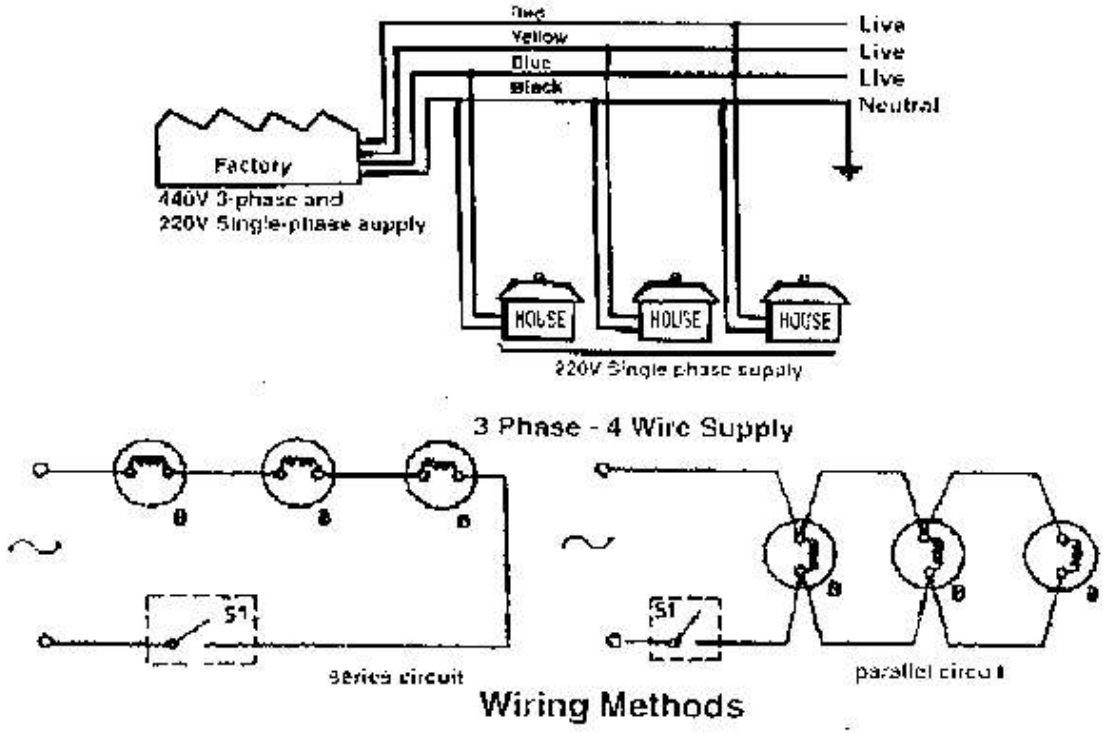
# HOUSE WIRING

**INTRODUCTION**

Power is supplied to the domestic installations through, the phase and a neutral, forming a single phase AC 230V, two wire system. For industrial establishments, power is supplied through three-phase four-wire system to give 440V. Figure shows the power tapping for domestic and industrial purposes. The neutral is earthed at the sub-station of the supply.

As a safe practice all single-phase devices such as switches, fuses, etc. are connected to the live conductor. All electrical conductors and cables are color coded and must be correctly connected up. Electrical wiring is defined as a system of electrical conductors, components and apparatus for conveying electrical power from the source to the point of use. The wiring system must be designed to provide a constant voltage to the load.

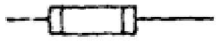
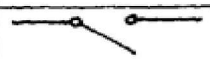
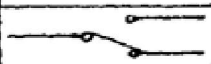
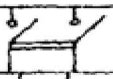
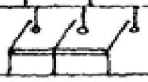
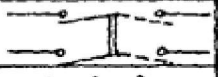
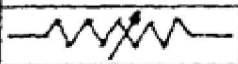
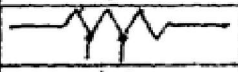
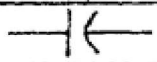
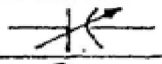
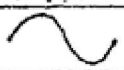
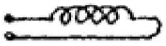
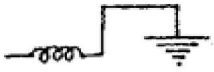
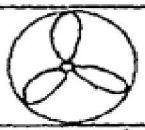
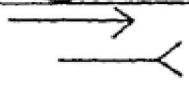


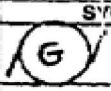
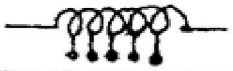
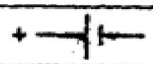
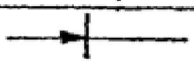
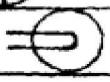
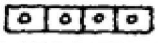
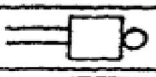
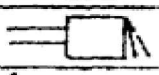
Wiring Methods

**Elements of House wiring:**

1. Fuses and circuit breakers
2. Electrical switch
3. Plug
4. Socket outlet
5. Lamp holder
6. Ceiling rose
7. Main switch
8. Incandescent light

# ELECTRICAL SYMBOLS

| S.No. | SYMBOL | INDICATES |
|---|---|---|
| 1 |  | POSITIVE |
| 2 |  | NEGATIVE |
| 3 |  | EARTH |
| 4 |  | FUSE |
| 5 |  | ONE-WAY SWITCH |
| 6 |  | TWO-WAY SWITCH |
| 7 |  | I C D P SWITCH |
| 8 |  | I C T P SWITCH |
| 9 |  | D P D T SWITCH |
| 10 |  | FIXED RESISTANCE |
| 11 |  | VARIABLE RESISTANCE |
| 12 |  | TAPPED RESISTANCE |
| 13 |  | FIXED CAPACITOR |
| 14 |  | VARIABLE CAPACITOR |
| 15 |  | ALTERNATING CURRENT |
| 16 |  | DIRECT CURRENT |
| 17 |  | A.C. VOLT METER |
| 18 |  | D.C. VOLT METER |
| 19 |  | A.C/D.C. AMMETER |
| 20 |  | CHOKE |
| 21 |  | LIGHTNING ARRESTER |
| 22 |  | **CEILING FAN** |
| 23 |  | EXHAUST FAN |
| 24 |  | PLUG & SOCKET |

| S.No | SYMBOL | INDICATES |
|---|---|---|
| 25 |  | GENERATOR |
| 26 |  | ALTERNATOR |
| 27 |  | AUTO TRANSFORMER |
| 28 |  | TRANSFORMER |
| 29 |  | SINGLE CELL |
| 30 |  | BATTERY OF CELLS |
| 31 |  | DIODE |
| 32 |  | TRANSISTOR |
| 33 |  | INCANDESCENT LAMP |
| 34 |  | FLUORESCENT LAMP |
| 35 |  | SIGNALING LAMP |
| 36 |  | TERMINAL CONNECTOR |
| 37 |  | BELL |
| 38 |  | BUZZER |
| 39 |  | ANTENNA |
| 40 |  | MICRO PHONE |
| 41 |  | HEAD PHONE |
| 42 |  | LOUD SPEAKER |
| 43 |  | NO CONNECTION CROSSING |
| 44 |  | **CONNECTION CROSSING** |
| 45 |  | **NORMALLYOPEN SWITCH** |
| 46 |  | NORMALLYCLOSED SWITCH |
| 47 |  | DELTA |
| 48 |  | STAR |

**Wires and wire sizes:**

A wire is defined as a bare or insulated conductor consisting of one or several strands. An insulated wire consists of a conductor (Silver/Copper/Aluminum) with insulating material made of vulcanized Indian Rubber (VIR) or Poly Vinyl Chloride (PVC). Wire sizes are specified by the diameter of the wire, using a standard wire gauge (SWG), which also gives an idea of the current carrying capacity. The specification consists of both the number of strands and diameter of each wire in it. For Example, the specification 3/18 PVC consists of 3 strands of 18 gauge each.

**Various systems of wiring:**

1. Cleat wiring
2. CTS / TRS wiring (Cap tyer sheathed/ Tough rubber sheathed wiring)
3. Wooden casing & capping wiring
4. Lead sheathed wiring
5. Conduit wiring
6. PVC casing & capping

**Wiring methods:**

1. Series circuit
2. Parallel circuit

**Fundamentals of Electricity:**

**Electricity:** Electricity is a form of energy, which cannot be seen. But can be felt and effectslike magnetic effect, heating effect and chemical effect.

**Voltage:** It is a pressure which makes the electricity to flow. The unit of measure is Volt. Thesymbol used is 'V'. The instrument used to measure is Voltmeter

**Current:** The free flow of electrons is called as current. The unit to measure current is 'Ampere'. The symbol is 'A'. The instrument used to measure the current is Ammeter.

**Resistance:** It is opposition to current. The unit of resistance is 'Ohm'. The symbol of ohm is Ω. The resistance is measured by Ohmmeter.

**Watt:** It is the rate of doing work, when potential difference across the current is of Volt andcurrent flowing is ampere per second. The energy consumed is of Watt.

1000 Watts = 1 Unit

746 Watts = 1 HP

The following are the formulae for calculation.

Voltage, $V = IR$

Current, $I = V / R$

Resistance, $R = V^2 / P$

Wattage, $P = V I = V^2 / R$

**House Wiring Tools:**

**Combination Pliers:** Used for holding, twisting or cutting of wires

**Side cutting Pliers:** Used for Cutting at narrow places or ordinary places for removing insulation

**Round Nose Pliers or Flat Nose Pliers:** Used for holding, twisting or joining the wire at narrow places.

**Firmer Chisel:** Used for chipping, scrapping and grooving the wood

**Cold chisel:** Used for chipping, Boring and channeling in walls.

**Tenon saw or back saw:** Used for cutting wooden boards, wooden blocks, etc.

**Hack saw:** Used for cutting conduit GI pipes or mild steel.

**Mallet:** Used as a hammer and made of wood.
**Double blade electric knife:** It has two blades, one for removing insulation of wires andanother for cleaning the wires.
**Soldering Iron:** Used to solder small joint terminals.
**Poker:** Used for making pilot holes for fixing wood screws.
**Line Tester:** Used for testing the current.
**Royal Plug Tool:** It is made of steel and is used for making holes in the stone wall or concretewall for fiber made Royal plugs
**Screw driver:** Used for loosening, tightening and to keep the screws in position.
**Ball Peen Hammer**: Used for fitting nails in the walls or wooden boards.


**Combination Pliers**

**Side Cutting Plier**

**Round Nose Plier**

**Chisel**

**Tenon Saw**


**Hacksaw**

**Knife**

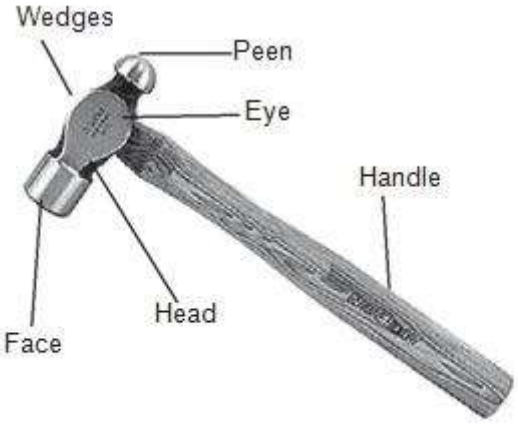
Soldering
Iron

Screw Drivers
Poker
Royal Jumper

Line Tester

Portable Drill

Hand Drill




Ball Peen Hammer

Pincer

**Instructions:**

1. When closing the electric switch, always grasp the switch by the insulated handle.
2. Do not run too many electrical items from one point.
3. Use fuses and circuit breakers of proper capacity, so as to interrupt the current before it becomes dangerous.
4. Disconnect the units to be repaired free from power supply and make sure that they might not be energized while the repair work continues.
5. Do not pour water to put-off fires in electric wires and electric equipment. You will be subjected to electric shock or you will be electrocuted. Use sand to put-off fires in electric items.
6. Whenever there is power failure, put-off the power supply to all equipment, in order to prevent spontaneous recovery.
7. Never remove a plug from an outlet by pulling cord. Always pull by holding the plug.
8. While testing always keep one hand in your pocket. If the hands are in contact with a circuit, current will flow across your body and is more dangerous.
9. Electricity has no respect for ignorance. Do not apply voltage or turn-on any device until it has been properly checked.
10. Check earth connection before switching on portable equipment.

# PARALLEL/SERIES CONNECTION OF THREE BULBS

Expt. No: Date:

**AIM:** To make a parallel/series connection of three bulbs

**APPARATUS REQUIRED**:

| S.No. | Name of apparatus | Type | Range | Quantity |
|---|---|---|---|---|
| 1 | MCB | Double pole | 6A, 230V | 1 |
| 2 | Fuse | Rewirable | 0-5A | 1 |
| 3 | Lamp | Incandescent | 60,230V | 3 |
| 4 | Switch (1-way) | (SPST)Bakelite | 6A,230V | 1 |
| 5 | Gang box | Bakelite Type | -- | 1 |
| 6 | Lamp holder | Battery Type | 6A,230V | 3 |
| 7 | Conduit box | PVC | 1-way, 2-way | ½ |
| 8 | Conduit | PVC | ½ inch | 1 |
| 9 | L-Bend | Solid bend(PVC) | ½ inch | 1 |
| 10 | Saddle | Iron | ½ inch | L.S |
| 11 | Connecting wires PVC | Insulation wire | 1/18 SWG | L.S |
| 12 | Ceiling plate | PVC | -- | 3 |
| 13 | Tape | Insulation | -- | L.S |

**TOOLS REQUIRED**:

1. Screwdriver
2. Cutting pliers
3. Voltage tester
4. Wire cutter
5. Lamp holders

**PROCEDURE**:

1. Take (1-way) SPST and mount it on a gang box by wiring screws given for the switch.
2. Fit the pipes on the wooden board with the help of screws and saddles as shown in linediagram.
3. Remove the insulation of wire in conduit.
4. Join and insert the wires in conduit.
5. Connect the phase to switch as shown in wiring diagram.

**SERIES CONNECTIONS**:

The wires from the second terminal of the switch are given to the terminal of the lamp holder of lamp "$L_1$" the other terminal at next lamp "$L_2$".The empty terminal at next lamp "$L_2$" the other terminal at next lamp "$L_3$".The empty terminal at next lamp "$L_3$" is given to the neutral wire directly from the supply of mains as shown in wiring diagram.

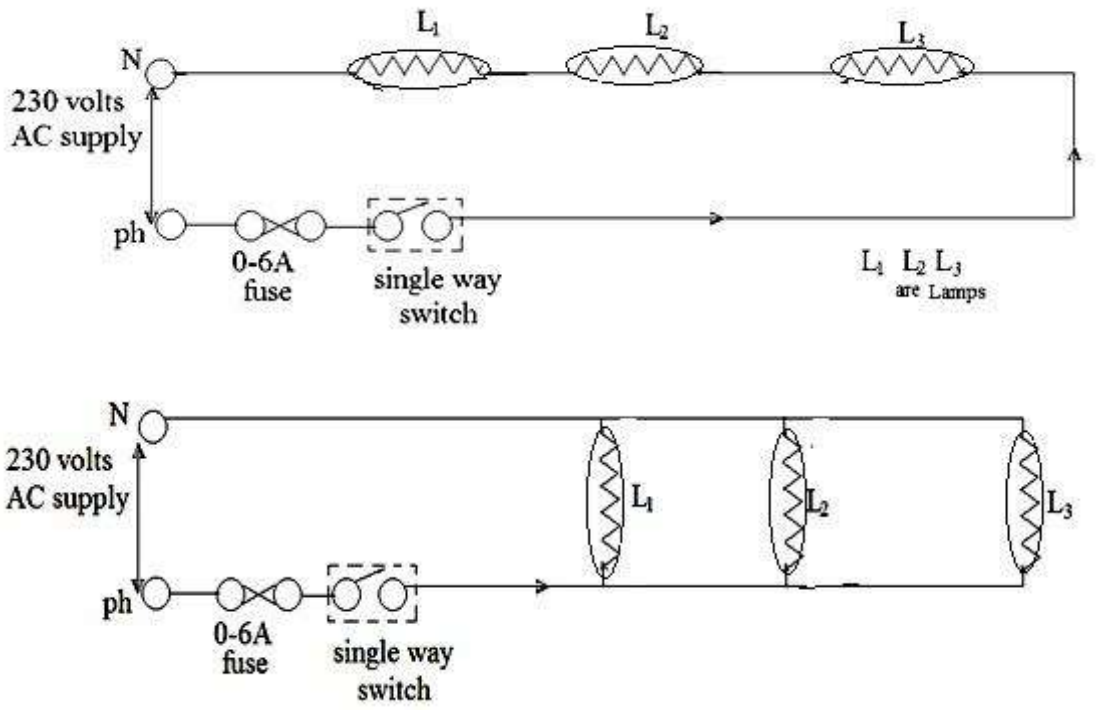
**PARALLEL CONNECTION**:

The wire from the second terminal of the switch is given to the terminal of lamp holder of "$L_1$" from the same terminal connect a wire to the any one of the terminal of lamp "$L_2$" from the same terminal connect a wire to the any one of the terminal of lamp "$L_3$" then take the neutral wire, directly from the supply mains is given to the other terminal of the lamp $L_1$, $L_2$ and $L_3$ as shown in figure.

**PRECAUTIONS**:

1. Keep the mains in OFF position.
2. Do not use a switch are fuse in neutral connector
3. Use black colour wire in neutral.
4. Loose connections should be avoided.
5. Keep insulation tape on the wire joints.
6. Do not connect phase and neutral together it may cause short circuits
8. Take care about electric supply.

**Bulbs in Series**




**Bulbs in Parallel**

Fig. Parallel/Series Connection of three bulbs

**RESULT:** Series/Parallel connection of three bulbs is made.

**VIVA QUESTIONS**

1. Name the safety devices used to protect the electric circuits from overload.

2. Name the various types of fuses.

3. Differentiate between a fuse and a circuit breaker.

4. Name the types of lamp holders available in the market.

5. What is difference between emergency and indicator lamp?

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# STAIR CASE WIRING

Expt. No: Date:

**AIM:** To do stair case wiring (i.e. control of one lamp by two switches fixed at two different places)

**APPARATUS REQUIRED**:

| S.No. | Name of apparatus | Type | Range | Quantity |
|---|---|---|---|---|
| 1 | MCB | Double pole | 5A, 230V | 1 |
| 2 | Fuse | Rewirable | 0-5A | 1 |
| 3 | Switch | (SPST)Bakelite | 2A,230V | 2 |
| 4 | Lamp | Incandescent | 60W,230V | 1 |
| 5 | Gang box | Bakelite | -- | 2 |
| 6 | Lamp holder | Battery | 2A,230V | 1 |
| 7 | Conduit box | PVC | ½ inch | LS |
| 8 | L-Bend | PVC | ½ inch | 1 |
| 9 | Conduit box | PVC | 2-way | 2 |
| 10 | Saddle | Iron | ½ inch | LS |
| 11 | Screws | Iron | ½ inch | LS |
| 12 | Connecting wires | C-W | 1/8 Swg | LS |

**TOOLS REQUIRED**:

1. Screwdriver
2. Cutting pliers
3. Tester
4. Wire cutter
5. Test lamp

**PROCEDURE**:

1. Mark the location of switch and bulb on the given wooden board.

2. Mark line for wiring on the wooden board.

3. The required length of PVC pipe can be fixed along the lines with help of clips.

4. The wires of required length and colours are chosen and the wiring is

being made through the PVC pipe.

5. The bulb holder and switches are fixed in the corresponding location.

6. Use the red colour wire for phase line to the bulb through two way switch.

7. Another point of the bulb is connected to the neutral line using black wire.

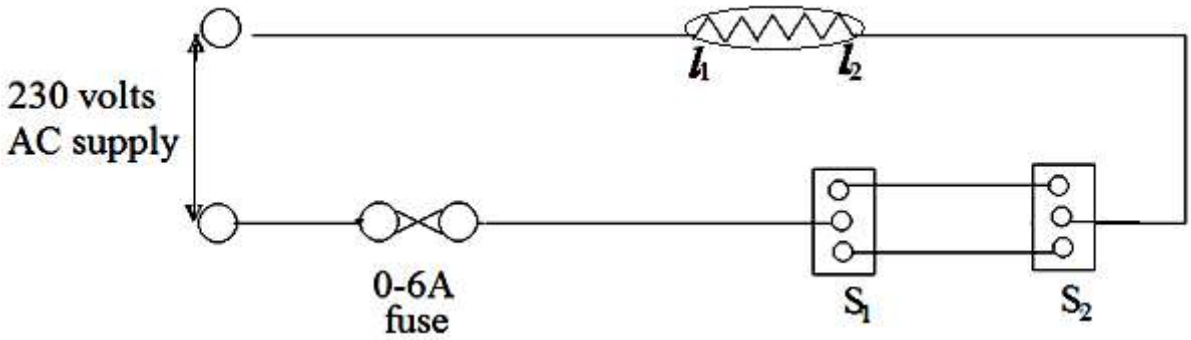
8. The red and black wire terminals are connected to main switch.

9. Give the supply to the circuit.

10. Make the bulb to glow by operating the switches as shown in circuit.

**PRECAUTIONS**:

1. Keep the machine in OFF position.
2. Connect the phase and neutral to the supply mails.
3. Use black colour wire in neutral.
4. Loose connections should be avoided.
5. Keep insulation tape on the wire joints.
6. Take care about electric supply



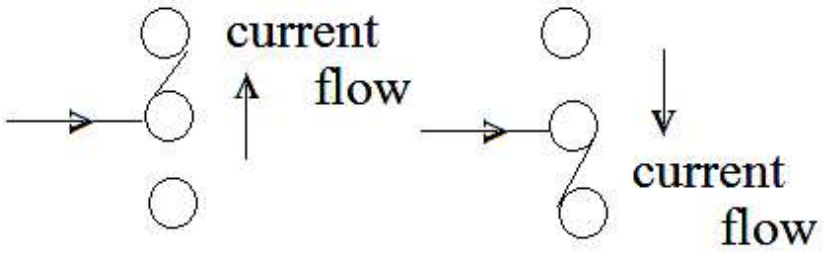



Fig. Stair Case Wiring

**RESULT:** Stair case wiring (i.e. control of one lamp by two switches fixed at two different places) is done.

**VIVA QUESTIONS**

1. What for a lamp holder is used in an electric circuit?

2. Name the different forms of interior wiring.

3. What for a ceiling rose is used?

4. What for a circuit breaker is used.

5. Define the term earthing or grounding.

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