

Difference Between Wire and Cables

Wires

As stated earlier, a wire is a single conductor strand or a group of conductor strands, sheathed in a jacket of insulation to prevent the conductors from making unwanted contacts. Wires are generally used to carry electricity and telecommunications signals; however, it can also be used for mechanical loads. Essentially, there are two types of wires, namely, solid and stranded. While a solid wire is actually a long length of single conductor, a stranded wire comprises of multiple thin strands of conductor twisted together. Solid wires offer low resistance, and are ideal to use in higher frequencies. Stranded wires are more flexible and thus, have a longer life. Furthermore, stranded wires have superior cross-sectional area than solid wires for the same current carrying capacity.

Cables

A cable is, generally, two or more wires running together or bonded, twisted or braided together. They are mostly insulated to offer better protection than just wires. Cables are largely employed in power transmission, and to carry electrical and telecommunications signals. There are many types of cables, such as, twisted pair cable, [coaxial cable](#), [multi-conductor cable](#), and fiber optic cable. If we talk about the **twisted pair cable**, it comprises two cables twisted around each other, and is mostly used for carrying signals.

On the other hand, a **multi-conductor cable** is made up of many conductors insulated from each other, and is used to protect signal integrity by reducing hum, noise and crosstalk. **Coaxial cable** is made up of an inner solid conductor surrounded by a paralleled outer foil conductor, protected by an insulating layer, and is generally used in TV Cable. **Fiber optic cables** help to transmit signals by a bundle of glass threads. These cables have a much greater bandwidth than metal cables, indicating that they can carry more data.

Basic Difference Between Wires and Cables

| | Wires | Cables |
|------------|------------------|-----------------------|
| Definition | Single conductor | Two or more conductor |

| | | |
|-----------|---|--|
| Uses | To bear mechanical loads, to carry electricity and telecommunications signals, heating, mesh, automotive or industrial manufactured parts, bulbs. | Power transmission, to carry electricity and telecommunications signals. |
| Types | Solid wire, and stranded wires | Twisted pair cable, coaxial cable, multi conductor cable and fiber optic cable |
| Advantage | solid wires are perfect for use in higher frequencies, offer low resistance. Stranded wire shows higher resistance to metal fatigue. | Higher strength, heavy duty, insulated. |

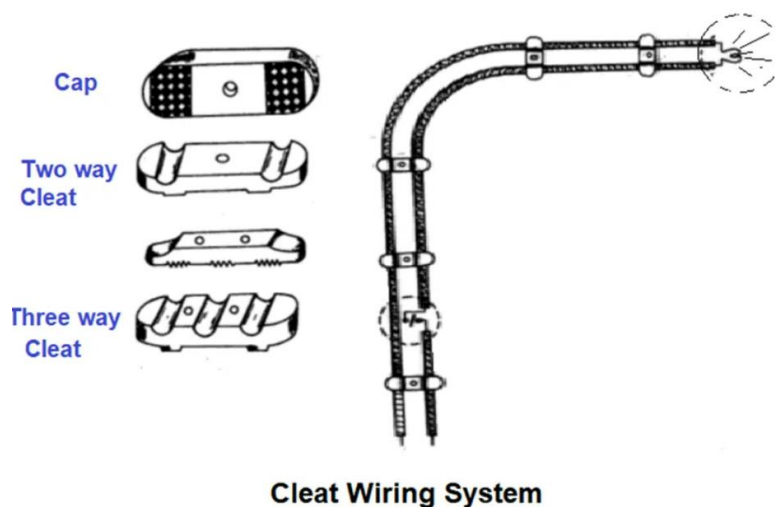
Types of Electrical Wiring

Basically, there are four types of electrical wiring procedures.

They are

- Cleat wiring.
- Batten wiring.
- Casing and capping.
- Conduit wiring.

1. Cleat wiring



In this type of wiring, the insulated conductors are supported on porcelain or wooden cleat. The cleats have two halves.

One base and another cap. The cables are placed in grooves in the base plate and a cap is placed on it. Cables are held in porcelain or wooden cleats at 6mm above the walls or ceiling.

Cleat wiring is generally used for temporary wiring purposes not as a permanent system of wiring. It is not preferred on domestic premises. But, it is quite suitable for taking a temporary connection in industrial construction work.

Advantages

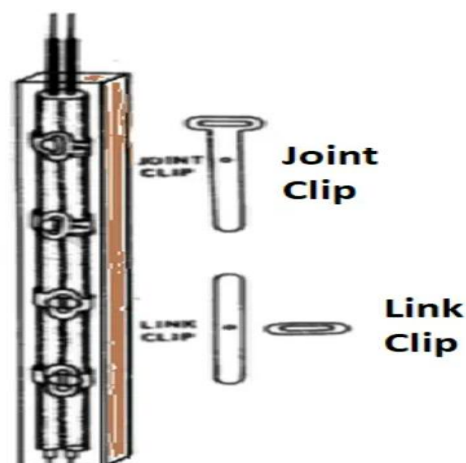
- This fitting is very easy and cheap.
- This method was very good for temporary fitting where some kind of construction is going on.

Disadvantages

- This fitting doesn't look good.
- As the cable is kept out, so it has the effect of every kind of environment, a low-quality wire spoils quickly.

2. Batten Wiring

This wiring system is a very old method in which all wires are tied with an iron clip on top of a wooden strip (batten) and this collection is used in large quantities so that the wire is very well sealed with some wooden strip.



Batten Wiring System

And then by linking wires on top of the batten. Which is tied with the first strip

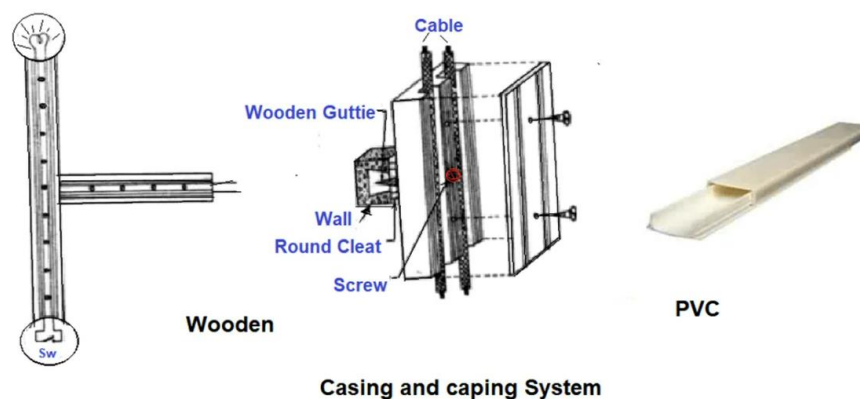
Advantages

- Wiring is simple and easy to do
- This wiring method is cheaper than another wiring.
- This wiring also looks great.
- It is also easy to repair this wiring

Disadvantages

- We can not do this wiring in the open outside the house
- This wiring is not protected from the external environment because it has a great impact on the weather.
- The heavy wire cannot be used in this wiring
- This wiring is up to 220 V only.
- Require more cables and wires.
- Cable sag may take place after a long period.

3. Casing and Capping



This type of wiring is very popular. Because this wiring system is very easy to do and it is also very cheap.

If it is done above the walls, then anyone can fit it very easily in this wiring fitting, the wires are placed inside the plastic casing or wooden enclosures.

Looks nice from fitting it is covered from the top so that it looks good and

Advantages

- This wiring system is much easier and cheaper than other wiring systems.
- This wiring system is very strong and long-lasting.
- One can make changes to this wiring very easily.

- There is no risk of electric shock as it covers the wires well.
- If phase and neutral follow a different path, repair becomes easy.

Disadvantages

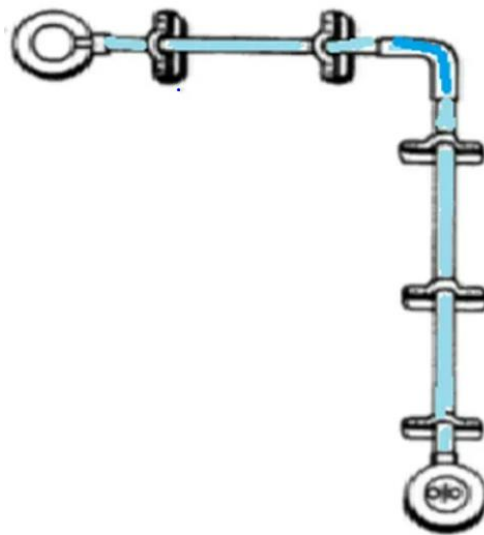
- if there is a fire in the wires inside it, then this whole fitting can burn.
-

4. Conduit Wiring

The conduit wiring system is of two types.

1. Surface mounting.
2. Concealed conduit wiring.

Surface mounting conduit wiring system



Conduits carrying the PVC insulated wires can be installed on the surface of the walls or concealed in the walls and the ceiling.

Concealed conduit wiring

Conduit wiring is a system, basically, wires or cables which are routed in metal or plastic inside the wall. **Conduits** isolate wires to avoid exposure, thereby reducing the risk of fires, short circuits, fire, electrocution.

Modern practice is the hidden installation of the conduit in the plaster of the wall, so that appearance of the house or the building remains unaffected. Conduits are available in standard lengths.

The conduits system for each circuit must be erected completely before any cable is drawn in.

Advantages

- A conduit wiring system is best for domestic and commercial installations.
- It provides proper protection to the installation against shock, fire hazards mechanical damage.
- Protected from external damage due to rodents, short circuit.
- Conduit is durable and strong, can last for a long time.
- Great protection as it is more robust.

Disadvantages

- If cable got damaged. replacement of cable is difficult compared to any other.
- Requires skill in running the conduit and wires through it.
- The cost, time, and efforts of installation are high.

Types of Switches:

The switch is an electrical device that is used to break or make an electrical circuit manually or automatically. The working principle of switch depends on ON/ OFF mechanism. Various electrical or electronic circuits use switches to control or trigger the owl circuit. The types of switches depend on the connections of the circuit they make. Two essential components such as pole and through can confirm what types of connections a switch can make. These two components are also used to define variations of switch contact.

Here, the poles and throws can be defined as; when the number of circuits is controlled by a switch is called poles, whereas throws can be defined as the number of positions that the switch can adopt. A single throw switch consists one pair of contacts like open or close. A double throw switch includes a contact, which can be connected to two other contacts. When the switch is activated, then the current flows through between the two terminals of the switch. When the switch is OFF, then the current doesn't flow between the two terminals of the switch.

The types of switches are classified into four types namely:

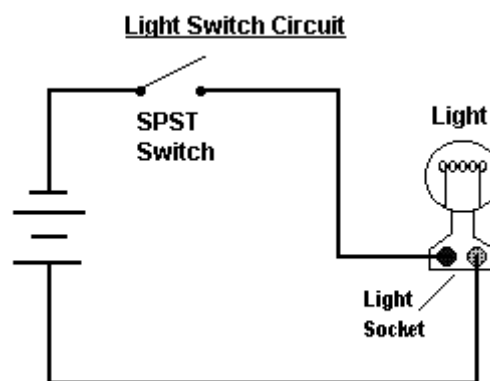
- SPST (Single Pole Single throw)
- SPDT (single pole double throw)
- DPST (double pole, single throw)
- DPDT (double pole double throw)

SPST (Single Pole Single Throw)

The SPST is a basic ON/OFF switch, that is used to connect or break the connection between two terminals. The power supply for the owl circuit is given by this switch. A simple PST switch is shown below.

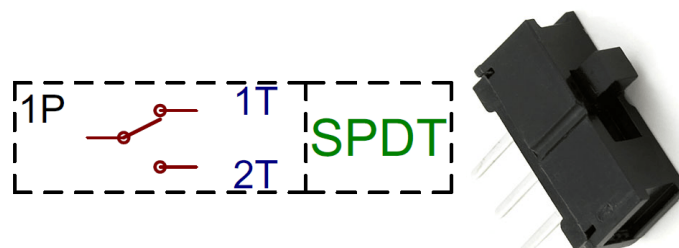


The application of SPST switch is light switch given below and it is also called as a toggle switch. This type of switch has one input and one output. This light switch circuit controls one wire and makes one connection. This is an ON/OFF switch, when the switch in the below circuit is ON or closed, then the current flows through the two terminals and the bulb in the circuit will blink. When the switch is OFF or open, then the current doesn't flow through the two terminals.

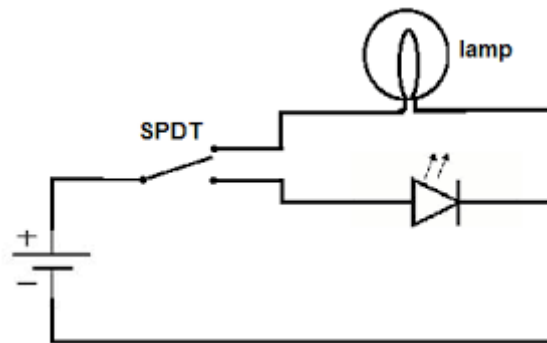


SPDT (Single Pole Double Throw)

The SPDT switch is a three terminal switch, one terminal is used as input and remaining two terminals are used as outputs. It joins a mutual terminal to one or the other of two terminals. In the SPDT switch, instead of other terminals, just use COM terminal. For example, we can use COM & A or COM & B.



The application of SPDT switch is mainly involved in a three-way circuit to turn ON/OFF a light from two locations like from the top & bottom of a stairway. In the circuit below, when the switch A is closed, then the current flows through the terminals, but only light A will glow and light B will OFF. When the switch B is closed, then the current flows through the terminals and only light B will glow and light 'A' will OFF. Her two circuits will be controlled through one source or one way.



DPST (Double Pole, Single Throw)

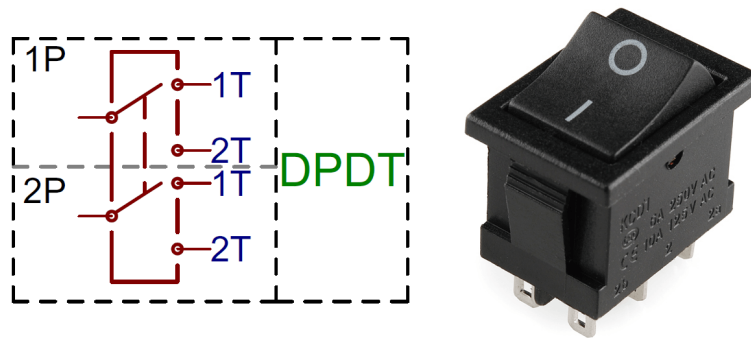
The DPST switch consists of two poles that means it includes two identical switches located on side by side. This switch is operated by one single toggle, which means that two discrete circuits are controlled at a time through one push.



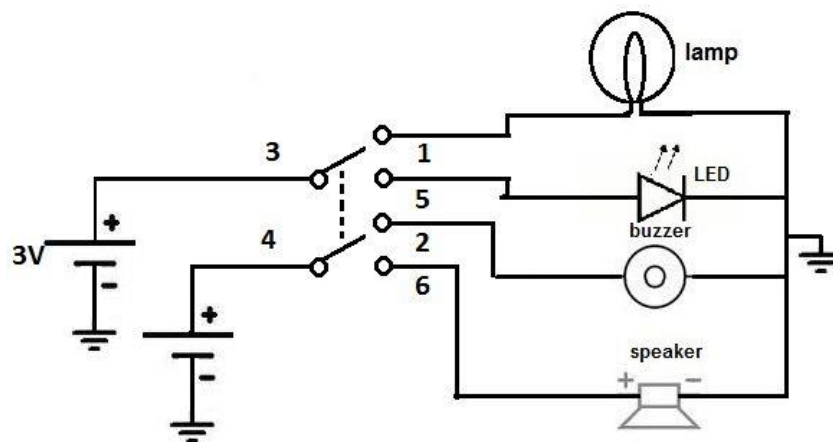
This switch is used to turn two circuits ON/OFF and it consists of four terminals namely two inputs and two o/p.s. The main purpose of this switch is to regulate a 240V appliance, where both supply voltages must be ON whereas the unbiased wire may be always connected. When this switch is ON then the current starts flowing through two circuits and when it is turned OFF then it is turned OFF.

DPDT (Double Pole Double Throw)

This switch is equal to two SPDT switches, it means two separate circuits, connecting two inputs of each circuit to one of two outputs. The switch position controls the number of ways and from the two contacts each contact can be routed.



When it is in ON-ON mode or ON-OFF-ON mode they work like two discrete SPDT switches worked by the similar actuator. At a time only two loads can be ON. A DPDT switch can be used in any application that needs an open & closed wiring system.



The best example of this is, modeling of the railroad, that makes use of small scaled railways and trains, cars and bridges. The closed permits for the system to be switched at all times, whereas open permits for extra piece to be switched ON or triggered through the relay. From the following circuit, A, B and C connections from one pole of the switch and D, E and F connections from the other pole of the switch. Connections B and E are mutual in each of the poles.

If the +Vs enters at connection B & the switch is fixed to the top most position, then the connection A becomes +ve and the motor will rotate in one direction. If the switch is set to the lowest position, the power supply is inverted and connection D becomes +ve then the motor will rotate in the opposite direction. In the middle position, the power supply is not linked to the motor and it does not rotate. This kind of switch is mainly used in several motor controllers where speed of that motor is to be inverted.

Earthing for Houses – Types & Methods of Earthing

Electricity was an ever important discovery for mankind. Be it basic necessities to exquisite designs – electricity has a major role to play in every sphere of our lives. Several technological advancements in the type of appliances have come to the fore, and this keeps on increasing day after day. Electricity was born to serve man, its master. But with the current scenario of several mishaps and lack of preventions, there has been a strange and undesirable role reversal. The human body has chances of severe damage in case an electric current of 5 milli Amps passes through it within a rapid time span. In such a case if a person touches an appliance, which has

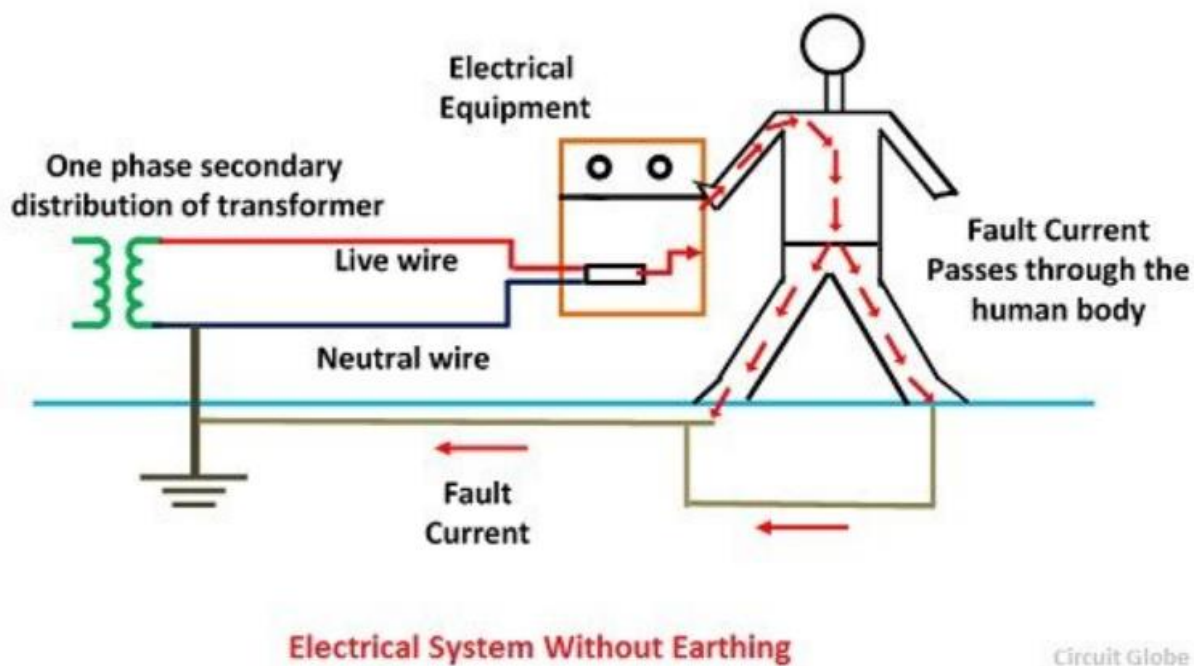
heavy currents flowing through it, with his bare hands there are high chances of this encounter being fatal.

The electrical potential of the Earth is considered to be zero. Hence on connecting the electrical channels of any appliance to the Earth, its potential would become zero too.

This is the main concept behind Earthing, which is a process bonding noncurrent bearing parts of an electrical device or the neutral summit of the electrical organization to the earth through wires possessing minor resistance to flow of current.

Why is Earthing required for Houses?

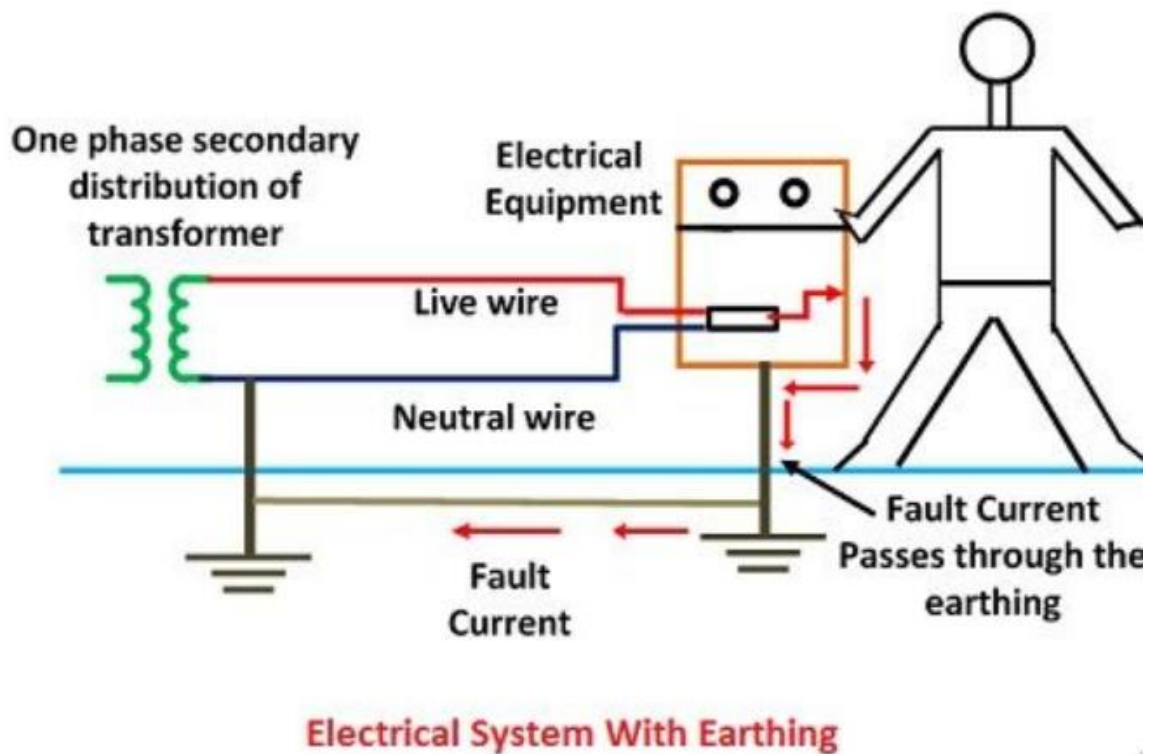
- To warrant that all pieces of equipment in use by the occupants of a building are at Earth Potential, thus safeguarding them from electric shocks through direct contact
- To protect electrical apparatus from getting damaged due to weighty currents along electrical lines
- To sustain stable voltages in three phase circuits even under unstable load state
- To protect tall buildings from getting harmed under lightning



We know that current flows from a higher to a lower potential. Any electrical appliance or any electricity line which has been connected to the earth is now at zero voltage.

In the case of any overloading of current, the immediate discharge of electrical energy takes place to the ground, without harming the appliance or the user.

Even if the insulation of the equipment fails, if it is earthed, the appliance is safe enough.



Methods of Earthing

There are several common methods employed for earthing of appliances, and each of them is used according to the site of the building, the type and number of appliances to be earthed, the budget and other such factors. Here are a few of them.

Plate Earthing

A 2.5 metre deep pit is dug into the ground and a Galvanised Iron (GI) plate is placed inside along with charcoal and sand for the purpose of maintain low resistance around the plate.

An earth wire, which is of GI or tinned copper, is bolted to the plate before burying it by means of nuts, bolts and washers. The wire is made to pass through a GI pipe through which some water is poured in to increase conductivity. The earth wire is connected to the Earth point of the socket and is finally covered.

Pipe Earthing

A 2.5 metre long pipe measuring about 35-75 mm in diameter is buried in the dig out pit along with sand and charcoal. The pipe is provided with several perforations to maintain dampness around and hence conductivity.

The earth wire is tied and clamped near the summit. Water may be poured into it during summers. The earth wire is safer against damage in such a setup.

Pipe Earthing

This method employs hammering of zinc and copper rods of about 1-1.5 metres length and 12-20 mm diameter into the general mass of the earth.

Successive rods are screwed together and this chain is tried making as long as possible for lowered resistance by the surrounding soil.

The earth wire is tied and clamped near the summit. This is a very economical and quick procedure for earthing.

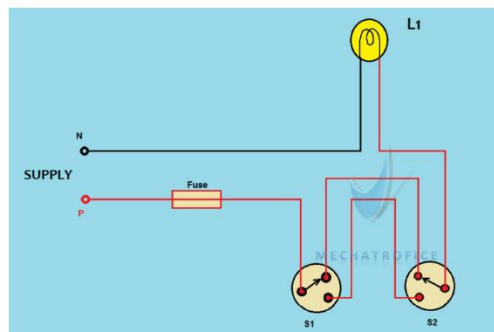
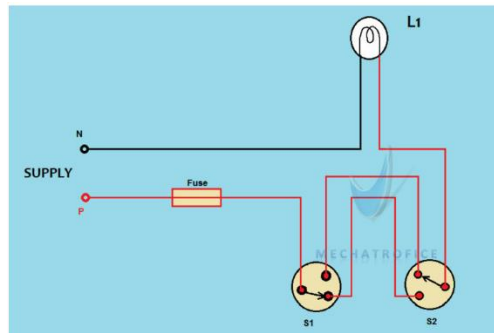
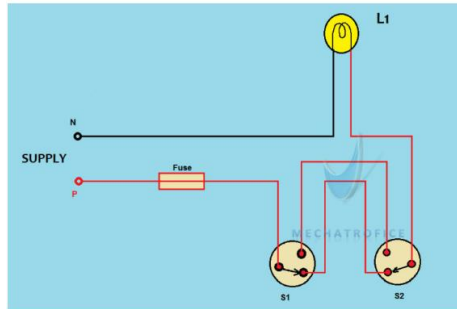
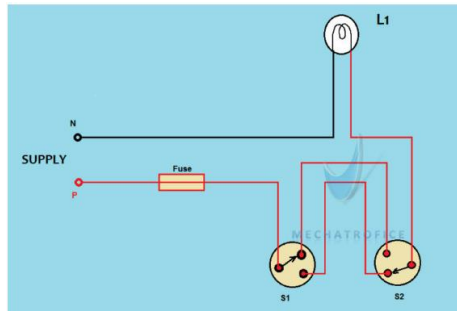
Working of SFU, MCB, MCCB – class notes

Difference between MCB and MCCB

| MCB vs MCCB | |
|--|---|
| MCB | MCCB |
| These are used for low energy requirements such as small electronic circuits or home wiring. | MCCBs are used in high energy requirement applications such as high-power equipment in industries or for commercial purposes. |
| MCBs have ratings under 100 amps. | MCCBs goes as high as 2500 amps. |
| It is a low-voltage circuit breaker. | It is also of low voltage to meet IEC ₉₄₇ standards. |
| Trip characteristics cannot be adjusted. | Trip characteristics can be adjusted. |
| Interrupting rating under 18000 amps. | Interrupting rating ranges from 10000 to 200000 amps. |

Staircase wiring

Staircase wiring is a common multi-way switching or two-way light switching connection; one light two switches wiring. Here one lamp is controlled by two switches from two different positions. That is to operate the load from separate positions such as above or below the staircase, from inside or outside of a room, or as a two-way bed switch, etc.



Staircase wiring circuit arrangement

The first pole and second pole of the [SPDT switch](#) S1 is connected to the corresponding first and the second pole of the SPDT switch S2. That is similar poles of both two switches are connected to each other.

The phase of the supply line is connected to the common pole of a switch. And the phase line to the load is taken from the common pole of the next switch. It makes an arrangement that, to close the circuit both the switches should be in the same position in order to make the two common poles in contact to achieve a closed circuit. Changing the ON & OFF condition of a single switch can determine whether the circuit is closed or open. Thus in staircase wiring, we

can control the load from both positions. If a truth table is made for the above traveler system output, it will have a result similar to an XNOR gate. That is the light ON's when both the switches are in the same position.

Similarly, if the connections between the switch s1 and s2 have interchanged, the load will ON when the switches have opposite positions.

Go-down Wiring Connection

- This type of lighting system is used in the tunnel-like structure. Where a person can go very deep or long but also want to save on electricity consumption, like in big godowns, long passages, warehouses and tunnel-like structures having many rooms or portions.
- It follows the linear sequence for switching the lights from one end to the other. So that it can cover all structure in less area.

Practically you can understand it like this :

- When a person leaves from one room and enters next, by turning the light switch makes earlier lamp switched OFF while the present room is switched ON. It turns OFF the lamp while switching another. No need to go back and switch OFF previous lamp.

