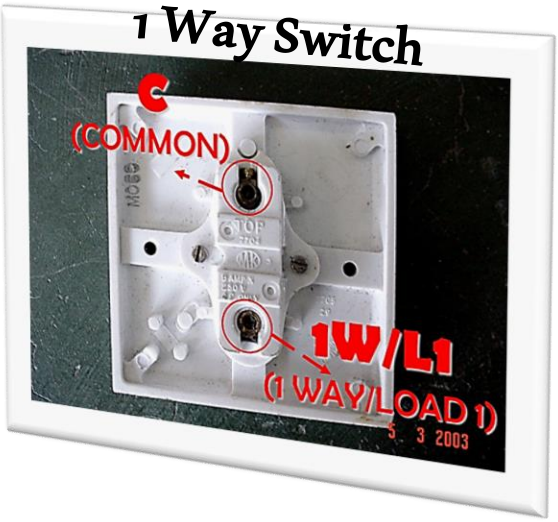
IEE Regulation

- Supply voltage does not exceed 250V
- Types of torque bases installed in damp & easily accessible areas must be earthed.
- Must be heat resistant

3. Switch

A switch is and additional then can disconnect and connect electrical circuit manually either directly or through the intermediate of a rope or stalk on the normal current of the circuit. The switch must also be able to withstand the excess current due to the load redundancy or short circuit.

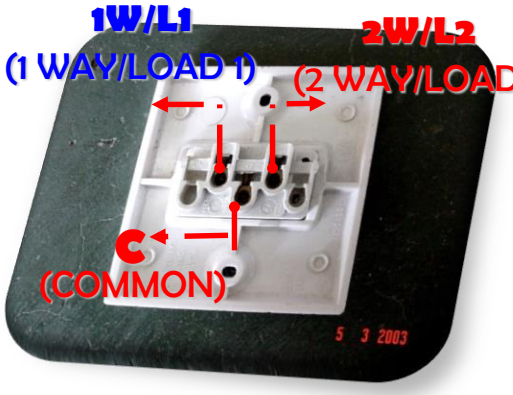
1 Way Switch



This type of switch has two terminals for the connection of the supply phase conductor and to the load.

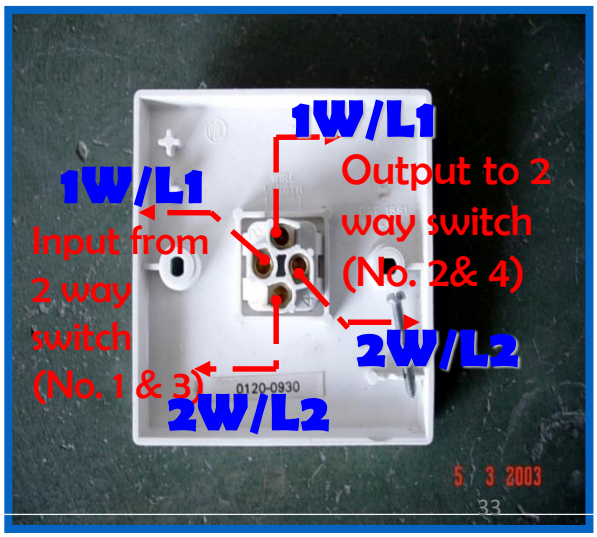
The switch is used to control a lamp or load in one position such as in a room.

2 Way Switch



For the use of two way switch control must have two units two way switches.

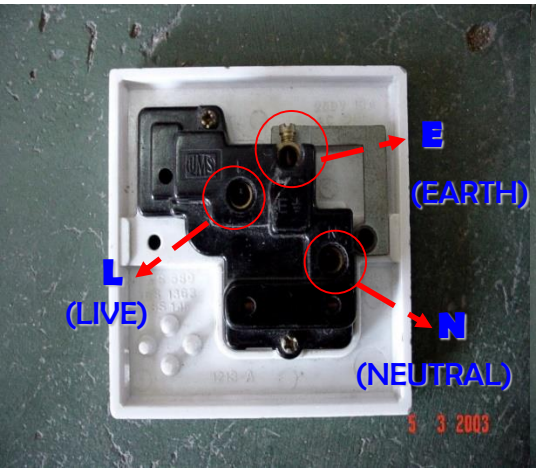
Intermediate Switch



The intermediate switch has four screwed terminals and has different operation of the two way switch.

This switch is used to control lights at more than two positions along with two units two way switch.

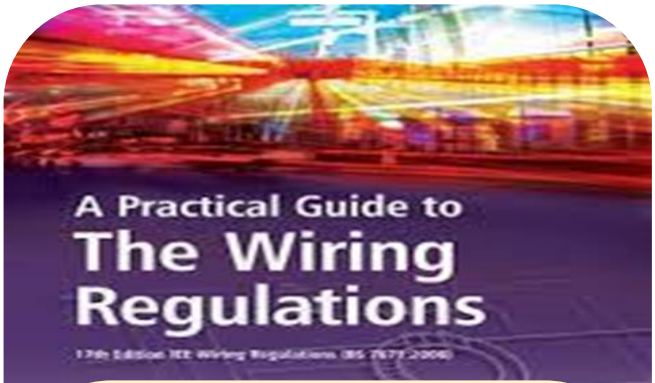
Its use as in long corridors and stair in tall building



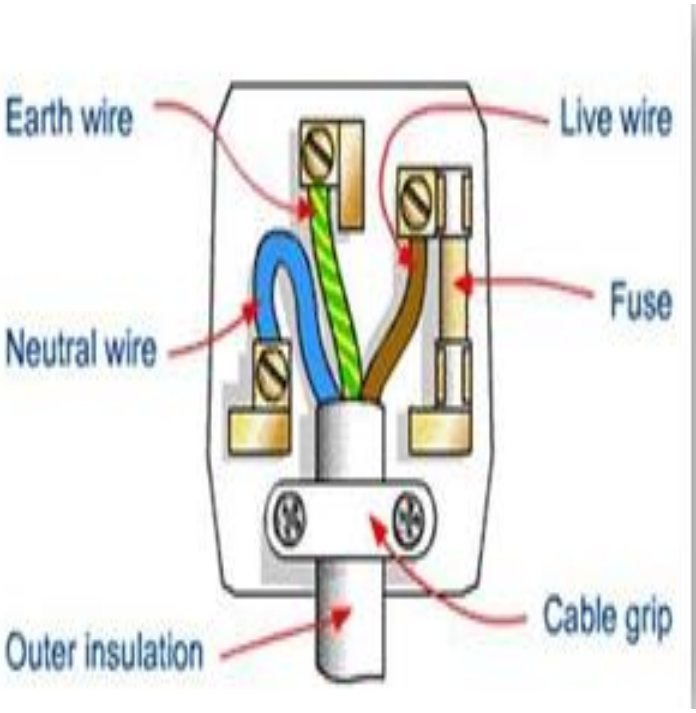
SWITCH SOCKET OUTLET

DESCRIPTION

- An outlet socket is a device that has several current-carrying contacts and is used to allow portable electrical appliances such as radios, table fans, table lamps etc.
- To be connected to the final small circuit to receive electrical supply using a suitable plug.



- The earth source of each socket shall be earthed.
- It is not allowed to install in a bathroom that has a fountain or shower.
- For floor sockets, protection efforts should be made during floor washing work.
- Only the supply voltage does not exceed 250V, unless it is specially made.
- S.A.K for whole household use must be of type MS 589



PLUG

A plug is a device that has several contact pins connected to a flexible cord and can be connected to an outlet socket with the pins located on the plug.

Plugs are used as supply connectors from outlet sockets to electrical appliances such as table fans, table lamps, scrubbers and more via flexible cords.

Global plug types can be classified into approximately fifteen distinct standards, designated alphabetically from A to O.

DISTRIBUTION BOARD (SINGLE PHASE)

BEFORE WIRING

AFTER WIRING

DISTRIBUTION BOARD

There are two types of Distribution Fuse Boxes that are commonly used in installation work, namely:

i. Single phase Distribution Fuse Box supplied with a voltage of 240 volts

ii. Three -phase Distribution Fuse Box supplied with a voltage of 415 volts.

The body of the distribution board is made of wood, PVC or metal.

Inside there are several sites for Phase, Neutral and earth conductors. Each terminal is segregated.

The rate of the protection device depends on the amount of load current in the circuit.

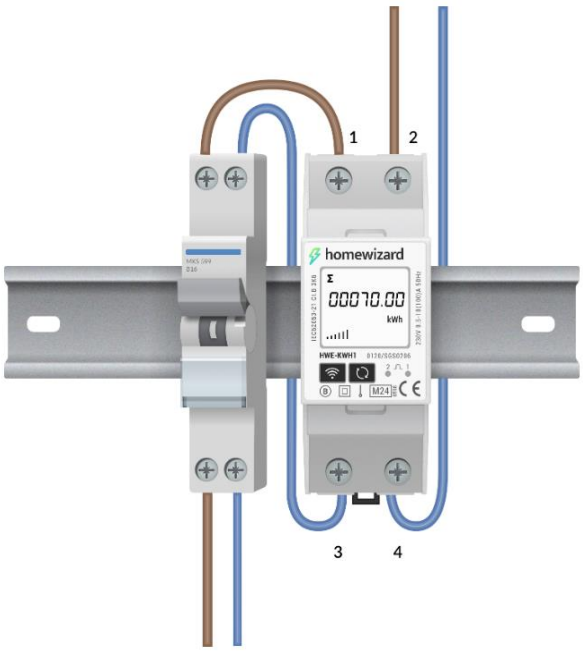
CIRCUIT BREAKER

- When there is a fault in an electrical circuit, a current larger than normal current called fault current or short circuit current that may be many times larger than normal current will flow and if this current is not protected or allowed to continue flowing, then it will endanger the system and users.

- One device used to eliminate these faulty currents or short -circuit currents is a circuit breaker.

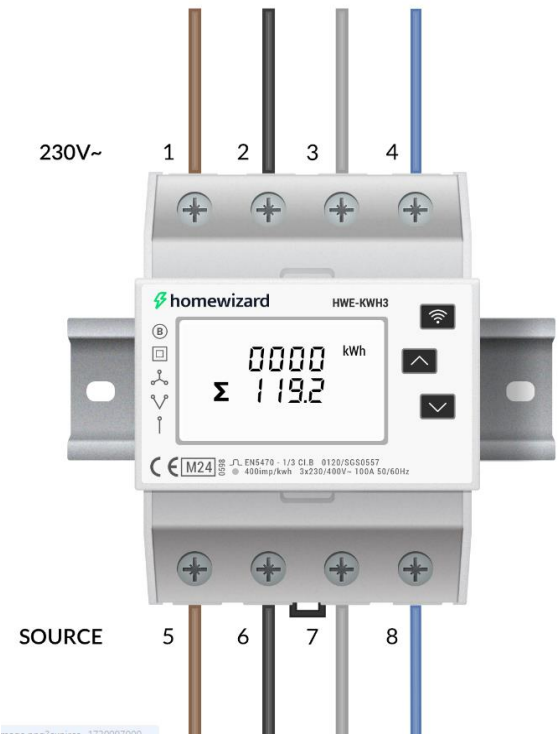
kWh Meter

The kWh Meter is installed after the circuit breaker.



Install the 1-Phase kWh meter

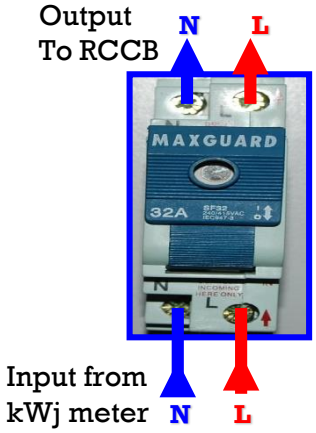
- The left side of the kWh Meter is connected to 230V~ from the breaker.
- The right side of the kWh Meter is connected to the SOURCE of which you want to get insight into. Such as solar panels, a car charger, heat pump, main connection etc.



Install the 3-Phase kWh meter

- The top side of the kWh meter is connected to 230V~ from the breaker.
- The bottom side of the meter is connected to the SOURCE of which you want to get insight into. Such as solar panels, a car charger, heat pump, mains connection etc.

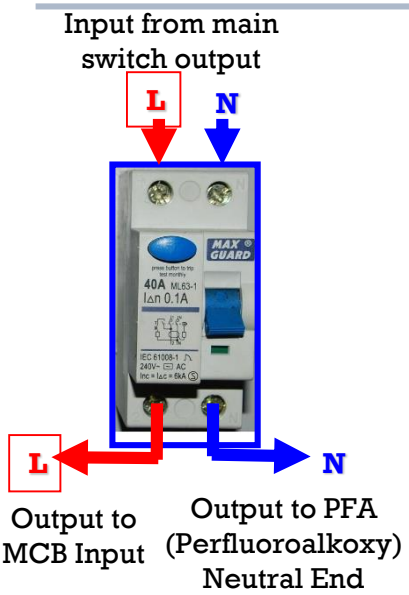
MAIN SWITCH



Serves as a device that can disconnect the distribution supply to the user by simultaneously opening the live and neutral wires if one of the poles of the supply is not grounded by using a networked two-pole switch.

The purpose of having an isolator is to protect the user from getting a continuous electric shock. Therefore isolators must be installed at the beginning of the wiring circuit for each installation as required by electrical regulations.

EARTH LEAKAGE CIRCUIT BREAKER (ELCB)



Serves as earth current leakage protection and circuit isolator.

Circuit breakers are made in various forms and types of operation, among which are the oil-filled type, the gas blown type, the air blown type (wind), the vacuum type and the miniature type.

MINIATURE CIRCUIT BREAKER (MCB)

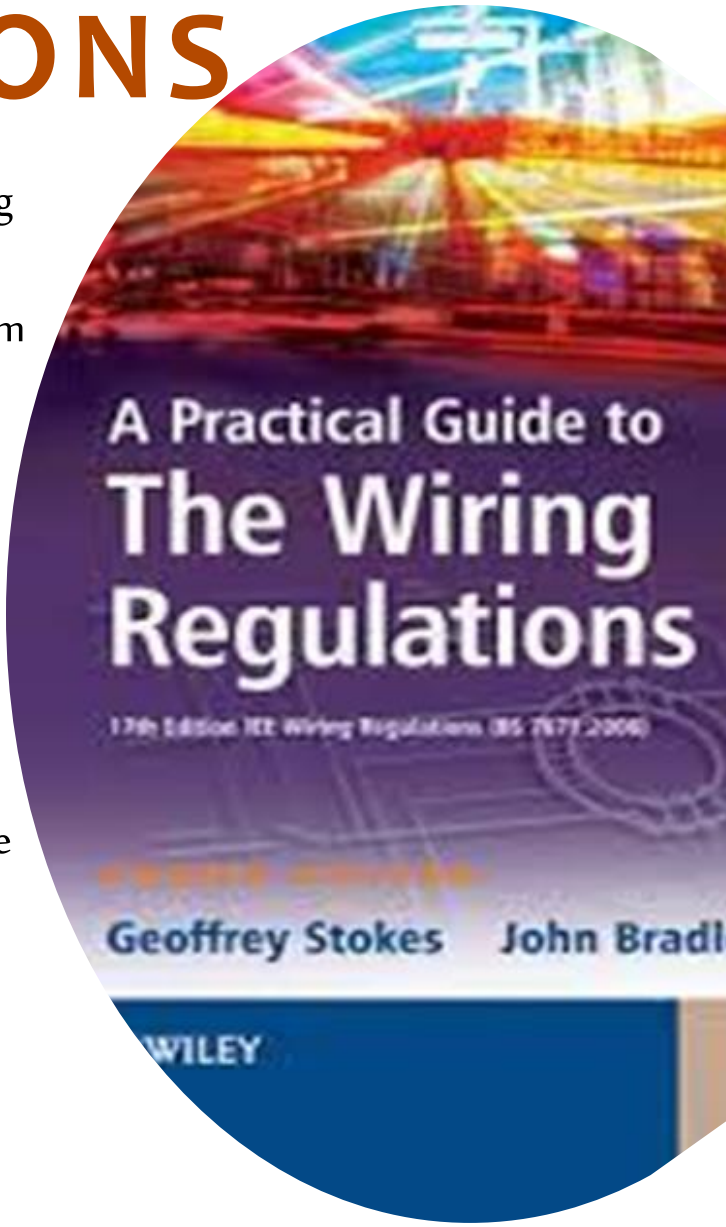
A circuit breaker specified in BS 3871 is an overcurrent protection device that has a high breaking rate and is used to connect and disconnect circuits under normal and abnormal conditions such as short circuits and over currents.

MCB Lighting Circuit 6A @ 10A (lamp, fan, bell)
MCB Power Circuit 16A, 20A, 32A (Air-conditioner, electric motor, electrical appliances).

MCB RATING VS CABLE SIZE

TYPES OF CIRCUIT	UNIT	SIZE OF CABLE (mm^2)	MCB VALUE (AMPERE)
Light/ Fan circuit	13	1.5	6
Air-Conditioner with DP (double pole) switch	1	4	20
Water heater with DP switch	1	4	20
13A Switch Socket Outlet - Radial Circuit	2	2.5	20
13A Switch Socket Outlet - Radial Circuit	4	4	32
13A Switch Socket Outlet - Ring Circuit	6	2.5/4	32

IEE REGULATIONS



- Switches used to control lighting equipment and electrical equipment must be isolated from such equipment unless the live conductor of the switch shall be as short as possible and constrained around it.

- Every switch used for the bathroom must be placed in a place that is not easily accessible by the user.

- The nominal current of each switch controlling the discharge lamp circuit must not be less than twice the amount of constant current flowing in the circuit.

- If the switch is used to control filament and discharge lamps, the nominal current must not be less than the total current of the filament lamp and twice the total constant current of the discharge lamp.

WIRING TOOLS

https://www.youtube.com/watch?v=0103hKyN7ko

Hammer

A tool specially designed for nailing clips or tins to grip wiring. Have a different head. One side is round and the other side is flat

Cable cutter

There are various types of cable cutters on the market, the following are examples of cable cutters that are commonly used in wiring works.

It is used to cut the cable and also remove the PVC wrap on a cable

Plier

There are various types of joint pliers on the market, the following are examples of cable joint pliers that are commonly used in wiring works.

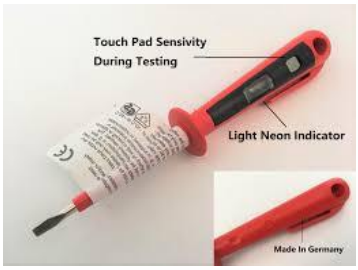
It is used to hold, grip, cut, bend and shape cables.

WIRING TOOLS

Screw driver

There are different types of screwdrivers. It is used to install and remove screws.

The correct use of a Phillips or plate screwdriver depends on the shape of the screw head



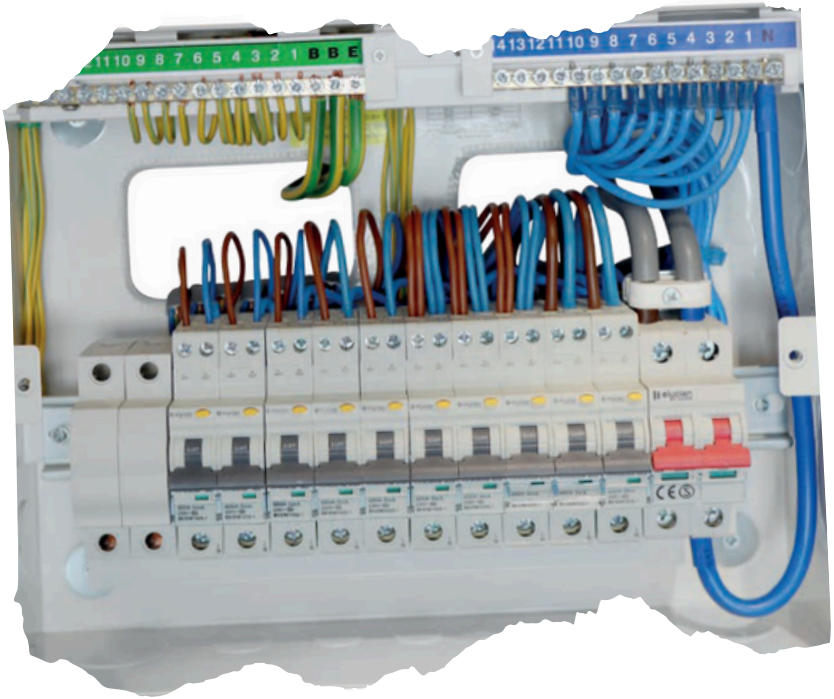
Test pen

To detect leakage of electric current or live cables. In addition, it can also be used for light work such as tightening small screws.

This test pen is suitable and safe to use to detect voltage 50 ~ 500V.

TOPIC 3
WIRING SYSTEM

SUB TOPIC 3.1
CONCEPT OF CONSUMER CIRCUIT



WHAT YOU SHOULD KNOW?

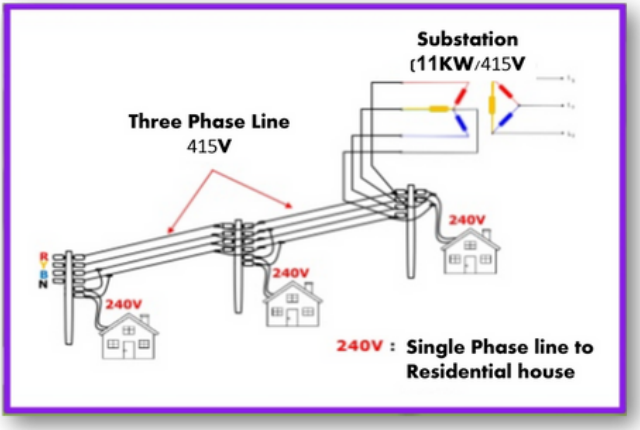
UNDERSTAND THE CONCEPT OF CONSUMER CIRCUIT

WIRING SYSTEM

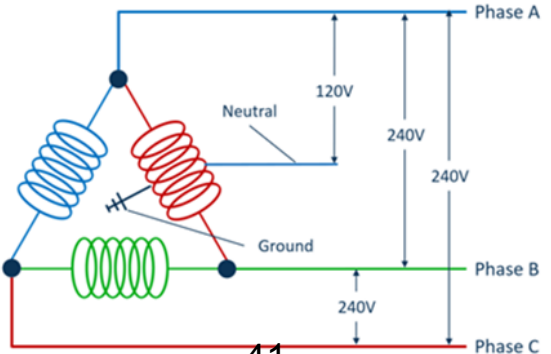
A wiring system is a system of installation of electrical circuits that includes conductors, insulation and mechanical protection for the cables used. The electrical wiring system is divided into 2 parts, namely:

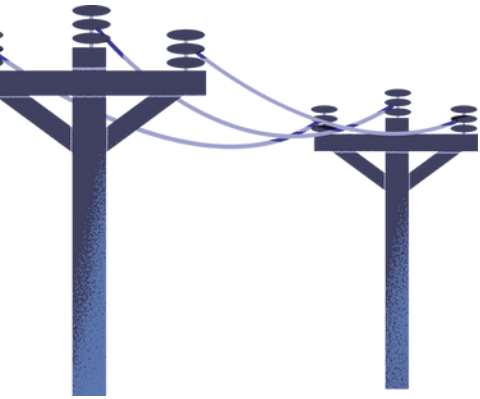
Single phase wiring system
Common in small and medium residential areas

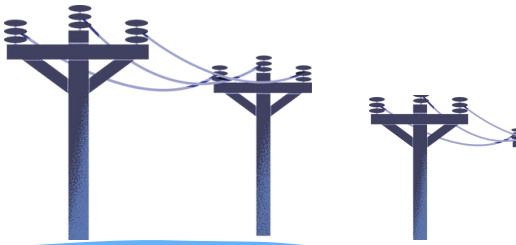
Three phase wiring system
Industrial and commercial areas



- The electricity supply received in a residential house (small/medium) is usually a 1-phase AC 240 V, 50 hz.
- This supply is obtained from a connection between a line (either r, y or b) and a neutral from a 3 -phase 4 -wire system (y -connection).
- The 3 -phase source is from a nearby substation.



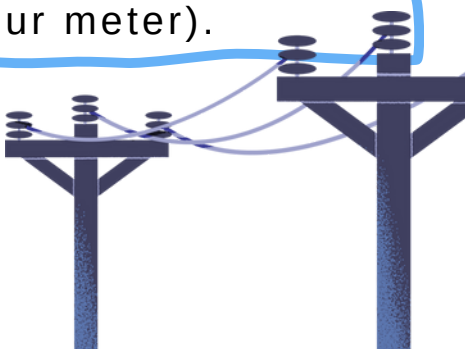




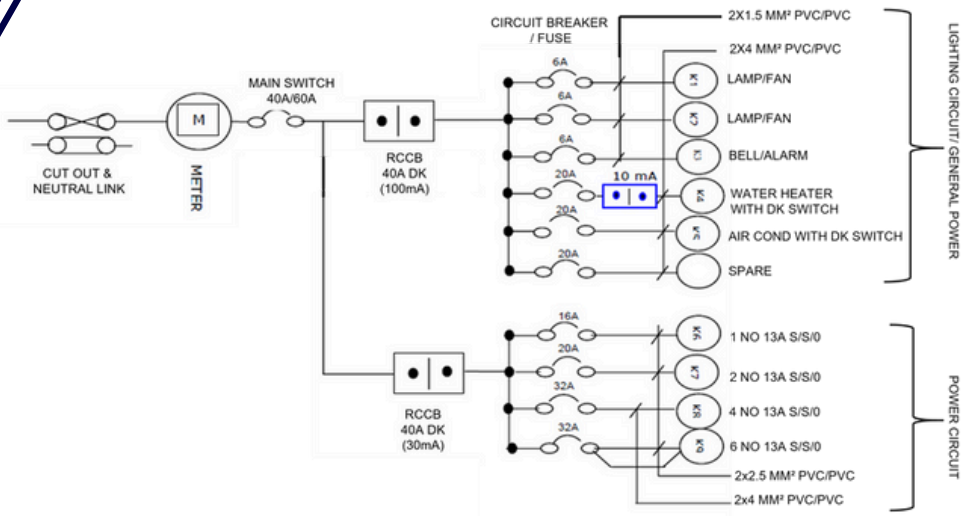
Cables or lines entering the building are directly connected to a connecting board (service base).

On this board there is a service fuse and a neutral line.
These two tools belong to TNB and are its responsibility.

After the service base, the electricity supply will be connected to the kilowatt hour meter (Watt hour meter).



SINGLE PHASE COMSUMER ELECTRICAL WIRING DIAGRAM



SEQUENCE CONTROL CIRCUIT

1. CUT OUT/ NUETRAL LINK

- It is the place of connection of electricity supply from the supplier to the consumer.
- Is A service fuse was the first live conductor used to limit current and protect a consumer's main circuit.
- It is also the absolute right of the supplier (TNB), must be sealed and cannot be modified by the consumer.
- The most commonly used service fuse sizes are 30A, 60A and 100A of the HRC or Cartridge type.

SEQUENCE CONTROL CIRCUIT

2. KILOWATT HOUR METER

- kilowatt hour is used to measure the amount of energy consumed by a consumer in a given period of time.
- Its basic construction consists of a current coil and a voltage coil.

3. MAIN SWITCH

- It is a mechanical device that can manually open and connect circuits.
- It is used to ensure that there is no danger in the event of overloads and short circuits."

4. RESIDUAL CURRENT CIRCUIT BREAKER

- RCCB used to control earth leakage circuits.
- It is turned on manually and will disconnect the circuit automatically in the event of a current leakage to earth

5. MINIATURE CIRCUIT BREAKER (MCB)

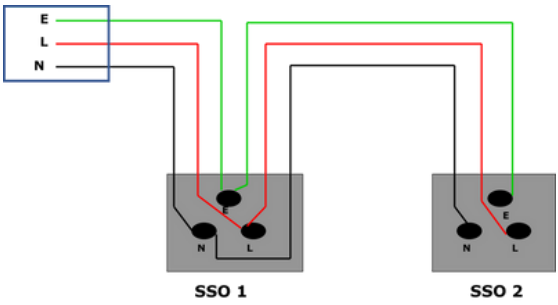
- Is an Electrical Switch that automatically switches off the electrical circuit during an abnormal condition of the network means an overload condition as well as a faulty condition

FINAL CIRCUIT IN ELECTRICAL WIRING : POWER CIRCUIT

1. RADIAL POWER CIRCUIT

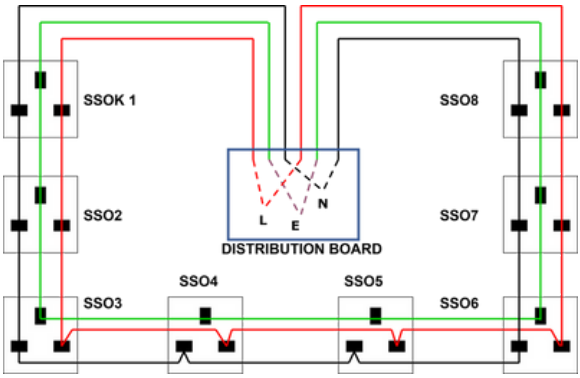
- The final circuit of the radial circuit type is a common wiring circuit in which the cable live, neutral and earth are taken from the consumer distribution box through one MCB with size 16 A or 20 A.
- At the end of the wiring will be connected to the outlet socket

THEORY DIAGRAM



2. RING POWER CIRCUIT

THEORY DIAGRAM



The ring circuit installation shall start from one MCB in the consumer's distribution box and its leads shall be connected to each termination point at the outlet socket which then returns to the same MCB

IEE REGULATIONS FOR OUTLET SOCKET CIRCUITS

RADIAL CIRCUIT

- IEE regulation 16 specifies the number of outlet sockets depending on the floor area of the room, the size of the conductor, and the degree of protection.
- This circuit must be controlled by a protective device either a fuse or an MCB
- The cable used is PVC coated copper cable and the cable size must not be less than 2.5mm2.

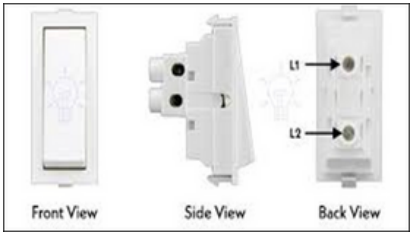
RING CIRCUIT

- The IEE regulations have stipulated that the Ring Circuit can only be installed on an area that does not exceed 100 square meters.
- The total number of sockets that can be installed is not limited.
- However, the amount of current used must not exceed the current rating of the fuse that controls the circuit.
- The rating of the overcurrent protection device is 30 Amp. / 32 Amp.
- The size of the cable used must not be less than 2.5mm2.

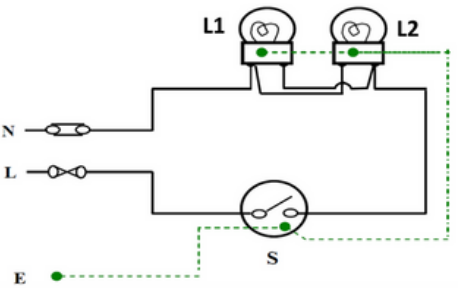
FINAL CIRCUIT IN ELECTRICAL WIRING : LIGHTING CIRCUIT

1. ONE WAY SWITCH

- There are two terminals in a one way light switch. When the switch is on, both terminals are connected together.
- This is the most common type of switch, and is used where a light is controlled from a single switch



THEORY DIAGRAM

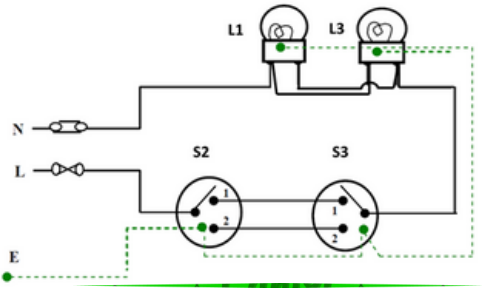


- Typically, these terminals will be marked COM and L1 (sometimes L1 and L2). Connect the permanent live (from the supply) to COM and the switched live (to the lamp) to L1.

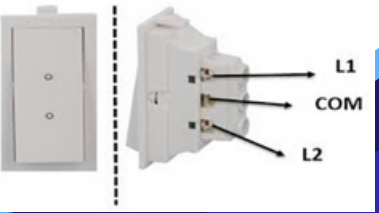
2. TWO WAY SWITCH

- 2 way switching means having two or more switches in different locations to control one lamp. They are wired so that operation of either switch will control the light.

THEORY DIAGRAM



- This arrangement is often found in stairways, with one switch upstairs and one switch downstairs or in long hallways with a switch at either end.

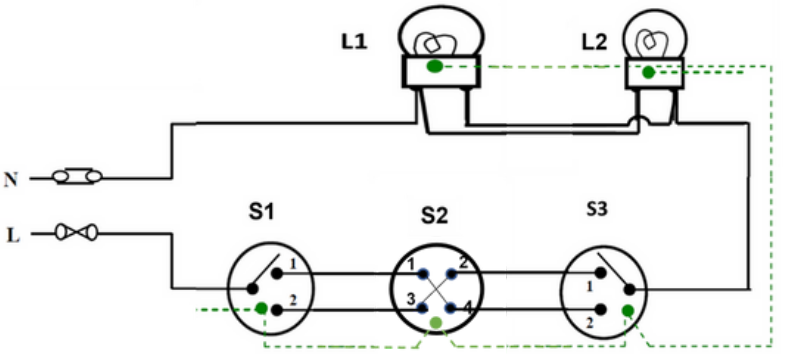


FINAL CIRCUIT IN ELECTRICAL WIRING : LIGHTING CIRCUIT

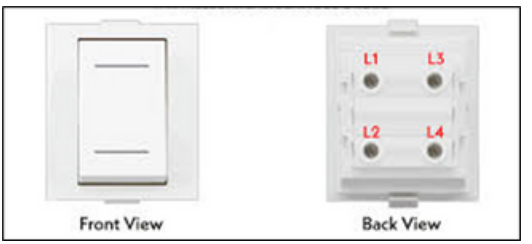
3. INTERMEDIATE SWITCH

- An intermediate switch is a three way light switch. It is used when you have three or more switches controlling one light, the middle switch needs to be an intermediate light switch.

THEORY DIAGRAM

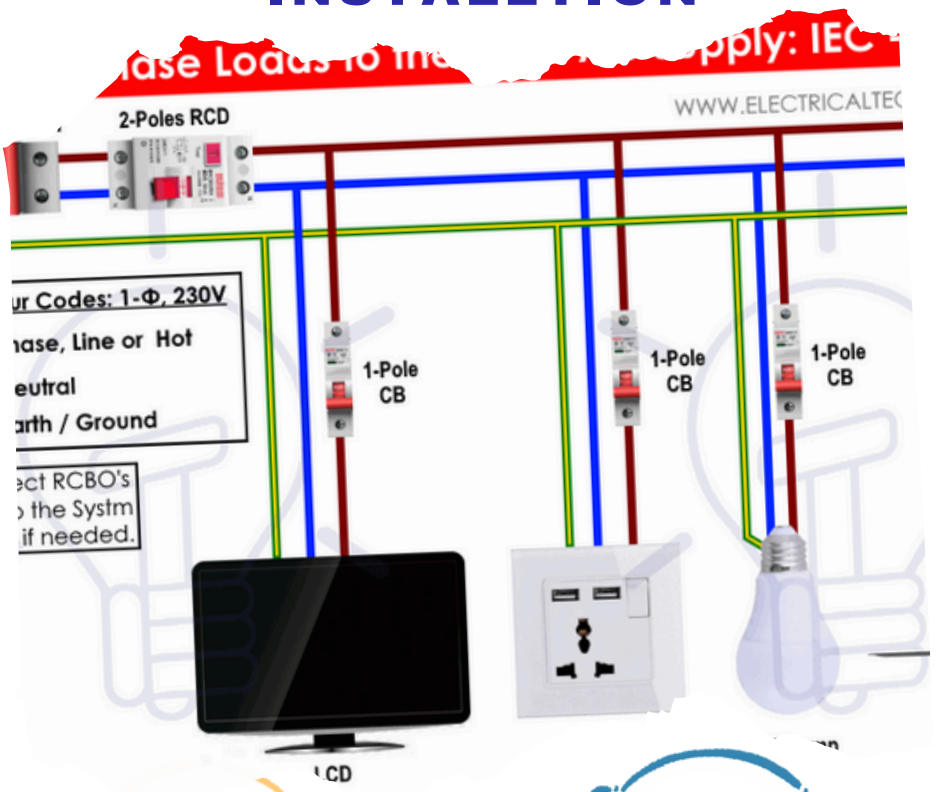


- The typical example of this is on a landing in a house, when perhaps there is a switch at the bottom of the stairs, one at the top of the stairs and one at the end of the landing.



- On this circuit you would need the middle switch (eg the one at the top of the stairs) to be an intermediate switch. This can be continued for multiple switches, so it applies to three or more switches.

SUB TOPIC 3.2
DOMESTIC ELECTRICAL INSTALLTION



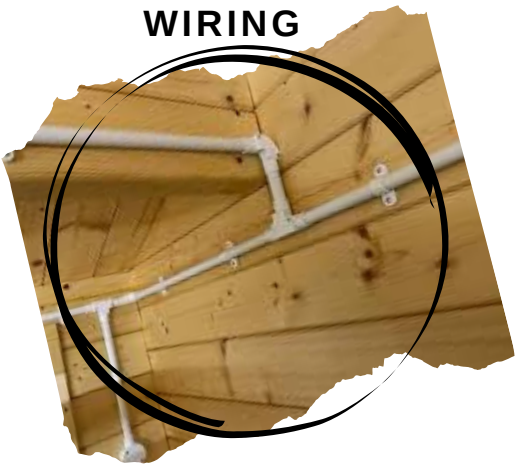
WHAT YOU SHOULD KNOW?

UNDERSTAND DOMESTIC ELECTRICAL INSTALLATION

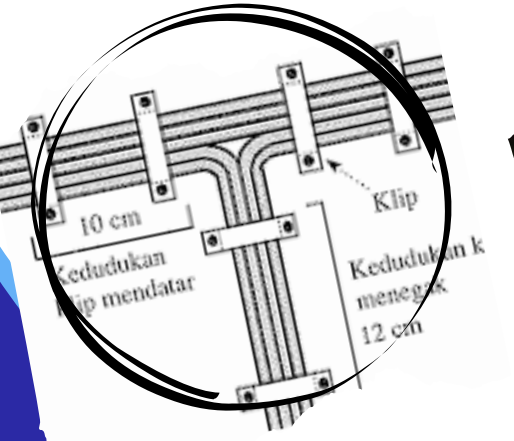
TYPES OF WIRING

CONCEAL WIRING

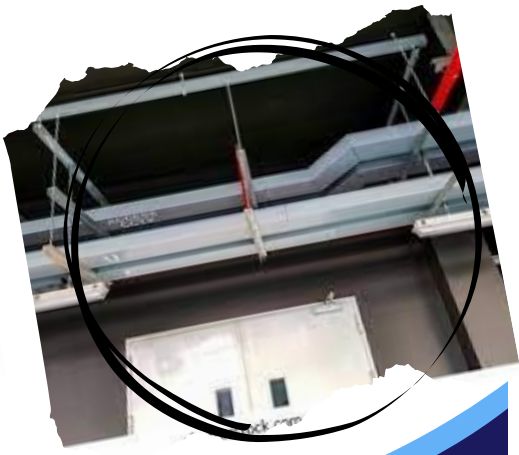
CONDUIT WIRING



SURFACE WIRING



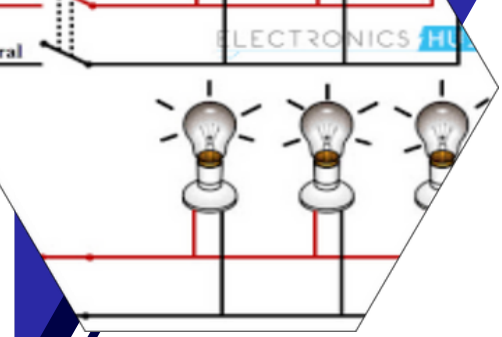
MAIN WIRING (TRUNCKING)



SURFACE WIRING

- Surface wiring systems can be installed directly to wooden walls and ceilings or on wooden planks for concrete walls
- The cable used must be of the type that has layered insulation - as it is prone to mechanical damage

ADVANTAGES	DISADVANTAGES
Neat & good looking	Prone to mechanical damage (exposed)
Suitable for small installations (residential houses)	Does not withstand hot and humid temperatures
Easy and quick installation	Suitable only in certain places
Maintenance / additional work is easy to do and does not affect existing wiring	Durability period is SHORT
The cheapest wiring cost	



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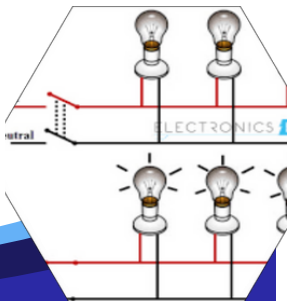
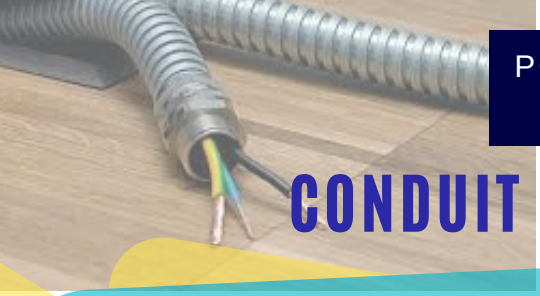
FEATURES OF SURFACE WIRING SELECTION

- The building is made of - wood/stone
- Low Voltage - single phase
- A Number of final circuits - s litle
- Installed Cable - not so much
- Less risk of mechanical damage
- Installation work - made quickly
- Power load used - small
- Installation cost - economical/ cheap





CONDUIT WIRING

Installed in places where there is a danger of mechanical damage, exposed to chemical action, liquids and outdoors. (Enterprise factories, laboratories, workshops, etc.).

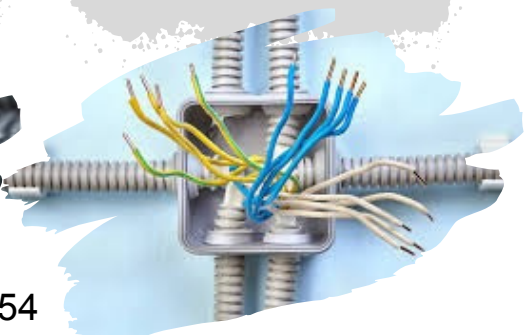
This wiring system can be installed either surface or concealed.

The number of cables installed in a conduit must be according to the space factor which does not exceed 40%.

The conduit used in this wiring system can be divided into several types, namely :
(a) Metal conduit
(b) Non Metal conduit (PVC).
(c) Flexible conduit (Metal & PVC

CONDUIT WIRING SYSTEM

ADVANTAGES	DISADVANTAGES
Has better mechanical protection	Untidy shape
Resistant to weather and heat conditions	Requires special equipment - bending machine
Durable and rugged	Needs skilled workers
Can be used as an additional earth continuity conductor	High cost
Can be planted directly into the ground	The completion period is longer



CONDUIT WIRING SYSTEM (METAL)

a) Load / power used - large.
b) Requires supply voltage - 1 phase & 3 Phase
c) Factory buildings, workshops, commercial buildings and stalls.
d) The wiring system is exposed to the danger of mechanical damage.

CONCEAL WIRING SYSTEM

- This wiring system is installed in a concrete wall/ceiling and is not directly visible except at the end of the cable used for connection to the wiring accessory terminal.

- Usually this wiring is done during the final stages of building construction (before the cement paving work is done).

- This wiring system is only allowed for low voltage only Concealed wiring systems can be divided into 2 types:

- Concealed wiring system - insulated cable

TOPIC 3.3 DOMESTIC TARIFF RATES IN MALAYSIA

RESIDENTIAL PRICING & TARIFFS

TENAGA NASIONAL
Better. Brighter.

	TARIFF CATEGORY	UNIT	CURRENT RATE
	Tariff A - Domestic Tariff		
	For the first 200 kWh (1 - 200 kWh) per month	sen/kWh	21.80
	For the next 100 kWh (201 - 300 kWh) per month	sen/kWh	33.40
1.	For the next 300 kWh (301 - 600 kWh) per month	sen/kWh	51.60
	For the next 300 kWh (601 - 900 kWh) per month	sen/kWh	54.60
	For the next kWh (901 kWh onwards) per month	sen/kWh	57.10
	The minimum monthly charge is RM3.00		

WHAT YOU SHOULD KNOW?

UNDERSTAND TARIFF

Understand Tariffs

Tariff is a payment scale that is charged to users depending on the amount of load, type of building and type of use

The tariff imposed must not burden the consumer and not disadvantage the supplier.

Therefore the tariff to be charged to the user must be approved by the Energy Commission

The purpose is to cover all costs incurred by the supplier starting from generation to supply to the consumer

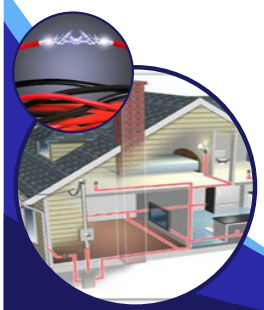
TYPE OF COST

Fixed Cost

Fixed costs are expenses that must be paid by the supplier regardless of whether the electricity produced is large or small. These costs include capital to build generators, transmission and distribution, workers' wages, insurance and etc.

Variable costs are expenses incurred by the supplier whose rate depends on the amount of energy produced. These costs include the additional costs of fuel and water units, replacement of plant equipment and etc

Variable Cost



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TARIFF CATEGORY

TARIFF A - RESIDENTIAL TARIFF

RESIDENTIAL TARIFFS ARE USED FOR USERS WHO OCCUPY PRIVATE RESIDENCES, WHICH ARE NOT USED FOR THE PURPOSE OF CARRYING OUT BUSINESS ACTIVITIES

TARIFF B,C1 & C2- TRADE TARIFF

COMMERCIAL TARIFF IS USED FOR USERS WHO OCCUPY OR OPERATE A PREMISES TO CARRY OUT COMMERCIAL ACTIVITIES

TARIFF D,E1, E2,E3 - INDUSTRIAL TARIFF

THE INDUSTRIAL TARIFF APPLIES TO USERS INVOLVED IN MANUFACTURING, QUARRYING AND PUMPING ACTIVITIES FOR WATER TREATMENT PLANTS

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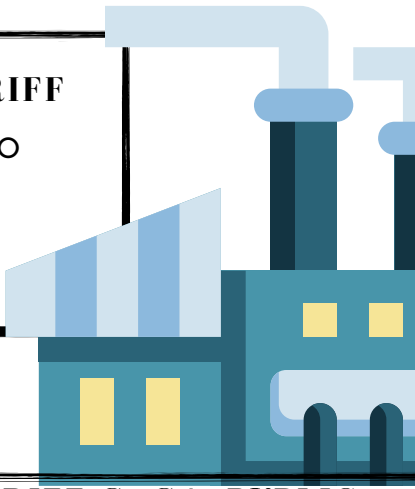
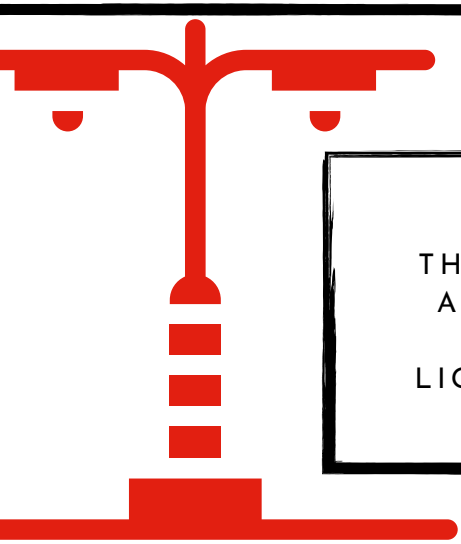
TARIFF CATEGORY



TARIFF F,F1 & F2- MININGTARIFF

THE MINING TARIFF APPLIES TO USERS WHO USE A LARGE PORTION OF ELECTRICITY TO MINE MINERALS



TARIFF G, G1- PUBLIC LIGHTING TARIFF

THE PUBLIC LIGHTING TARIFF APPLIES TO USERS WHO USE ELECTRICITY FOR PUBLIC LIGHTING, NEON LIGHTS AND FLOODLIGHTS

TARIFF H,H1 & H2- SPECIFIC AGRICULTURAL TARIFF

THE SPECIFIC AGRICULTURAL TARIFF IS USED FOR USERS WHO CARRY OUT SPECIFIC AGRICULTURAL ACTIVITIES. CONDUCT BUSINESS ACTIVITIES

EXAMPLE 1 ELECTRICAL BIL

Maklumat Terperinci Penggunaan Elektrik

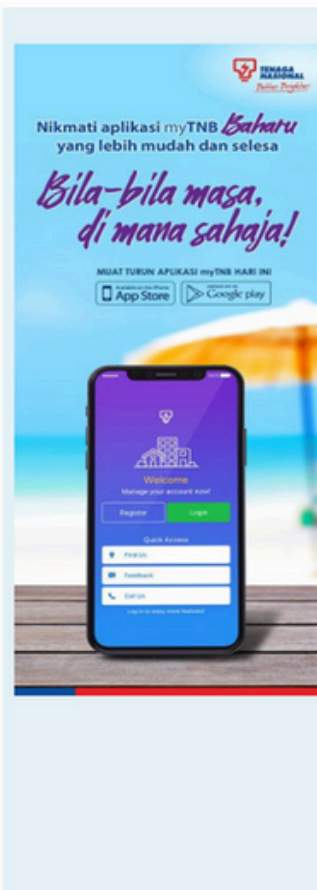
Jenis Bacaan : Bacaan Sebenar

TENAGA NASIONAL

Pengiraan Penggunaan Elektrik Semasa

Tempoh Bil :	23.06.2022 - 22.07.2022 (30 hari)	Faktor Prorata 1.00000

Blok Tarif (kWh)	Blok Prorata (kWh)	Kadar (RM)	Amaun (RM)
200	200	0.218	43.60
100	100	0.334	33.40
300	231	0.516	119.20
Jumlah	**531**		**196.20**



No. Meter	Faktor Meter	Bacaan Meter		Kegunaan	Unit
		Dahulu	Semasa		
M3142134620	1.00000	32,445	32,976	531.00	kWh

Rekod Penggunaan 14 Bulan Bil Anda

Jumlah Kegunaan 13 bulan terdahulu ialah 7,914 kWh

N - Bacaan Sebenar E - Bacaan Anggaran A - Bacaan Anggaran Meter Rosak

Keterangan	Bulan	KWh	Bil.Hari	kWh/hari	Kos/hari (RM)
Semasa	JUL-22	531.00	30	17.70	6.54
Dahulu	JUN-22	568.00	30	18.93	7.18
Tahun terdahulu	JUL-21	744.00	30	24.80	10.35

HOW TO CALCULATE

TENAGA NASIONAL

Kegunaan TNB

No. MRU	: 24200223
No. Sequence	: 0015
Bil	: OPC

Bil Terperinci Anda

NO. AKAUN
220396727403

ALAMAT PREMIS
16, JALAN BAWAL 4
TAMAN BAWAL
06150 AYER HITAM
KEDAH

MAKLUMAT BAYARAN AKHIR
Amaun : RM286.35
Tarikh : 27.06.2024

Anda Guna

EXCERSICE ELECTRICAL BIL CALCULATION

SCAN THIS TO ASSIT YOU
Wordwall EXCERSICE

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