HOUSE WIRING

3. Introduction:

Power is supplied to domestic installations through a phase and a neutral, forming a single phase A.C.230V, two-wire system. For industrial establish ments,power is supplied through three-phase four wire system, to give 440v.Figure 3.1 shows the power tapping for domestic and industrial purposes. The neutral is earthed at the distribution sub-station of the supply.

When supplied to domestic utilities, power is fed to a kilowatt meter and then to a distribution panel. The panel distributes power along several circuits. It also protects these circuits from overload by safety devices like fuses or circuit breakers. The panel also serves as a main switch.

As a safety 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 electric conductors, components and apparatus for conveying electric power from the source to the point of use. The wiring system must be designed to provide a constant voltage to the load.

Fig.3.1 3 phase- 4 wire supply

3.1. Elements Of house wiring:

3.1.1. Fuses and Circuit Breakers:

These are the devices designed to provide protection to a circuit against excess current. In old type of distribution panels, open link fuses, plug or cartridge fuses were used. In newer panels, circuit breakers are used. If something goes wrong with an appliance or supply, the line becomes over loaded or short-circuited. Then, either the fuse blows-out or circuit breaker trips open, isolating that circuit or appliance. In such cases, the appliance must be checked for defects or it must be ensured that there are not too many appliances in that particular circuit.

Fig. 3.2 shows several forms of fuses that are in use. Open link fuses are not safe in operation, even though they are cheaper and reliable. It consists of a thin strip of metal or wire.Here, when the fuse blows-off due to heavy current in the

circuit, the metal is spilled around. A modified version of it consists of a porcelain fuse link, backing the wire safely.

Fig.3.2 Forms of fuses

Through the plug fuse confines the molten metal thrown out while blowing, it is not very accurate in operation. The length of the element also is very short. The cartridge fuse of non-renewable type, enclose the fuse element in a fiber tube with a non-inflammable material. During the blowing-off, the arc produced is chilled by the non-inflammable material. In case of a renewable type, a cheap renewable fuse material is used in the cartridge.

The trouble with fuses is that they must be replaced once they burn away, whereas the circuit breaker can be reset after the original condition is established. An electromagnetic circuit breaker is shown in Fig.3.3.A set of switch contacts inside the circuit breaker is normally kept closed by an armature. When too much current flows through the coil, the armature is attracted, breaking the circuit. The circuit breaker may be reset by a toggle lever.

Fig.3.3 Circuit breaker

3.1.2. Electric switch:

This is a device that makes and breaks or changes the course of electric circuit. It consists of two or more contacts mounted on an insulating structure and arranged such that, they may be moved into and out of contact with each other by a suitable operating mechanism.Fig.3.4.shows one way and two way switches used in domestic wiring practice.

Fig.3.4 Electric switches

3.1.3. Plug:

It is a device, carrying two or three metallic contacts in the form of pins, intended for engaging with corresponding socket contacts and arranged for attachment to appliances such as radio, T.V., table fan, etc. Figure 3.5a shows both two pin and three pin plugs.

3.1.4. Socket Outlet:

It is a device, carrying two or three contacts, designed for engagement with the corresponding plug pins and arranged for connection to fixed wiring.Fig.3.5b shows socket outlet for both two and three pin plugs.

Fig.3.5 Plug and socket out lets.

3.1.5. Lamp Holder:

Lamp holders are designed to hold lamps and connect them in the circuit. Both bayonet cap and screw lamp holders are available up to 200 W lamps. Figure 3.6 shows a lamp holder (pendant type).

Fig.3.6 Pendant lamp holder

3.1.6. Ceiling Rose:

A ceiling rose consists of a circular base and a cover made of bakelite as shown in Fig.3.7. The base has two or three terminal plates. One end of the plates is connected to supply and the other end, to flexible wire connected to pendant lamp, ceiling fan, exhaust fan, etc.

Fig.3.7 ceiling rose

3.1.7. Main Switch:

This is a switch intended to connect or cut-off the supply of electricity to the whole of an installation. It is generally of metal clad type (Fig.3.8).The metal clad type gives greater strength and safety. The main switch contains one or more fuses. Iron clad double pole switches are used for single phase A.C.circuits.

Fig.3.8 Main (iron clad) switch

Fig.3.9 parts of a Bulb

3.1.8. Incandescent Light:

Incandescent means ‘glowing at white hot’ .A lamp actually works like a heating element, except that it gives off light by becoming white hot. Figure 3.9.shows the parts of a bulb. The amount of power it consumes is stamped on the bulb. The higher the wattage, brighter the light. The bulbs have filaments made of tungsten. However, special bulbs are available with inside coating and filled with gas.

3.1.9. Wires and Wire Sizes:

A wire is defined as a bare or an insulated conductor consisting of one or several strands. An insulated wire consists of a conductor with insulating material made of vulcanized India rubber (VIR) or poly vinyl chloride (PVC). The wire may consist of one or several twisted strands. A multi core conductor consists of several cores insulated from one another and enclosed in a common sheathing (fig.3.10).

Wire sizes are specified by 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 no. of strands and the diameter of each wire in it. For example, the specification, *(i) silk wire 14/36 indicates 14 strands of 36 SWG each and (ii) 3/18 PVC indicates 3 strands of 18 gauge each*.

Fig.3.10 wires

3.2 wiring methods

A circuit is a path along which the electric current flows from the negative side of the power source to the positive side .there are three types of electrical circuits that are used for connecting devices or controls to the power source, viz., series circuit, parallel circuit and combination of the two.

The series circuit provides a single, continuous path through which current flows .in this, the devices are connected one after another and the current flows through them until it returns to the power source (fig.3.11a).hence, even *when one device breaks down, the remaining devices will not operate, because the circuit is broken*.

In parallel circuit, the devices are connected side by side so that, current flows in a no. of parallel paths. *In this type of circuit each device is connected across the power source so that even if one device breaks down the other devices continue to operate (fig.3.11b).*hence, this type of circuit is used in house wiring. The wires used in house wiring contain multi strand copper wire, covered with fabric rubber or plastic insulation.

Fig.3.11 wiring methods

3.3 common house wiring connections

3.3.1 One lamp controlled by a one way switch

Figure 3.12a shows the wiring diagram for a lamp controlled by a one way switch. This is the normal connection one comes across in house wiring. However, more than one lamp may be connected either in series or parallel and controlled by a one way switch as shown in figure3.12b and c respectively.

3.3.2 Lamp with independent control from two places

It is some times desirable to control from two different places .one may come across this situation with stair case, bed room, long corridors or hall containing two entrances, etc.this is achieved by two way switches as shown in fig.3.12d.

3.3.3 Two lamps connected in series or parallel by a one way switch

Two lamps may be connected by a one way switch in parallel for bright glow or in series for dull glow .this is recommended when the intensity in the room as to be controlled (fig.3.12e).

3.3.4 Tube light connection

Figure 3.12f shows a typical tube light connection. Tube lights are the commonly used light sources for illumination in the houses, industries, commercial organizations, etc. a tube light is a low power mercury discharge lamp with internal surface coated with suitable fluorescent material.

Fig.3.12 types of connections

This lamp consist of a glass tube ,provided at both ends with caps having two pins and oxide coated tungsten filament .the tube contains argon or krypton gas to facilitate starting with small quantity of mercury at low pressure.

Fluorescent material, when subjected to electro magnetic radiations of a particular wave length produced by the discharge through mercury vapour, gets excited and in turn gives out radiations at some other wave length, which falls under visible spectrum. These secondary radiations from fluorescent powder increase the efficiency of the lamp. Tube lights are generally made of 20watt or 40watt rating.

In order to make a tube light self starting a starter and a choke are connected in the circuit as shown in figure.

When switch s1 is closed, full supply voltage induces across the starter electrode P and Q which are enclosed in a glass bulb, filled with organ gas. This voltage causes discharge in the organ gas, resulting in the heating of the electrodes. Due to this heating, the electrode P which is made of bimetallic strip, bends closes the contact of the starter. At this stage the choke, the filaments M1 and M2 of the

tube T and the starter become connected in series across the supply; causing current flow through the filaments M1 and M2 and heating them. Mean while, the argon gas discharge in the starter tube disappears causing sudden break between electrodes P and Q .this causes a high value of induced e.m.f in the choke.

The induced emf in the choke is applied across the tube light electrodes M1 and M2 and is responsible for initiating a gaseous discharge. Thus, the tube light starts giving light out put. Once the discharge through the tube is established, a much lower voltage then the supply voltage is required to maintain it. A reduction in voltage available at the tube during running condition is achieved by having a voltage drop across the choke. The capacitor connected across the starter terminals P and Q is used to suppress the electromagnetic waves generated at the gap due to sparking.

Note: the wattage of the tube, choke and starter should be the same.

3.4 Earthing

The definition of the term ,'earthing ' or 'grounding' as it is otherwise called, refers to the connection of the electrically equipment ,to the mass of the earth by a wire of negligible resistance ,for the safety of the human body from shocks .the metallic covers of the machines ,the frames of the machines ,sheathing of wiring,etc,are generally dead. Failure of insulation or workmanship may make these alive. When this happens, a person touching the parts receives an electric shock. To avoid this, the relevant parts are earthed .a good earthing system should have a very low resistance and should be in a position to allow the leakage current through it. The following are the methods of earthing.

(i). earthing through a water main,
(ii). Plate earthing, and
(iii). Pipe earthing.

The following are the some of the items that need earthing:

Metallic coverings,containg electric supply wire, switches, distribution fuse boards,cealing fans, generator frames ,stationary and portable motors, metallic parts of transformer, refrigerators ,energy meters, cooking oven, a electric heaters,etc.

3.5 Safe practices

1. When closing the electric switch, always grasp the switch by the Insulated handle
2. Do not run two many electrical items from one point.
3. Use fuses in the 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 pore 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 the cord. Always pull by the plug.
8. Never work on electric wires when the power is on.
9. Never work with bare feet.
10. While testing, always keep one hand in your pocket. If the hands are in contact with a circuit, a current will flow across your body and is more dangerous.
11. Electricity has no respect for ignorance. Do not apply voltage or turn-on any device until, it has been properly checked.
12. Check the earth connection before switching-on portable equipment.
13. Before replacing the blown fuse, always switch-off the main switch.