

## Introduction to Domestic Wiring

Before going into the details of domestic wiring, it is necessary to get acquainted with the various types of commonly used tools, types of wires and its ratings and other accessories used in domestic wiring.

The most commonly used tools for lighting and wiring are (1) Screw drivers (thin blade type and square blade type) (2) Hammer (Ball-pen type and claw hammer) (3) Pliers (side cutting plier, diagonal cutting plier, long nose plier, slip joint plier) (4) Pocket knife (5) Hand drill (6) Chisel (7) Wooden saw (8) Hacksaw (9) Centre punch (10) Pipe vice (11) Pipe cutter (12) Dies (13) Wrenches and (14) Scratch awl etc.

## Wire specifications

The gauge commonly used is the British Standard Wire gauge. Numbers have been assigned to the wire sizes. For example, the gauge number 7/0 has a diameter of 0.500 inch whereas gauge number 36 has a diameter of 0.0076 inches. It should be noted that the higher the number of the wire gauge, the smaller is the diameter. The table 12.1. below gives the diameter of the British Standard Wire Gauge.

The wires used for domestic wiring may be of single solid conductor or a flexible cord with number of wires stranded together (for greater flexibility). The number of wires stranded together depends upon the current carrying capacity. For example, a flexible cord of 40/0.0076 has 40 conductors of 0.0076 inch dia i.e., 36 swg (from Table 12.1) and has a current carrying capacity of 7 amperes.

## Wiring accessories

The commonly used accessories in domestic wiring include, switches, lamp holders, socket outlets, ceiling roses, plugs, flexible cords, distribution boards, fuses and cables etc.

### Switches

The purpose of switch in a circuit is to make or break the electric connection. There are various types of switches. Some of them are listed below.

- (i) Tumbler switch or surface switch
- (ii) Flush switch
- (iii) Pull switch
- (iv) Rotary switch
- (v) Push button switch
- (vi) Iron clad switch
- (vii) Knife switch
- (viii) Two-way switch

The tumbler switch projects out of the surface of the wall where as a flush switch is fixed in flush with the wall and it does not project out of the wall. The flush switch is preferred when high quality performance and appearance are required. The pull switches are used in bathrooms (to operate heater) and in bed rooms (to operate lights and fans). They are fixed on the ceiling and are operated with a single pull on the cord. The rotary switches are used in speed control of fans (to change the speed) and also in heaters to change the range of heat. They consist of insulated handle to which the blades are fixed. The blades move in steps and make contact with the terminals. The push button switches are used for starting the motors. The iron clad switch used to control all the subcircuits which are enclosed in an iron box. To control a single phase two wire circuit, a double pole iron clad switch is used. The triple pole iron clad switch is used to control the 3 phase 3 wire system. A 3 phase 4 wire system could be controlled by a triple pole iron clad switch with neutral link. The two way switch is a special purpose switch used for stair-case wiring.

### Lamp holders

The purpose of lamp holder is to hold the lamp. Lamp holders are normally available with bakelite exterior and porcelain interior or brass exterior with porcelain interior. The lamp holders are classified as follows:

- (i) Batten holder
- (ii) Pendant holder
- (iii) Angle holder and
- (iv) Bracket holder.

### Socket outlets

The socket outlets are of either 2 pair or 3 pair type. They have insulated base with moulded or socket base. These sockets are available either in flush pattern or surface mounting.

### Ceiling roses

They consist of a circular porcelain or bakelite base and a cover. They are used to connect a ceiling fan or tube light to the supply through flexible wires.

### Plugs

Plugs are used to tap the power from the socket outlets. They are available in the form of Two pin plugs and Three pin plugs.

### Flexible cords

They consist of large number of fine wires to form a conductor and are insulated with the help of plastic. They are flexible and can be used as connecting wires for connecting electric /electronic gadgets.

### Distribution board

The output of the main switch is given to the distribution board. Here the consumer's load, branches into smaller ones forming subcircuits. In the distribution board each subcircuit is electrically isolated from one another.

### Fuse

It is a safety device or wire whose purpose is to isolate the circuit in the event of any overload or fault. The fuse wire should always be placed in the live wire or phase of the circuit. The fuse holders are used to hold the fuse wires. For small values of current lead-tin alloy is used as fuse wire. For currents beyond 10 amperes, copper wires are used.

### Cables

A cable consists of a conductor made of copper or aluminium surrounded by insulation and a sheath. The commonly used cables for domestic wiring are

- (i) Vulcanized Indian Rubber (VIR) insulated cables
- (ii) Poly-Vinyl Chloride (PVC) insulated cables
- (iii) Tough Rubber Sheathed (TRS) cables.
- (iv) Cab Tyre Sheathed (CTS) cables
- (v) Lead sheathed cables and
- (vi) Weather proof cables.

VIR and PVC cables are used for all types of wiring except for lead sheathed wiring system. TRS cables are used for TRS wiring. CTS and lead sheathed cables are used for CTS wiring and lead sheathed wiring system respectively.

In addition to the above accessories, some more accessories are used in the domestic wiring. They are junction boxes, elbows, bends and tees, saddles, earth clips, hooks, GI conduit, earth wire, screws, wooden plugs, wooden round blocks, teak wood battens, porcelain cleats etc.

### Ratings of Wiring Materials

The ratings of wiring materials are given in Table 12.2.

Table 12.2 Rating of wiring materials

Wiring material	Rating
Switches	6A, 240 V
	16A, 240 V
Socket outlets	6A, 240 V, 2 pin / 3 pin
	16A, 240 V, 3 pin
Ceiling roses	6A, 240 V, 2 plate
Plugs	6A, 2 pin / 3 pin
	16A, 3 pin
Distribution Box	16A, 240 V, one way
	16A, 240 V, two way

### Types of Wiring

The type of wiring to be employed depends on various factors like durability, cost, safety and appearance etc. The different types of wiring systems adopted in electric installation are

- (i) Cleat wiring system.
- (ii) Wooden casing-caping wiring system,
- (iii) Tough Rubber sheath wiring system.
- (iv) Lead sheathed wiring system.
- (v) Conduit wiring system.

#### Cleat Wiring System

In this type of wiring system, the conductors are supported by porcelain cleats. The cleats are of three types, having one, two or three groves for receiving one, two or three wires respectively. Each cleat is made of two halves namely base and cap. The base of the cleat is grooved to accommodate the cables and the cap is placed on it. The base and cap assembly is screwed with wooden plugs which are cemented in the wall. This type of wiring is very cheap and can be done very easily. The life of cleat wiring system is short and hence is not permitted for permanent jobs. It sags at some places giving a shabby look after some time. Maintenance cost is also high. Thus,

cleat wiring is used in industries and workshops for temporary wiring. The following points are to be kept in mind while installing the cleat wiring system.

- (i) The distance between the cleats may vary from 30 cm to 60 cm.
- (ii) Where the wires are to pass through the walls, they must be taken through conduits.
- (iii) The wires should not be run near water and gas pipe lines.
- (iv) Sharp bends should be avoided.
- (v) Spacing between the cleats near the bends should be reduced.
- (vi) This type of wiring should not be used at damp places.

The arrangement of cleat wiring system is as shown in the Figure 12.1.

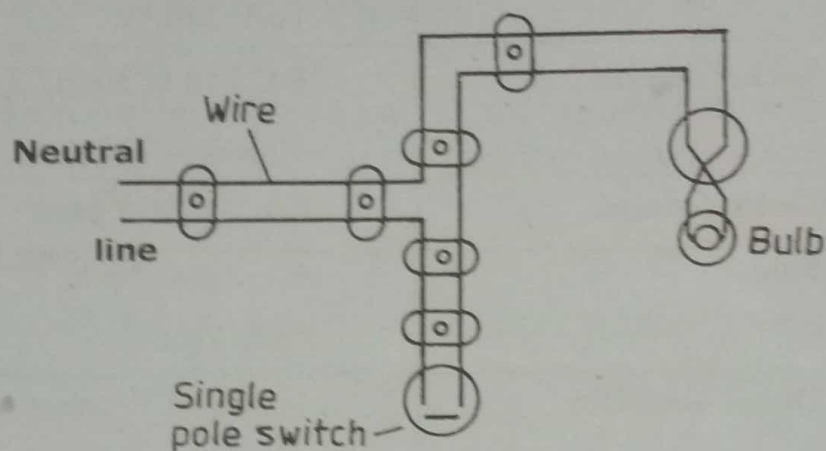


Figure 12.1

### Wooden Casing - Capping Wiring System

Though this type of wiring is costly, it is most commonly used for residential building. The PVC or VIR cables are laid in the grooves provided in the casings made of seasoned teak wood. These casings are covered by means of rectangular strip of wood of same width (as that of casing) known as capping and is screwed to it. The capping and casing is available in pieces of 3 to 6 metres length. The following points are to be kept in mind while installing this type of wiring system.

- (i) To avoid trouble from white ants, only seasoned wood should be used for casing and capping.
- (ii) The casing should be properly fixed to the wall.
- (iii) In no case, the casing should be buried under the masonry work.
- (iv) At the bends, the grooves must be well rounded off to avoid damage of insulation.
- (v) Where the wiring passes through a wall, it must pass through conduits.

The arrangement of wooden casing - capping wiring system is shown in the Figure 12.2

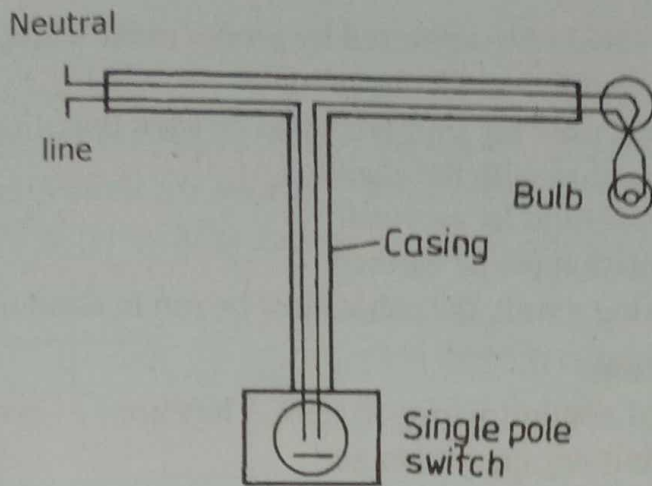


Figure 12.2

### Tough Rubber Sheath Wiring System

Here the cables are run over wooden batten hence this type of wiring system is also called batten wiring system. The cable used may be PVC cable or CTS cable or TRS cable. Accordingly, the wiring system is named as PVC wiring or CTS wiring or TRS wiring system. The battens are fixed with the clips and then screwed to the walls with the help of wooden plugs and screws. The distance between the clips vary from 6 cm to 15 cm. The following points are to be kept in mind while installing TRS wiring system.

- (i) The cable should not be put under stress either to lead clips or bends
- (ii) To avoid cracks, bends should be provided with longer radius.
- (iii) In damp places, care must be taken to earth the switches, lamp holders and other metal fittings.
- (iv) Fibre clips which are hygroscopic should not be used in damp places.
- (v) While taking the wires through walls, conduit must be used.

The arrangement of TRS wiring system is as shown in the Figure 12.3.

### Lead sheathed wiring system

The arrangement is just similar to TRS wiring system except that the cable used (here it is lead sheathed cable). This wiring system has longer life but it is costly. The lead sheath provides protection from mechanical injury. The following points are to be kept in mind while installing lead sheathed wiring.

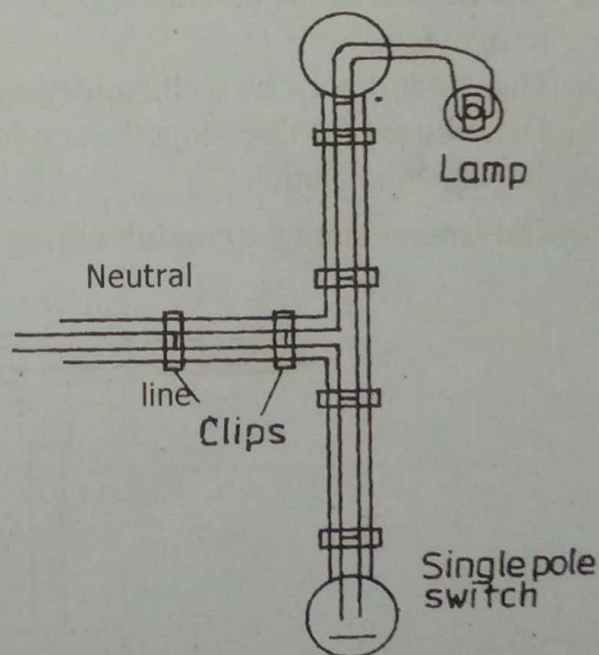


Figure 12.3

- (i) The cables should be supported by proper metal clips, saddles etc which must not be more than 30 cm apart.
- (ii) The materials used for supports must be such that, they should not set-up chemical reaction with the sheath.
- (iii) Sharp bends should be avoided.
- (iv) The lead sheath must be earthed.
- (v) While crossing a wall, the cable must be run in conduits.

### Conduit Wiring System

There are two types of conduit wiring system. They are

- (i) Surface conduit wiring system and
- (ii) Concealed conduit wiring system.

The wiring system with the conduit on the surface of the wall is known as surface conduit wiring system and the wiring system with conduit buried inside the ceiling and the walls is known as concealed conduit wiring system.

In the conduit wiring system, the PVC or VIR conductors are run in metallic tubes called conduits. It is preferable in factories and important public buildings because it has longer life and safe against fire. The conduit gives good mechanical protection and protection against moisture. Since, the conduit is made of conducting material, earthing is necessary. The conduit (in the case of surface conduit wiring system) is fixed on the wall with the help of saddles and gutties. A snake wire (thin steel or GI wire) is used to draw the cables inside the conduits. Inspection boxes are provided at periodic intervals to facilitate drawing-in of the cable. The following points are to be kept in mind while adopting conduit wiring.

- (i) The conduit must be effectively earthed.
- (ii) The contact of the conduit with the metal work of the roof /wall should be avoided.
- (iii) The conduit must be well painted even if it is galvanised.
- (iv) The oil used for threading the conduits must be wiped off as it causes injury to the rubber insulation.

The arrangement for conduit wiring system is as shown in the Figure 12.4

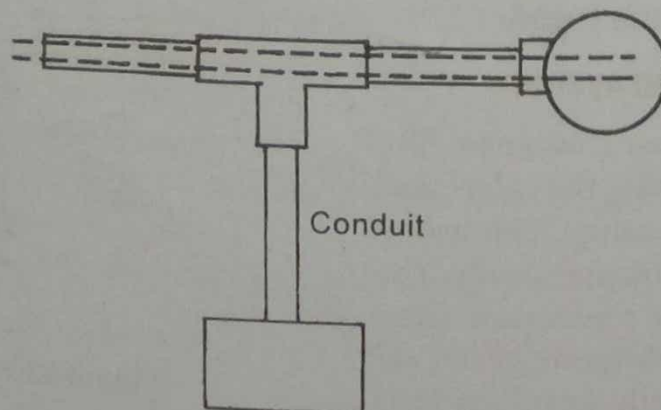


Figure 12.4

**Stair Case Wiring**

In this type of wiring, the lamp is controlled by using two-way switches. We can switch-on and switch-off the lamps from more than one place. The lamp control circuit using two-way switch are shown in Figure 12.5.  $S_1$  and  $S_2$  are the two-way switches. The condition of the lamp depends on the position of these switches.

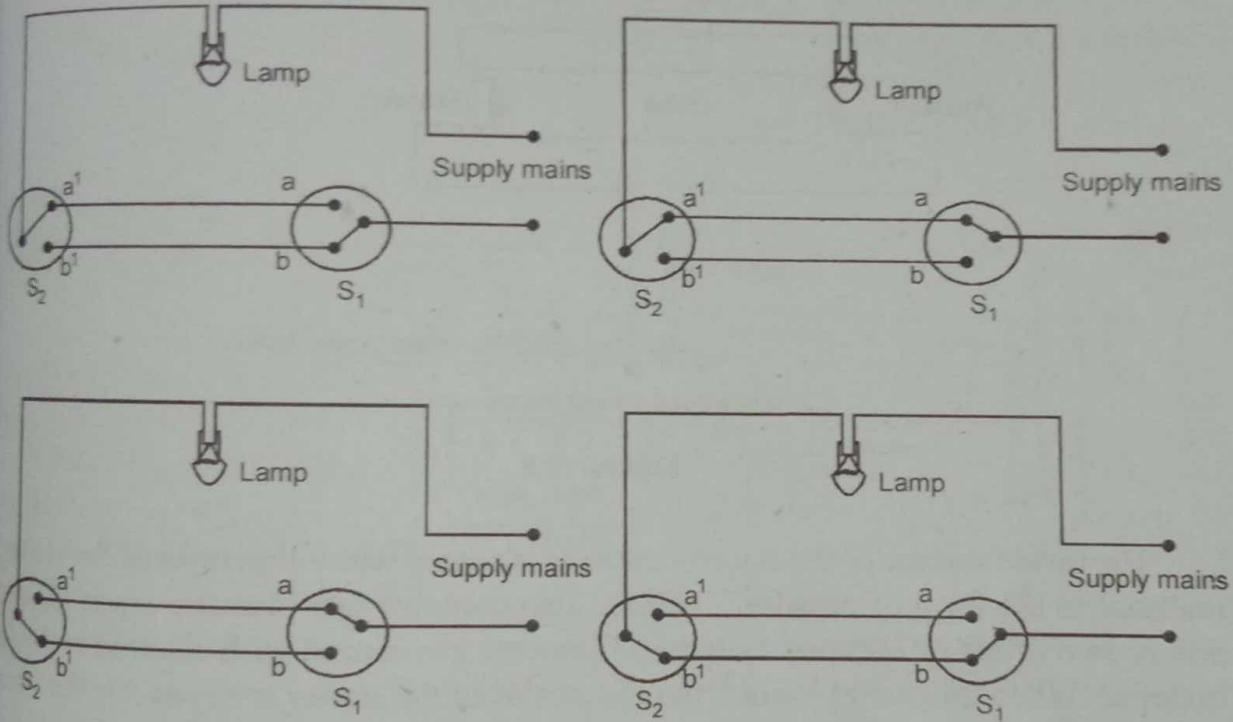


Figure 12.5

The condition of the lamp can be summarised as given in Table 12.3

Table 12.3

Position of $S_1$	Position of $S_2$	Condition of the Lamp
b	$a'$	OFF
a	$a'$	ON
a	$b'$	OFF
b	$b'$	ON



**Fluorescent Tube Wiring**

The fluorescent tubes are usually available in lengths of 0.61 metres and 1.22 metres. (Now a days variety of lengths are also available) The various parts of fluorescent tube include (i) Glass tube (ii) Starter (iii) Choke (iv) Fluorescent material and (v) Filaments. The wiring diagram of fluorescent tube is as shown in the Figure 12.6.

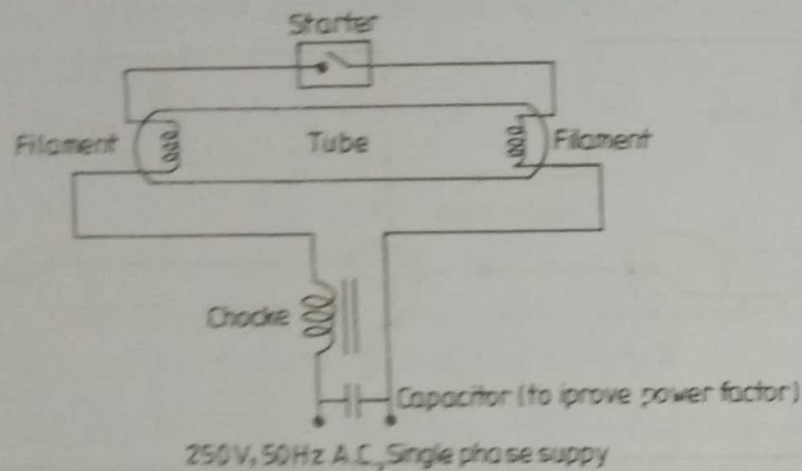


Figure 12.6

The inside surface of the fluorescent tube is coated with a thin layer of fluorescent material in the form of powder. The tube also contains low pressure argon gas and one or two drops of mercury. The two filaments are coated with electron emissive material. When the starter is cold, the electrodes of the starter are open. On the other hand, when the supply is 'on', the full voltage is applied across the electrodes of the starter, thus starting a glow which warms up the electrodes, thus bending the bimetallic strip, making the two electrodes to touch each other. It completes the series circuit and causes the current to flow through the filaments, thus heating them and starting the emission of electrons. In the mean time, the potential across the electrodes of the starter falls to zero, and thus the electrodes cool down and it causes the strips to be separated out, thus breaking the series circuit. Due to the presence of the choke, this break causes very high voltage. Since the electrons are already present in the tube, this induced voltage is quite sufficient to break down the long gap and hence the lamp lights up. A capacitor is used across the supply to improve the power factor.

**Simple Wiring Layout**

While planning for a domestic electrical installation, the following points are to be kept in mind.

- (i) Select the type of wiring (depending on the nature of the load, cost, safety, appearance and life of the wiring).
- (ii) The location of fan points, lighting points, heating points are to be finalised.
- (iii) All runs of wirings, exact position of switch boxes and outs-lets are to be marked.
- (iv) A layout of power distribution has to be prepared.