



PUBLIC WORKS DEPARTMENT

EXECUTIVE ENGINEER
PW-P & IWTD DIVISION
BELGAUM

Tender Schedule for Electrical Fittings

Name of Work _____

commercially pure lead or, alternatively, of pure lead to which a small percentage of rarer metals has been added for hardening purposes.

Cable, Metal-Sheathed : An insulated cable with a metal sheath.

Cable, Polythene-Insulated : A cable in which the insulation of the conductor or conductors is a polythene compound.

Cable, PVC-Insulated : A cable in which the insulation of the conductor is a polyvinyl chloride compound.

Cable, PVC-Sheathed : A cable in which mechanical protection is provided for the core or cores by a sheath of a polyvinyl-chloride compound.

Cable, Touch Rubber-Sheathed (Cable, TRS) : An insulated cable consisting of one or more vulcanized insulated cores surrounded by a close-fitting rubber sheath.

Cable-Weatherproof : A cable so constructed that when installed in uncovered locations, it will withstand all kinds of weather variations.

Circuit : An arrangement of conductor or conductors for the purpose of conveying energy and forming a system or a branch of a system.

Circuit-Breaker : A device, capable of making and breaking the circuit under all conditions, and unless specified otherwise, so designed as to break the current automatically under abnormal conditions.

Circuit, Final, Sub : An outgoing circuit connected to one-way distribution, fuseboard and intended to supply electrical energy at one or more points to current-using appliances without the intervention of a further distribution fuse-board other than a one-way board. It includes all branches and extensions derived from that particular way in the board.

Cleat : An insulated incombustible support normally used for insulated cable.

Conductor, Aerial : Any conductor which is supported by insulators above the ground and is directly exposed to the weather.

Note : Four classes of aerial conductors are recognized :

- Baro aerial conductors,
- Covered aerial conductors,
- Insulated aerial conductors, and
- Weatherproof neutral-screened cable.

Conductors, Bare : A conductor not covered with insulating material.

Conductor, Earthed : A conductor with no provision for its insulation from earth.

Conductor, Insulated : A conductor adequately covered with insulating material of such quality and thickness as to prevent danger.

Conductor of A cable or Core : The conducting portion consisting of a single wire or group of wires, assembled together and in contact with each other or connected in parallel.

Connector : A mechanical clamp shrouded in insulating material for connection the conductor of a cable or of a flexible cord to that of another cable or of another flexible cord.

Connector Box or Joint Box : A box forming a part of wiring installation provided to contain joints in the conductors of cable of the installation.

Connector for Portable Appliances : A combination of a plug and socket arranged for attachment to a portable electrical appliance or to a flexible cord.

Consumer's Terminals : The ends of the electrical conductors situated upon any consumer's premises and belonging to him at which the supply of energy is delivered from the service line.

Cord, Flexible : A flexible cable having conductor of small cross-sectional area. Two, flexible cords twisted together are known as twin 'flexible cord'.

Cord of a Cable : A single conductor of a

Part-VIII Building Services

Section-2 : ELECTRICAL INSTALLATIONS

0. Forward

0.1 This section covers the essential requirements for electrical installations in buildings.

0.2 The importance of preplanning and exchange of information among all concerned agencies from the earlier stages of the building work has been emphasized. This section has to be read together with Part-VIII Building services, section-1 lighting and ventilation for making provision for the desired levels of illumination as well as ventilation for the different locations in different occupancies.

0.3 The information contained in this section is largely based on the following Indian Standards :

IS : 732-1963 Code of practice for electrical wiring installations (system voltage not exceeding 650 volts) (revised)

IS : 2032 (Part XI)-1969 Graphical symbols used in electro technology : Part XI Electrical installations in buildings (architectural symbols)

1. SCOPE

1.1 This section covers the essential requirements for electrical installations in buildings to ensure efficient use of electricity including safety from fire and shock.

1.2 The essential requirements for electrical installations exceeding 650V particularly for industrial buildings and hazardous occupancies are not covered in this section and these shall be done in accordance with good practice [VIII-2(1)].

1.3 This section does not cover techniques of telecommunication installation work.

2. TERMINOLOGY

2.1 For the purpose of this section, the following definitions shall apply.

Accessory : Any device, associated with the wiring and electrical appliance of an installation, for example, a switch, a fuse, a plug, a socket-outlet, a lamp-holder, or a ceiling rose.

Apparatus : Electrical apparatus including all

* In this section where reference is made to 'good practice' in relation to design or testing and construction procedures, the appropriate document listed in The Appendix to the Code, may be used as a guide to the interpretation of this term.

machines, appliances and fittings in which conductors are used or of which they form a part.

Bunched : Cables are said to be 'bunched' when two or more are contained within a single conduit, duct, or groove or, if not enclosed, are not separated from each other.

Cable : A length of single-insulated conductor (solid or stranded), or two or more such conductors, each provided with its own insulation, which are laid up together. The insulated conductor or conductors may or may not be provided with an overall mechanical protective covering.

Cable, Armoured : A cable provided with a wrapping or metal (usually in the form of tape or wire) serving as a mechanical protection.

Cable, Flexible : A cable containing one or more, cores, each formed, of a group of wires, the diameters of the cores and of the wires being sufficiently small to afford flexibility.

Cable, Lead-covered : A cable provided with a lead sheath for the purpose of excluding moisture from the conductors and insulation thereof, such sheath consisting either of

cable with its insulation but not including any mechanical protective covering.

Cut-out : Any appliance for automatically interrupting the transmission of energy through any conductor when the current rises above a predetermined amount and shall also include, fusible cut-out.

Damp Situation : A situation in which moisture is either permanently present or intermittently present to such an extent as to be likely to impair the effectiveness and safety of the installation.

Dead : At or about earth potential and/or disconnected from any live system.

Direct Earthing System : A system of earthing in which the parts of an installation are so earthed specified but are not connected within the installation to the neutral conductor of the supply system or to earth through the trip coil of an earth leakage circuit-breaker.

Distribution Fuse-Board : An assemblage of parts including one or more fuses arranged for the distribution of electrical energy to final sub-circuits or to other distribution fuse-boards.

Earth : A connection to the general mass of earth by means of an earth electrode. An object is said to be 'earthed' when it is electrically connected to an earth electrode; and a conductor is said to be 'solidly earthed' when it is electrically connected to an earth electrode without a fuse, switch, circuit-breaker, resistance or impedance in the earth connection.

Earth Continuity Conductor : The conductor, including any clamp, connecting to the earthing lead or to each other those part of an installation which are required to be earthed. It may be in whole or in part the metal conduit or the metal sheath or armour of the cables, or the special continuity conductor of a cable or flexible cord incorporating such a conductor.

Earth Electrode : A metal plate, pipe or other conductor electrically connected to the general mass of the earth.

Earthing Lead : The final conductor by which the connection to the earth electrode is made.

Earth Leakage Circuit-Breaker System : A system of earthing in which the parts of an installation, specified, to be earthed are so earthed through one or more earth leakage circuit-breakers or relays.

Exposed Metal : All metal parts of an installation which are easily accessible other than :

- parts separated from live parts by double insulation;
- metal name-plates, screw heads, covers, or plates, which are supported on or attached or connected to substantial non-conductive material only in such a manner that they do not become alive in the event of failure of insulation of live parts and whose means of fixing do not come in contact with any internal metal; and
- parts which are separated from live parts by other metal parts which are themselves earthed or have double insulation.

Fitting, Lighting : A device for supporting or containing a lamp or lamps together with any holder, shade, or reflector, for example, a bracket, a pendant with ceiling rose, an electrolier, or a portable unit.

Fuse : A device that, by the fusion of one or more of its specially designed and proportioned components, opens the circuit in which it is inserted when the current through it exceeds a given value for a sufficient time. The fuse comprised all the parts that form the complete device.

Inflammable : A material capable of being easily ignited.

Installation (Electrical) : All the electrical wiring, accessories, fittings, consuming devices, control and protective gear, and other apparatus associated with the wiring situated on any premises in which electricity is supplied or is to be supplied through any service connection.

Insulation, double

a) **Of a Conductor** : A conductor is said to have double insulation when insulating material intervenes not only between the conductor and its surrounding envelope (if any cable) or immediate support (if bare) but also between the envelope or support and earth.

b) **Of an Appliance** : An applicable having accessible metal parts is doubly insulated when protective insulation is provided in addition to the normal functional insulation in order to protect against electric shock in case of breakdown of the functional insulation.

Insulation (Electrical) : Suitable non-conducting material, enclosing, surrounding or supporting a conductor.

Live or Alive : Electrically charged so as to have a potential different from that of earth.

Locations, Industrial : Locations where tools and machinery consuming large scale power load are installed. These include the industrial areas notified in the local supply regulations.

Locations, Non-Industrial : Locations other than industrial locations, and shall include residences, offices, shops, showrooms, stores and similar premises where consumption is predominantly of lighting load. These include the areas notified as non-industrial in the local supply regulations.

Multiple Earthed Neutral System : A system of earthing in which the parts of an installation specified to be earthed are connected to the general mass of earth and in addition are connected within the installation to the neutral conductor of the supply system.

Neutral or Neutral Conductor : Includes the neutral conductor of a three-phase four wire system, the conductor of a single-phase or dc installation which is earthed by the supply undertaking (or otherwise at the source of the supply), and the middle wire or common re-

turn conductor of a three-wire dc or single-phase ac system.

Point : A point shall consist of the branch wiring from the branch distribution board, together with a switch as required, as far as and including the ceiling rose or socket-outlet or suitable termination. A three-pin socket-outlet point shall include, in addition, the connecting wire or cable from the earth pin to the earth stud of the branch distribution board.

Service : The conductors and equipment required for delivering energy from the electric supply, system to the wiring system of the premises served.

Socket-outlet and Plug : A device consisting of two portions for easily connecting portable lighting fittings and other current using appliances to the supply. The socket outlet, is designed as a fixed member and the plug portion carries two or more metal contacts which connect with corresponding metal contacts in socket portion.

Switch : A manually operated device for closing and opening or for changing the connection of a circuit.

Switchboard : An assemblage of switch gear with or without instruments but the term does not apply to a group of local switches on a final sub-circuit, where each switch has its own insulating base.

Switchgear : Main switches, cut-outs or fuses, conductors and other apparatus in connection therewith, used for the purpose of controlling or protecting electrical circuits or machines or other current using appliances.

Voltage, Low : The voltage which does not normally exceed 250 volts (see Note under 'Voltage, High').

Voltage, Medium : The voltage which normally exceeds 250 volts but does not exceed 650 volts (see Note under 'Voltage, High').

Voltage, High : The voltage which normally exceeds 650 volts (see Note).

electrical substation are kept to the barest minimum.

4) The availability of power lines nearby may also be kept in view while deciding the location of the substation.

5) For detailed information regarding location of transformers, reference may be made to good practice [VIII-2(3)].

c) **Layout of Substation** : In allocating area of substation, it shall be noted that the flow of electric power is from supply company's room to HT room; then to transformer and finally to the low voltage switchgear room. The layout of rooms shall be in accordance with this flow.

d) **Rooms/Spaces Required** : Generally the following rooms/spaces are required in a substation :

1) Supply company's switchgear room and/or space for meters.

2) **Transformer Rooms** : The number and size of transformer rooms shall be ascertained from the total power requirement of the consumer. To determine the size of transformer and clearance around a transformer, reference may be made to good practice [VIII-2(3)]. As a very rough guide a 500 kVA transformer may require a space of 4m x 4 m.

Transformer is to be installed outdoor space shall be provided on similar considerations and adequate provision for safety enclosure is to be made. For transformers having large oil content (more than 2000 litres), soak-pits are to be provided in accordance with rule 64 of Indian Electricity rules, 1956.

3) **High Voltage Switch Rooms** : In case of substation having one transformer, the owner is required to provide only one high voltage switch. In the case of single point supply for two transformers, the number of switches required is 3 and for 'n' transformers the number of switches is 'n' plus 1. The floor area

required in case of a single switch will be roughly 4m x 4m and for every additional switch the length should be increased by 1m.

4) **Low Voltage Switch Rooms** : The floor area requirement in respect of low voltage switchgear room cannot be determined by any formula.

5) **Room for Stand-by Generator** : A room space not less than 6m x 9m may be provided for housing a standby generator set of 5 KW to 100 kW.

e) Requirements of Rooms

1) The area given above in respect of the different categories of rooms hold good if they are provided with windows and independent access doors in accordance with local regulations.

2) All the rooms should be provided with partitions up to the ceilings and shall have proper ventilation. Special care should be taken to ventilate the transformer rooms and where necessary louvers at lower level and exhaust fans at higher level shall be provided at suitable locations.

3) In order to prevent storm water entering the transformer and switch rooms through the soak-pits, the floor level of the substation shall be at least 15 cm above the highest flood water level that may be anticipated in the locality.

4) The minimum height of high voltage switchgear room shall be 3.6 m.

3.5.3 **Location of Switch Room** : In large installations other than where a substation is provided, a separate switch room shall be provided; this shall be located as closely as possible to the electrical load centre and suitable ducts shall be laid with minimum number of bends from the point of entry of the supply to the position of the main switchgear. The switch room shall also be placed in such a position that rising ducts may readily be pro-

Note : The installation shall be so designed as to take into account the permissible variation in the declared supply voltage of 6 percent in respect of low voltage and medium voltage and 9 percent in respect of high voltage.

Weather proof : Accessories, lighting fittings, current-using appliances and cables are said to be of the 'weatherproof' type, if they are so constructed that when installed in open situation they will withstand the effects of rain, snow, dust and temperature variations.

3. General Requirements

3.1 **Conformity with Indian Electricity Act 1910 and Rules Made Thereunder** -The installation shall generally be carried out in conformity with the requirements of the Indian Electricity Act, 1910 and the Indian Electricity Rules, 1956 framed thereunder and also the relevant regulations of the Electric Supply authority concerned as amended from time to time, Extracts from the Indian Electricity rules, 1956, referred to in this section are given in Appendix A.

3.2 **Conventional Symbols** : The architectural symbols that are to be used in all drawings, wiring plans, etc., for electrical installations in buildings shall be as given in Appendix B.

3.2.1 For other graphical symbols used in electrotechnology, reference may be made to good practice [VIII-2(2)].

3.3 **Materials** : All materials, fittings, appliances, etc., used in electrical installations, shall conform to Part V Building materials.

3.4 **Execution of Work** : Unless otherwise exempted under the appropriate rule of the Indian Electricity Rules the work of electrical installations shall be carried out under the supervision of a person holding certificate of competency issued by recognized authority. The workmen also shall hold a similar certificate of competency.

3.5 **Exchange of Information for Planning a Building for Electrical Installations** :

3.5.1 **Co-ordination** : Proper co-ordination and collaboration between the architect, building engineer and the electrical engineer shall be effected from the planning stage of the installation. The provisions that will be needed for the accommodation of substation, transformer, switchrooms, lift wells and other appurtenant rooms, service cable ducts, rising mains and distribution cables, sub-distribution boards, openings and chases in floors and walls for all required electrical installations, etc., shall be specified in advance.

3.5.2 **Location and Requirements of Substation** : The following requirements of a substation shall be followed :

a) **Total Plinth (covered) Area** : Electrical substations may normally be required in case of office buildings with a total plinth (covered) area of 5000 m²; even buildings with smaller plinth (covered) areas with larger loads, or under local regulations, may require a substation.

b) **Load Centre and Centre of Gravity of Buildings** :

1) The ideal location of an electrical substation for a group of buildings would be at the load centre and shall be located on the ground floor.

2) In multi-storeyed buildings, the substation shall preferably be installed on the lowest floor level, but direct access from the street for installation or removal of the equipment shall be provided. The floor level of the substation or switch room shall be above the highest flood level of the locality. In this case the load centre would be somewhere between the geometrical centre and the air-conditioning plant room.

3) It is preferable to locate the electrical substation adjacent to the air-conditioning plant room in such a way that the distance from the controlling switch-board of the air-conditioning plant room and the corresponding switches in the

provided therefrom to the upper floors of the building in one straight vertical run. In larger buildings, more than one rising duct and horizontal ducts may also be required for running cables from the switch room to the foot of each rising main. Such cable ducts shall be reserved for the electrical services only which may, however, include medium and low voltage installations; such as call-bell systems; telephone installations should be suitably segregated.

3.5.4 **Location and Requirements of Distribution Panels** : The electrical control gear distribution panels and other apparatus, which are required on each floor may conveniently be mounted adjacent to the rising mains, and adequate space should be provided at each floor for this purpose.

3.5.5 **Location and Requirements of PBX/PABX Rooms** : Information regarding provision for and location of PBX/PABX rooms, telephone outlets and risers shall be ascertained from the relevant authority. Adequate space should be provided for installation of sub-distribution boards.

3.5.6 Local Supply Authority

a) In all cases, that is, whether the proposed electrical work is a new installation or extension of an existing one, or a modification, the electricity supply undertaking shall be consulted.

b) **Addition to an Installation** : An addition, temporary or permanent, shall not be made to the authorized load of an existing installation, until it has been definitely ascertained that the current-carrying capacity and the condition of existing accessories, conductors, switches, etc., affected, including those of the supply authority are adequate for the increased load.

3.5.7 **Levels of Illumination** : The levels of illumination for the different types of visual tasks are given in Part VIII Building services, Section-I Lighting and ventilation.

3.5.8 **Fannage** : Information on size and location of bays and nature of occupancy would facilitate in assessing the requirement and location of fans.

4. Planning and Designing

4.1 **General** : The information given under 3 shall be taken note of for planning and designing electrical installations.

4.2 The design and planning of an electrical installation shall take into account all the prevailing conditions which may include some or all of the following :

a) Type of supply.

b) Envisaged load having regard to the requirements of the owner or occupier.

c) The probable modifications and future extensions.

d) The degree of electrical and mechanical protection necessary.

e) The probable operation and maintenance cost taking into account the electricity supply tariffs available.

f) The relative cost of various alternative methods, and

g) The need for radio and telecommunication interference abatement.

4.2.1 It is recommended that advice of a competent electrical engineer be sought at the planning stage with a view to providing an installation that will provide adequate for its intended purpose and safe and efficient in its use.

4.3 Layout and Installation drawing

4.3.1 The electrical layout should be considered after proper locations of all outlets for lamps, fans, appliances both fixed and transportable, motors, etc., have been selected and best methods of wiring determined.

4.3.2 All runs of wiring and the exact positions of all points of switch-boxes and other outlets shall be first marked on the plans of the building and approved by the engineer-in-charge or the owner before actual commencement of the work.

4.4 The design of the wiring system and the sizes of the cables should be decided taking into account two factors:

- Voltage Drop:** This should be kept as low as economy permits to ensure proper functioning of all electrical appliances and equipment including motors.
- First cost against operating losses.**

4.5 **Voltage and Frequency of Supply:** It should be ensured that all equipment connected to the system including any appliances to be used on it are suitable for the voltage and frequency of supply of the system. The nominal values of low and medium voltage systems in India are 240V and 415V AC respectively and the frequency 50Hz.

4.6 RATINGS

4.6.1 The current-carrying capacity of different types of cables shall be chosen in accordance with good practice (VIII-2(4)).

4.6.2 The current ratings of switches for domestic and similar purposes are 5A and 15A.

4.6.3 The current ratings of isolators and normal duty switches and composite units of switches and fuses shall be selected from one of the following values:

16, 25, 32, 63, 100, 160, 200, 320, 400, 500, 630, 800, 1000 and 1250 A

4.6.3.1 The ratings of rewirable and HRC fuses shall be in accordance with good practice (VIII-2(5)).

4.6.4 The current rating of the distribution fuse-board shall be selected from one of the following values:

6, 16, 25, 32, 63 and 100A.

Note: The above ratings are for each fuse way of the distribution fuse-board.

4.7 Lighting and Levels of Illumination

4.7.1 **General:** Lighting installation shall take into consideration the many factors on which the quality and quantity of artificial lighting depends. The modern concept is to provide

illumination with the help of a large number of light sources not of higher illumination level. Also much higher levels of illumination are called for than in the past, often necessitating the use of fluorescent lighting suitably supplemented with incandescent fittings, where required.

4.7.2 **Future Demand:** However, if for financial reasons, it is not possible to provide a lighting installation to give the recommended illumination levels, the wiring installation at least should be so designed that at a later date, it will permit the provision for additional lighting fittings or conversion from incandescent to fluorescent lighting fittings to bring the installation to the required standard. It is essential that adequate provisions should be made for all the electrical services which may be required immediately and during the intended useful life of the building.

4.7.3 **Principles of Lighting:** When considering the function of artificial lighting, attention shall be given to the following principal characteristics before designing an installation:

- Illumination and its uniformity;**
 - Special distribution of light.** This includes a reference to the composition of diffused and directional light, direction of incidence, the distribution of luminances and the degree of glare; and
 - Colour of the light and colour rendition.**
- 4.7.4 The variety of purposes which have to be kept in mind while planning the lighting installation could be broadly grouped as:
- industrial buildings and processes;
 - offices, schools and public buildings;
 - surgeries and hospitals; and
 - hostels, restaurants, shops and homes.

4.7.4.1 It is important that appropriate levels of illumination for these in accordance with 3.5.7 are provided and the types and positions of fittings determined to suit the task and the disposition of the working planes;

4.7.5 For specific requirements for lighting of special occupancies, reference shall be made to good practice (VIII-2(6)).

4.8 Fanning

4.8.1 Where ceiling fans are provided, the bay sizes of a building, which control fan point locations, play an important part.

4.8.2 Fans normally cover an area of 9 m² to 10 m² and therefore in general purpose office buildings, for every part of a bay to be served by the ceiling fans, it is necessary that the bays shall be so designed that full number of fans could be suitably located for the bay, otherwise it will result in ill-ventilated pockets. In general, fan in along halls may be spaced at 3m to 3.5 m in both the directions. If building modules do not lend themselves for proper positioning of the required number of ceiling fans, other types of fans, such as air circulators or bracket fans would have to be employed for the areas uncovered by the ceiling fans. For this, suitable electrical outlets shall be provided although result will be disproportionate cost on account of fans.

4.8.3 Proper air circulation could be achieved either by larger number of smaller fans or smaller number of larger fans. The economics of the system as a whole should be a guiding factor in choosing the number and type of fans and their locations.

4.8.4 Exhaust fans are necessary for spaces, such as community toilets, kitchens and canteens, and godowns to provide the required number of air changes (see Part VIII Building Services, Section 1 Lighting and ventilation). Since the exhaust fans are located generally on the outer walls of a room, appropriate openings in such walls shall be provided for in the planning stage.

4.8.5 Positioning of fans and light fittings shall be chosen to make these effective without causing shadows on the working planes.

4.9 Time Schedule: Electrical installation

in a new building shall normally begin immediately on the completion of the main structural building work and before such finishing work as plastering has begun except in the case of surface wiring which can be carried out after the plaster work. Usually, no installation work should start until the building is reasonably weatherproof, but where electric wiring is to be concealed within the structures as may be the case with a reinforced concrete building, the necessary conduits and ducts (or former for ducts cast in situ) shall be positioned after the shuttering is in place and before the concrete is poured, provision being made to protect conduits from damage.

5. Reception and Distribution of Main Supply

5.1 Control at Point of Commencement of Supply

5.1.1 There shall be a circuit-breaker or miniature circuit-breakers or a linked switch on each live conductor of the supply mains at the point of entry. The wiring throughout the installation shall be such that there is no break in the neutral wire in the form of a switch or fuse unit. The neutral shall also be distinctly marked. In this connection, Rule 32 (2) of Indian Electricity Rules, 1956 (see Appendix A) shall also be referred.

5.1.2 The main switch shall be easily accessible and situated as near as practicable to the termination of service line.

5.1.3 On the main switch, where the conductors include an earthed conductor of a two wire system or an earthed neutral conductor of a multi-wire system or a conductor which is to be connected thereto, an indication of a permanent nature shall be provided to identify the earthed neutral conductor. In this connection, Rule 32(1) of Indian Electricity Rules, 1956 (see Appendix A) shall be referred.

5.2 Main Switches and Switchboard

5.2.1 All main switches or miniature circuit breakers shall be either of metal-clad enclosed

pattern or of any insulated enclosed pattern which shall be fixed at close proximity to the point of entry of supply.

5.2.2 Location

a) Open type switchboards shall be placed only in dry and ventilated rooms and they shall not be placed in the vicinity of storage batteries or exposed to chemical fumes.

b) In damp dusty situation the switch board shall be totally enclosed in accordance with accepted standards (VIII-2(7)).

c) Switchboards shall not be erected above gas stoves or sinks, or within 2.5 m of any washing unit in the washing rooms of laundries, or in bathrooms, lavatories of toilets, or kitchens.

d) In case of switchboards unavoidably fixed in places likely to be exposed to weather, to drip, or to abnormal moist atmosphere, the outer casing shall be weatherproof and provided with glands or bushings or adopted with glands or bushings or a adopted to receive screwed conduit, according to the manner in which the cables are run.

5.2.3 **Metal:** clad switchgear shall preferably be mounted on any of the following types of boards:

- Hinged-Types Metal boards:** These shall consist of a box made of sheet metal not less than 2 mm thick and shall be provided with a hinged cover. The joints shall be welded. A wooden board protected on both sides with insulating varnish and of not less than 6.5 mm thickness, shall be provided at the back. There shall be a clear distance of not less than 2.5 cm between the board and the cover. The joints shall be welded. A wooden board protected on both sides with insulating varnish and of not less than 6.5 mm thickness, shall be provided at the back. There shall be a

clear distance of not less than 2.5 cm between the board and the cover, the distance being increased for larger boards. The board increased for larger boards. The board shall be securely fixed to the wall and shall be provided with a locking arrangement and an earthing stud. All wires passing through the metal board shall be provided with insulating bushes. Alternatively, hinged-type metal boards shall be made of sheet covering mounted on channel or angle iron frame.

Note: Such type of boards are particularly suitable for small switchboards for mounting metal clad switchgear connected to supply at low voltages.

b) **Fixed-Type Metal Boards:** These shall consist of an angle or channel iron frame fixed on the wall or on the floor and supported on the wall at the top, if necessary. There shall be a clear distance of 1 m in front of the switchboard. If there are any attachments of bare connections at the back of the switch board, Rule 51(1) (c) of Indian Electricity

In this section where reference is made to 'accepted standards' in relation to material specification, the appropriate document listed in THE APPENDIX to the Code may be used as a guide to the interpretation of this term.

Rules, 1956 (see Appendix A), shall apply.

Note: Such type of boards are particularly suitable for large switchboards for mounting large number of switchgears or higher capacity metal-clad switchgear or both.

c) **Wood Boards:** For small installations connected to a single-phase 240 volts supply, these boards may be used as mainboard or sub-boards. These shall be of seasoned and durable wood with solid back impregnated with varnish with all joints dove-tailed.

5.2.4 In large size medium voltage installations, before proceeding with the actual construction of the boards, a proper drawing showing the detailed dimensions and design includ-

ing the disposition of the mounting, which shall be symmetrically and neatly arranged for arriving at the overall dimensions, shall be prepared and approved by the engineer-in-charge.

5.2.5 **Recessing Of Boards:** Where so required, the switchboards shall be recessed in the wall. The depth of recess provided at the back for connection and the space at the front between the switchgear mounting shall be adequate.

5.2.6 Arrangement Of Mountings

a) Mounting which is on the front of a switchboard shall be so arranged that inadvertent personal contact with live parts is unlikely during the manipulation of switches, changing of fuses or like operation.

b) No mounting shall be mounted within 2.5 cm of any edge of the panel and no hole other than the holes by means of which the panel is fixed shall be drilled closer than 1.3 cm from any edge of the panel.

c) The various live parts, unless they are effectively screened by substantial barriers of non-hygroscopic, non-inflammable insulating material, shall be so spaced that an arc cannot maintain between such parts and earth.

d) The arrangement of the gear shall be such that they shall be readily accessible and their connections to all instruments and apparatus shall also be easily traceable;

e) In every case in which switches and fuses are fitted on the same pole, these fuses shall be so arranged that the fuses are not alive when their respective switches are in the 'off' position.

f) No fuses other than fuses in instrument circuit shall be fixed on the back of or behind a switchboard panel or frame.

5.2.7 Marking of Apparatus

a) Where a board is connected to voltage higher than 250 volts, all the apparatus mounted on it shall be marked in the following colours to indicate the different poles or phases to which the apparatus or its different terminals may have been connected:

Alternate Current	Direct Current
Three phases: red, yellow and blue	Three-wire system: 2outer wires, positive and negative blue
1 Neutral-black	1 Neutral - black

b) Where a board has more than one switch, each such switch shall be marked to indicate which section of the installation it controls. The main switch shall be marked as such and where there is more than one main switch in the building, each such switch shall be marked to indicate which section of the installation it controls.

c) All markings required shall be clear and permanent.

5.3 Main and Branch Distribution Boards

5.3.1 Main and branch distribution boards shall be of any type mentioned in 5.2.3.

5.3.2 Main distribution boards shall be provided with a switch or circuit-breaker on each pole of each circuit, a fuse on the phase or live conductor of each circuit. The switches shall always be linked.

5.3.3 Branch distribution boards shall be provided with a fuse on the live conductor of each circuit and the earthed neutral conductor shall be connected to a common link and be capable of being disconnected individually for testing purposes. One spare circuit of the same capacity shall be provided on each branch distribution board. Lights and fans may be wired on a common circuit. Such sub-circuit shall not have more than a total of ten points of lights, fans and socket-outlets. The load of such circuit shall be restricted to 800 watts. If

* In this section where reference is made to 'accepted standards' in relation to material specification, the appropriate document listed in THE APPENDIX to the code may be used as a guide to the interpretation of this term.

a separate fan circuit is adopted, the number of fans in the circuit shall not exceed ten. As regards power sub-circuits, the outlet shall be provided according to the load design for these circuits but in no case shall there be more than two outlets on each sub-circuit. Special requirements like air-conditioning should be visualized and in such cases it is desirable to wire such outlets on separate circuits with a control such as IC switch/miniature circuit breaker contactor.

5.3.4 Installation Of Distribution Boards

- The distribution fuse-boards shall be located as near as possible to the centre of the load they are intended to control.
- These shall be fixed on suitable stanchion or wall and shall be accessible for replacement of fuses.
- These shall be of either metal-clad type or all-insulated type. But, if exposed to weather or damp situations, they shall be totally enclosed in accordance with accepted standards [VIII-2(7)].
- Where apparatus is to be operated at medium voltage, or where medium voltage exists between two or more adjacent low-voltage circuits, all terminals or other fixed live parts not permanently shrouded in insulating material shall be enclosed in earthed metal or noncombustible insulating material and the distribution boards shall be fixed not less than 2 m apart.
- All circuits shall be marked distinctly on distribution boards as 'lighting' or 'power' as the case may be, and also marked with the voltage and number of phases of the supply. Each board shall be provided with a circuit list giving details of each circuit which it controls and the current rating of the circuit and size of fuse-element.

5.3.5 Wiring Of Distribution Board

- In wiring a branch distribution board,

total load of the consuming devices shall be distributed, as far as possible, evenly between the number of ways of the board, leaving the spare circuit for future extension. Spare circuits on branch distribution boards shall be at least 10 percent of the number of ways of the board subject to a minimum of 1 in 6 way board and above.

- All connections between pieces of apparatus or between apparatus and terminals on a board shall be neatly arranged in a definite sequence, following the arrangements of the apparatus mounted thereon, avoiding unnecessary crossings.
- Cables shall be connected to a terminal only by soldered or welded lugs, unless the terminal is of such a form that it is possible to securely clamp them without cutting away of the cable strands. Aluminium conductors should be tinned before insertion in clamps.
- If required, a pilot lamp shall be fixed and connected through an independent single-pole switch and fuse to the bus-bars of the board.
- In a hinged type board, the incoming and outgoing cables shall be fixed at one or more points according to the number of cables on the back of the board leaving suitable space in between cables, and shall also, if possible, be fixed at the corresponding points on the switchboard panel. The cables between these points shall be arranged to form a 'U' or 'S' shaped loop which shall be of such length as to allow the switchboard panel to swing through an angle of not less than 90°.

5.3.6 Protection of Circuits

- Appropriate protection shall be provided at switchboards and distribution boards for all circuits and sub-circuits against over current and earth faults, and the protective apparatus shall be capable of

interrupting any fault current that may occur, without danger. The ratings and settings of fuses and the protective devices shall be co-ordinated so as to afford selectivity in operation, where necessary.

- Where circuit-breakers are used for protection of a main circuit and of the sub-circuits derived therefrom, discrimination in operation may be achieved by adjusting the protective devices of the sub-main circuit-breakers to operate at lower current settings and shorter time-lag than the main circuit-breaker.
- Where HRC type fuses are used for back-up protection or circuit-breakers, or where HRC fuses are used for protection of main circuits, and circuit-breakers for the protection of sub-circuits derived therefrom, in the event of short-circuits exceeding the breaking capacity of the circuit-breakers, the HRC fuses shall operate earlier than the circuit-breakers; but for smaller overloads within the breaking capacity of the circuit-breakers, the circuit-breakers shall operate earlier than the HRC fuse blows.
- If rewirable type fuse are used to protect sub-circuits derived from a main circuit protected by HRC type fuses, the main circuit fuse shall normally blow in the event of a short-circuit or, earth fault occurring on a sub-circuit, although discrimination may be achieved in respect of overload currents. The use of rewirable fuses is restricted to the circuits with short-circuit level of 4 KA; for higher level either cartridge or HRC fuses shall be used.
- A fuse carrier shall not be fitted with a fuse-element larger than that for which the carrier is designed.
- The current rating of a fuse shall not exceed the current rating of the smallest cable in the circuit protected by the fuse.

g) Every fuse shall have its own case or cover for the protection of the circuit and an indelible indication of its appropriate current rating in an adjacent conspicuous position.

h) For detailed information regarding selection, installation and maintenance of fuses, reference may be made to good practice [VIII-2(8)].

5.4 Branch Switches : Where the supply is derived from a three-wire or four-wire source, and distribution is done on the two-wire system, all branch switches shall be placed in the outer or live conductor of the circuit and no single-phase switch or fuse shall be inserted in the middle wire, earth or earthed neutral conductor of the circuit. Single-pole switches (other than for multiple control) carrying not more than 15 amperes may be of tumbler type which shall be 'on' when the handle or knob is down.

6. Wiring

6.1 Provision for Maximum Load : All conductors, switches and accessories shall be of such size as to be capable of carrying, without their respective ratings being exceeded, the maximum current which will normally flow through them.

6.1.1 Estimation of Load Requirements : In estimating the current to be carried by any conductor the following ratings shall be taken, unless the actual values are known or specified for these elements :

Element	Rating in Watts
Incandescent lamps	60
Ceiling fans, Table fans, ordinary socket outlet points	60
Fluorescent tubes :	
Length : 600 mm	25
1200 mm	50
1500 mm	90
Power socket-outlet	1000

6.2 Selection of Size of Conductor : The sizes of conductor of circuits shall be so selected that the drop in voltage from consumer's terminals in a public supply (or from the bus-bars of the main switchboard controlling the various circuits in a private generating plant) to any and every point on the installation does not exceed three percent of the voltage at the consumer's terminals (or at the bus-bars as the case may be) when the conductors are carrying the maximum current under the normal conditions of service.

6.2.1 If the cable size is increased to avoid voltage drop in the circuit, the rating of the cable shall be the current which the circuit is designed to carry. In each circuit or sub-circuit every cable shall have a current rating not less than that of the fuse which protects the circuit or sub-circuit, respectively.

6.3 Conductors : All conductors shall be of copper or aluminium. The conductor for final sub-circuit wiring shall have a nominal cross-sectional area not less than 1.00 mm² copper and 1.50 mm² aluminium. The cross-sectional area of conductor for power wiring shall be not less than 2.5 mm² copper and 4.00 mm² aluminium. The minimum cross-sectional area of conductor of flexible cord shall be 0.50 mm². In the case of power circuit, the wiring shall be designed for the load which it is supposed to carry.

6.3.1 Various precautions to be taken and techniques to be employed in using aluminium conductor cables shall be in accordance with good practice [VIII-2(9)].

6.4 "Power" sub-circuits shall be kept separate and distinct from "lighting" and "fan" sub-circuits. All wirings shall be done on the distribution system with main and branch distribution boards at convenient physical and electrical load centres and without isolated fuses. All types of wiring, whether recessed or surface should be capable of easy inspection. The surface wiring when run along the walls should be as near the ceiling as possible. In all

types of wirings due consideration shall be given for neatness and good appearance.

6.5 Balancing of circuits in three-wire or poly-phase installation shall be planned beforehand. In such cases it is recommended that all socket-outlets in a room are connected to one phase. However, in non-domestic premises if it is impracticable to meet this requirement, more than one phase (or pole) of the supply may be utilized provided that all socket-outlets on one phase are grouped together and are not intermingled with socket-outlets connected to a different phase, and provided that in no circumstances may a socket-outlet be installed at a distance less than 2m from any socket-outlet connected to a different phase. The conductors shall be so enclosed, in earthed metal or incombustible insulating material, that it is not possible to have ready access to them. If the points, between which a voltage exceeding 250 volts is present, are 2m or more apart, the covers or access doors shall be clearly marked to indicate the voltage present.

6.5.1 The above requirements apply equally to three-phase circuits in which the voltage between lines or to earth exceeds 250 volts and to groups of two or more single-phase circuits between which medium voltage may be present, derived therefrom. They apply also to 3-wire dc or 3-wire single-phase ac circuits in which the voltage between lines or to earth exceeds 2500 volts and to groups of 2-wire circuits, between which medium voltage may be present, derived therefrom.

6.6 Medium voltage wiring and associated apparatus shall comply, in all respects, with the requirements of Rules 50, 51 and 61 of the Indian Electricity Rules, 1956 (see appendix A).

6.7 Flexible Cables and Flexible Cords : Unless cables and cords are protected by flexible conduits or tough rubber or PVC sheath, they shall not be used in places where they are liable to be subjected to mechanical damage.

6.8 Cable Ends

6.8.1 Stranded conductors having a nominal cross-sectional area exceeding 6.0 mm² shall always be provided with soldered terminals.

6.8.2 When a stranded conductor having a nominal cross-sectional area less than 6.0 mm² is not provided with cable sockets, all strands at the exposed end of the cable shall be soldered together. 'No-oxide' grease shall be provided on the exposed end of the conductor after soldering.

6.8.3 Connection of cable ends by crimping shall also be permitted for solid conductors.

6.9 Joints and Looping Back : Where looping back system of wiring is specified, the wiring shall be done without any junction or connector boxes on the line. Where joint box system is specified, all joints in conductors shall be made by means of approved mechanical connectors insuitable and approved joint boxes. Wherever practicable, looping back system should be preferred.

6.9.1 In any system of wiring, no bare or twist joints shall be made at intermediate points in the through run of cables unless the length of a final sub-circuit, sub-main or main is more than the length of the standard coil as given by the manufacturer of the cable. If any jointing becomes unavoidable, such joint shall be made through proper cut-outs or through proper junction boxes open to easy inspection, but in looping back systems no such junction boxes shall be allowed.

6.10 Connection to Ancillary Buildings : Unless otherwise specified, electrical connections to ancillary buildings, like outhouses, garages, etc, adjacent to the main building at a distance not greater than 3 m and when no roadway intervenes, shall be taken in an earthed GI pipe of suitable size in the exposed portion at a height of not less than 2.5 m or by underground cables. This applies to both runs of mains or sub-mains or final sub-circuit wirings between the buildings. When the distance between the buildings exceeds 3m or a

roadway intervenes, normally separate mains or sub-mains shall be run from the main building to ancillary buildings and the portion of the same exposed to weather shall be carried in weatherproof cable on GI bearer wire at a height not less than 4m above the ground.

6.11 Passing Through Walls and Floors

6.11.1 Where conductors pass through walls, one of the following methods shall be employed. Care shall be taken to see that wires pass freely through protective pipe or box and that the wires pass through in a straight line without any twist or cross in wires on either ends of such holes :

a) A wooden box extending through the whole thickness of the wall shall be buried in the wall and casings or conductors shall be carried so as to allow 1.3 cm air space on three sides of the casing or conductor.

b) The conductor shall be carried either in a rigid steel conduit conforming to accepted standards [VIII-2(10)] or a rigid non-metallic conduit conforming to accepted standards [VIII-2(11)] or in a porcelain tube of such a size which permits easy drawing in.

c) Insulated conductors while passing through floors shall be protected from mechanical injury by means of rigid steel conduit to a height not less than 1.5 m above the floors and flush with the ceiling below. This steel conduit shall be earthed and securely bushed.

6.11.2 Where a wall tube passes outside a building so as to be exposed to weather, the outer end shall be bell-mouthed and turned downwards and properly bushed on the open end.

6.12 Fixing to Walls and Ceilings : Plugs for ordinary walls or ceilings shall be of seasoned wood not less than 5 cm long and 2.5 cm square on the inner end and 2 cm square on the outer end. The shall be cemented into

7.3.2 Where a lighting fitting is supported by one or more flexible cords, the maximum weight to which the twin flexible cords may be subjected shall be as given in Table-1.

7.3.6 General safety requirements for electrical lighting fittings shall be in accordance with good practice [VIII(2)(13)].

b) Fan clamps shall be of suitable design according to the nature of construction of ceiling on which these clamps are to be fitted. In all cases, fan clamps shall be fabricated from tested metal of suitable sizes and they shall be as close fitting as possible. Fan clamps shall have a sufficient clearance between ceiling and hook and the shape of the hook shall be proportioned for fixing a 50-mm shackle insulator. Fan clamps for

Fig. 1 Typical Design of fan Clamps

7.2 Where wooden boards are used for mounting switches, regulators, etc., these boards shall be well varnished with pure shellac on four sides, both inside and outside, respectively of begin painted to match the surroundings. The size of such boards shall depend on the number of accessories that could be conveniently and neatly arranged. Where there is danger of attack by white ants, the boards shall be painted with suitable anti-termite paint on the underside instead of pure

3.3.1 General : Wiring with tough rubber sheathed cables is suitable for low voltage installation and shall not be used in places exposed to sun and rain or in damp places; but may be installed in the above places, provided wires are sheathed in special approved protective covering against atmosphere and well protected to withstand dampness; and wiring with PVC-sheathed cables is suitable for medium voltage installation and may be installed directly under exposed conditions of sun and rain or damp places. This system of wiring is

8.4.3.1 In cases where there are chances of any damage to the wiring, such wiring shall be covered with sheet metal protective covering, the base of which is made flush with the plaster or brickwork, as the case may be, or the wiring shall drawn through a steel conduit pipe by complying with all requirements of conduit system of wiring.

8.4.3.2 The protective covering shall in all cases be carried right through the entire length of such doubtful positions.

8.4.4 For detailed information, reference may be made to good practice [VIII-2(9)].

8.5 Conduit Wiring System

8.5.1 Surface Conduit Wiring System with Rigid Steel Conduits

8.5.1.1 **Type and Size of Conduit :** All conduit pipes shall be finished with galvanized or stove enamelled surface. All conduit accessories shall be of threaded type and under no circumstances pin grip type or clamp type accessories be used. The inside of the conduit shall be reamed to clear the burrs as otherwise it may damage the insulation of the wire. No steel conduit less than 16 mm in diameter shall be used. For detailed information of permissible number of cables that can be drawn into rigid steel conduit, reference may be made to good practice [VIII-2(9)].

8.5.1.2 **Bunching Of Cables :** Unless otherwise specified, insulated conductors of AC supply and DC supply shall be bunched in separate conduits.

8.5.1.3 **Conduit Joints :** Conduit pipes shall be jointed by means of screwed couplers and screwed accessories only.

8.5.1.4 **Protection Against Dampness :** In order to minimize condensation or seeping inside the tube, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects as far as possible.

8.5.1.5 **Conductors :** All conductors used in conduit wiring shall preferably be stranded.

8.5.1.6 **Erection Of Conduit :** The conduit of each circuit or section shall be completed before conductors are drawn in. The entire system of conduit after erection shall be tested for mechanical and electrical continuity throughout and permanently connected to earth conforming to good practice [VIII-2(7)]. If conduit pipes are liable to mechanical damages, they shall be adequately protected.

8.5.2 **Recessed Conduit Wiring System With Rigid Steel Conduit :** Recessed conduit wiring

system shall comply with all the requirements for surface conduit wiring system (see 8.5.1) and, in addition, conform to the requirements given in 8.5.2.1 and 8.5.2.2.

8.5.2.1 **Making Of Chase :** The chase in the wall shall be neatly made and be of ample dimensions to permit the conduit to be fixed in the manner desired. In the case of buildings under construction, chases shall be provided in the wall, ceiling, etc., at the time of their construction and shall be filled up neatly after erection of conduit and brought to the original finish of the wall.

8.5.2.2 **Fixing Of Conduit In Chase :** The conduit pipe shall be fixed by means of staples or by means of saddles not more than 60 cm apart. Fixing of standard bends or elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with a long radius which will permit easy drawing-in of conductors. All threaded joints of rigid steel conduit shall be treated with some approved preservative compound to secure protection against rust.

8.5.3 **Conduit Wiring System With Rigid Non-Metallic Conduits :** Rigid non-metallic conduits are used for surface and recessed conduit wiring in low and medium voltage installations.

8.5.3.1 **Bunching Of Cables :** Conductors of AC supply and DC supply shall be bunched in separate conduits.

8.5.3.2 **Heat may be used to soften the conduit for bending and forming joints in case of plain conduits.** As the material softens when heated, siting of conduit in close proximity to hot surfaces should be avoided. Caution shall be exercised in the use of this conduit in locations where the ambient temperature is 50°C or above. Use of such conduits in places where ambient temperature is 60°C or above is prohibited.

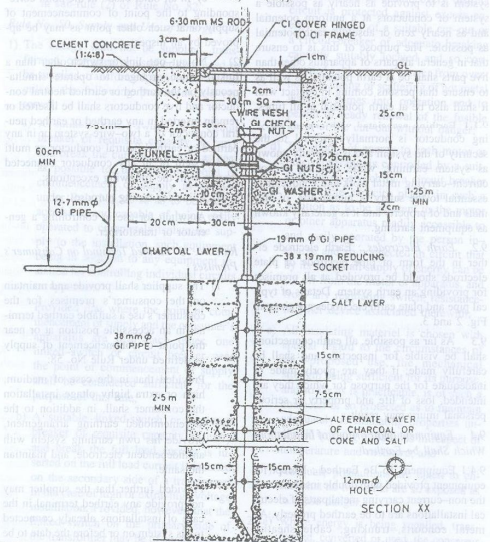
8.5.3.3 **Conduit Joints :** Conduits shall be jointed by means of screwed or plain couplers depending on whether the conduits are screwed

or plain. Where there are long runs of straight conduits, inspection type couplers shall be provided at intervals. Conduit fittings and accessories shall conform to accepted standards [VIII-2(18)].

8.6 **Electrical wiring installation in industrial locations (for voltage of above 650 volts)**

shall be done in accordance with good practice [VIII-2(11)].

8.7 **Guide Lines for Electrical Layout in Residential Buildings :** For guide lines for the electrical installation in residential buildings, reference may be made to good practice [VIII-2(19)].



Note : Three or four buckets of water to be poured into sump every few days to keep the soil surrounding the earth plate or pipe permanently moist.

Fig. 2 Pipe Earthing

8.8 For detailed information regarding the installation of different electrical equipments, reference may be made to good practice [VIII-2(20)].

9. EARTHING

9.1 **General :** The object of an earthing system is to provide as nearly as possible a system of conductors at a uniform potential and as nearly zero or absolute earth potential as possible. The purpose of this is to ensure that in general all parts of apparatus other than live parts shall be at earth potential as well as to ensure that persons coming in contact with it shall also be at earth potential at all times.

9.1.1 Earthing associated with current carrying conductor is normally essential to the security of the system and is generally known as system earthing, while earthing of non-current-carrying metal work and conductor is essential to the safety of human life, of animals and of property and it is generally known as equipment earthing.

9.2 **Earth Electrodes :** Earth electrode either in the form of pipe electrode or plate electrode should be provided at all premises for providing an earth system. Details of typical pipe and plate earth electrodes are given in Fig. 2 and 3.

9.3 As far as possible, all earth connections shall be visible for inspection and shall be carefully made; if they are poorly made or inadequate for the purpose for which they are intended, loss of life and property or serious personal injury may result.

9.4 Equipment and Portions of Installations Which Shall be Earthed

9.4.1 **Equipment To Be Earthed :** Except for equipment provided with double insulation, all the non-current carrying metal parts of electrical installations are to be earthed properly. All metal conduits, trunking, cable sheaths, switchgear, distribution fuse-boards, lighting fittings and all other parts made of metal shall be bonded together and connected by means of two separate and distinct conductors to an efficient earth electrode.

9.4.2 **Structural Metal Work :** Earthing of the metallic parts shall not be effected through any structural metal work which houses the installation. Where metallic parts neutral conductor at the point where such connection is to be made; and

c) In all other case : at the point corresponding to the point of commencement of supply or at such other point as may be approved by an inspector.

2) No cut-out, link or switch other than a linked-switch arranged to operate simultaneously on the earthed or earthed neutral conductor and five conductors shall be inserted or remain inserted in any earthed or earthed neutral conductor of a two-wire system or in any earthed or earthed neutral conductor or multi wire system or in any conductor connected thereto with the following exceptions:

- a) a link for testing purpose ; or
- b) a switch for use in controlling a generator or transformer.

Rule No. 33. Earthed Terminal on Consumer's Premises

1) The supplier shall provide and maintain on the consumer's premises for the consumer's use a suitable earthed terminal in an accessible position at or near the point of commencement of supply as defined under Rule No. 58:

Provided that in the case of medium, high or extra high voltage installation the consumer shall, in addition to the aforementioned earthing arrangement, provide his own earthing system with an independent electrode, and maintain the same.

Provided further that the supplier may not provide any earthed terminal in the case of installations already connected to his system on or before the date to be specified by the State Government in this behalf if he is satisfied that the consumer's earthing arrangement is efficient.

2) The consumer shall take all reasonable precautions to prevent mechanical damage to the earthed terminal and its lead belonging to the supplier.

3) The supplier may recover from the consumer the cost of installation of such earthed terminal on the basis laid down in sub-rule (2) of Rule No. 82.

Rule No. 50. Supply and Use of Energy.

1) The energy shall not be supplied, transformed, converted or used or continued to be supplied, transformed, converted or used unless the following provisions are observed:

- a) A suitable linked-switch or a circuit breaker of requisite capacity to carry and break the current is placed as near as possible to, but after the point of commencement of supply as defined under Rule No. 58, so as to be readily accessible and capable of being easily operated to completely isolate the supply to the installation, such equipment being in addition to any equipment installed for controlling individual circuits or apparatus;

Provided that where the point of commencement of supply and the consumer's apparatus are near each other, one linked-switch or circuit breaker near the point of commencement of supply shall be considered sufficient for the purpose of this rule;

- b) A suitable linked-switch or a circuit breaker of requisite capacity to carry and break the full load current is inserted on the full load current is inserted on the secondary side of a transformer in the case of high or extra-high voltage installation. Provided, however, that the linked-switch on the primary side of the transformer may be of such capacity as to carry the full load current and to break only the magnetizing current of the transformer;

Provided further that the provision of this clause shall not apply to transformers installed in substations up to and including 100kVA belonging to the supplier;

c) Except in the case of composite control-gear designed as a unit, every distinct circuit is protected against excess energy by means of a suitable cut-out or a circuit-breaker of adequate breaking capacity suitably located and so constructed as to prevent danger from overheating, arcing or scattering of hot metal when it comes into operation and to permit of ready renewal of the fusible metal of the cut-out without danger;

d) The supply of energy to each motor or other apparatus is controlled by a suitable linked-switch or a circuit breaker of requisite capacity placed in such a position as to be adjacent to the motor or other apparatus readily accessible to and easily operated by the person in-charge and so connected in circuit that by its means all supply of energy can be cut off from the motor or apparatus, and from any regulating switch, resistance or other device associated therewith;

e) All insulating material is chosen with special regard to the circumstances of its proposed use, the mechanical strength being sufficient for its purpose, and so far as is practicable, is of such a character or so protected as to maintain adequately its insulating properties under all working conditions in respect of temperature and moisture; and

f) Adequate precautions are taken to ensure that no live parts are so exposed as to cause danger.

2) a) Where energy is being supplied, transformed, converted or used, the consumer or the owner of the concerned installation shall be responsible for the continuous observance of the provisions of sub-rule (1) in respect of his installation.

b) Every consumer shall use all reasonable means to ensure that where energy is supplied by a supplier no person other than the supplier, shall interfere with the service lines and apparatus placed by the supplier on the premises of the consumer.

Rule No. 51. Provisions Applicable to Medium, High or Extra-High Voltage Installations

The following provisions shall be observed where energy at medium, high or extra-high voltage is supplied, converted, transformed or used:

i) a) All conductors (other than those of overhead lines) shall be completely enclosed in mechanically strong metal casing or metallic covering which is electrically and mechanically continuous and adequately protected against mechanical damage unless the said conductors are accessible only to an authorized person or are installed and protected to the satisfaction of the Inspector so as to prevent danger.

b) All metal work enclosing, supporting or associated with the installation other than that designed to serve as a conductor shall, if considered necessary by the Inspector, be connected with earth.

c) Every main switchboard shall comply with the following provisions, namely: i) a clear space of not less than 0.914 m in width shall be provided in front of the switchboard;

ii) if there are any attachments or bare connections at the back of the switchboard, the space (if any) behind the switchboard shall be either less than 0.229 m, or more than 0.762 m in width, measured from the further, outstanding part of any attachment or conductor;

iii) if the space behind the switchboard exceeds 0.762 m in width there shall be a passage-way from either end of the switchboard clear to a height of 1.829 m.

Rule No. 58. Point of Commencement of Supply

The point of a commencement of supply of energy to a consumer shall be deemed to be the point at the out-lets inserted by the supplier in each conductor or every service line other than an earthed or earthed neutral conductor or the earthed external conductor of a concentric consumer's premises.

Rule No. 61. Connection with Earth

i) The following provisions shall apply to the connection with earth of systems at low voltage in cases where the voltage between phases or outers normally exceed 125 volts and of systems at medium voltage:

a) The neutral conductor of a three phase four-wire system and the middle conductor of a two-phase three-wire system shall be earthed by not less than two separate and distinct connections with earth both at the generating station and at the substation. It may also be earthed at one or more points along the distribution system or service line in addition to any connection with earth which may be at the consumer's premises.

2) The frame of every generator, stationary motor, and so far as is practicable, portable motor, and the metallic parts (not intended as conductors) of all transformers and any other apparatus used for regulating or controlling energy and all medium voltage energy consuming apparatus shall be earthed by the owner by two separate and distinct connections with earth.

Appendix B (Clause 3.2)

ARCHITECTURAL SYMBOLS FOR ELECTRICAL INSTALLATIONS IN BUILDINGS

B-1. WIRING	B-2.1.2 Main Fuse-Board with switches
B-1.0 Remarks 'upwards' and 'downwards' apply only when the drawing is read the right way up.	B-2.1.3 Distribution Fuse Board without switches
B-1.0.1 An arrow on the slant line indicates the direction of the power flow.	B-2.1.4 Distribution Fuse Board with switches
B-1.0.2 The wiring terminates at the circle or the black dot.	B-2.2 POWER CIRCUIT FUSE-BOARDS
B-1.1 General Wiring	B-2.2.1 Main Fuse-Boards with out switches
B-1.2 Wiring on the Surface	B-2.2.2 Main Fuse-Board with switches
B-1.3 Wiring under the Surface	B-2.2.3 Distribution Fuse Board without switches
B-1.4. WIRING IN CONDUIT	B-2.2.4 Distribution Fuse Board with switches
B-1.4.1 Conduit on surface	B-3.0 SWITCHES AND SWITCH OUTLETS
B-1.4.2 Concealed Conduit	B-3.1 One-Way Switch
Note: The type of conduit may be indicated, if necessary.	B-3.1.1 Single-pole
B-1.5 Wiring Going Upwards	B-3.1.2 Two-Pole
B-1.6 Wiring Going Downwards	B-3.1.3 Three-Pole
B-1.7 Wiring Passing Vertically Through a Room	B-3.2 Single-Pole Pull Switch
B-2.0 FUSE-BOARDS	B-3.3 Multiposition Switch (for Different Degrees of Lighting)
B-2.1 Lighting Circuit Fuse-Boards	B-3.4 Two-Way Switch
B-2.1.1 Main Fuse-Board with out switches	B-3.5 Intermediate Switch
	B-3.6 Period Limiting Switch

B-3.7 Time Switch	B-5.2 Lamp, Mounted on a Wall
B-3.8 Pendant Switch	B-5.3 Lamp, Mounted on a Ceiling
B-3.9 Push Button	B-5.4 Counter Weight Lamp Fixture
Note: The use of the push button may be indicated, if desired.	B-5.5 Chain Lamp Fixture
B-3.10 Luminous Push Button	B-5.6 Rod Lamp Fixture
B-3.11 Restricted Access Push Button	B-5.7 Lamp Fixture with Built-in Switch
Note: The use of the push button may be indicated if desired.	B-5.8 Lamp Fed from Variable Voltage Supply
B-4. SOCKET-OUTLETS	B-5.9 Emergency Lamp
B-4.1 Socket-Outlet, 5A	B-5.10 Panic Lamp
B-4.2 Socket-Outlet, 15A	B-5.11 Bulk-Head Lamp
B-4.3 Combined Switch and Socket-Outlet, 5A	B-5.12 Water-Tight Lighting Fitting
B-4.4 Combined Switch and Socket-Outlet 15A	B-5.13 Batten Lamp Holder
B-4.5 Interlocking Switch and Socket-Outlet 5A	B-5.14 Projector
B-4.6 Interlocking Switch and Socket-Outlet, 15A	B-5.15 Spot Light
B-5. LAMPS AND LIGHTING APPARATUS	B-5.16 Flood Light
B-5.0 Symbols B-5.1 to B-5.18 represent either the lamp or a group of lamps or the outlet for lamps. If it is desired to specify that the lamp is fixed to the wall or ceiling, a vertical or horizontal line respectively may be added to the symbol.	B-5.17 Fluorescent Lamp
B-5.1 Lamp or Outlet for Lamp	B-5.17.1 Group of Three 40-w fluorescent lamps
B-5.1.1 Group of three 40-w lamps	B-6.0 ELECTRICAL APPLIANCES
	B-6.1 General
	Note: If necessary, use designation to specify.
	B-6.2 Heater

B-6.3 Storage Type Electric Water Heaters	B-9.6 Television Receiving Set
B-7.0 BELLS, BUZZERS AND SIRENS	B-9.7 Control Board (for Public Address System)
B-7.1 Bell	B-10.0 CLOCKS
B-7.2 Buzzer	B-10.1 Synchronous Clock Outlet
B-7.3 Siren	B-10.2 Impulse Clock Outlet
B-7.4 Horn or Hooter	B-10.3 Master Clock Outlet
B-7.5 Indicator (At 'N', insert number of ways)	B-11.0 FIRE ALARMS
B-8.0 FANS	B-11.1 Manually Operated Fire Alarm
B-8.1 Ceiling Fan	B-11.2 Automatic Fire Detector Switch
B-8.2 Bracket Fan	B-11.3 Bell Connected to Fire Alarm Switch
B-8.3 Exhaust Fan	B-11.4 Fire Alarm Indicator
B-8.4 Fan Regulator	B-12.0 EARTHING
B-9.0 TELECOMMUNICATION APPARATUS	B-12.1 Earth Point
B-9.1 Socket-Outlet for Telecommunication	
B-9.2 Aerial	
B-9.3 Loudspeaker	
B-9.4 Radio Receiving Set	
B-9.5 Amplifying Equipment	

APPENDIX-C

(Clause 10.1(a)(5))

FORM FOR COMPLETION CERTIFICATE

I/We certify that the installation detailed below has been installed by me/us and tested, and that to the best of my/our knowledge and belief, it complies with the Indian Electricity Rules, 1956, as well as Part-VIII Building Services, Section-2 Electrical installations of the Code.

- a) Electric installation at
- b) Voltage and system of supply

Particulars of work	Number	Total load	Type or system of wiring
1) Light points			
2) Fan points			
3) Plug points (3-pin)			
4) Motors			
5) Other plant			

d) If the work involves installation of overhead lines and/or underground cable

e) Earthing : Description of earthing electrode, size of earth wire and number of earth electrodes provided.....

f) Test results :

- 1) Insulation resistance for the whole installation :
- i) between conductors
- ii) between each conductor and earth
- 2) Resistance of earthing electrode or earthing system
- 3) Maximum earthing resistance of installation

Signature of Supervisor
Name and Address of Supervisor

Signature of Contractor
Name and Address of Contractor

DETAILED TECHNICAL SPECIFICATION FOR ELECTRICAL WORKS

GENERAL CONDITIONS

These specifications apply to the Electrical Installation work to the Electrical Installation work to be executed by the contractor. These specifications are to be read in conjunction with the general conditions of contract drawings and the schedule of quantities.

General conditions of contract to be according to the conditions of contract preceding. The following clause be considered as an extension and not in limitation of the obligation of the contractor.

1.0 GENERAL

1.1 SCOPE

The scope of supplies and services shall include transport, supplies, storage, erection, testing and commissioning of all equipments required for electrical works. In the process the contractor shall supply and furnish all materials, labour, tools and equipments as required.

The contractor shall also be responsible for submission and follow up of applications for power sanction. The contractor's scope drawings/schemes as required by the local inspectorate and getting the same approved by the electrical inspectorate.

On completion of work, the contractor shall obtain approval from the electrical inspector for the installation itself.

Hence, the scope shall cover all liaison and Co-ordination charges with KEB and Electrical Inspectorate.

Wherever such services are mentioned specifically by a separate item in the bill of quantities the service charges towards the above shall be indicated against the respective item falling which, the cost shall be absorbed in the rates for other items.

On completion of the work, the contractor shall obtain and deliver to the employer a certificate of final inspection and approval as given by the local electric supply authorities.

1.2 CONTRACTOR :

The contractor shall hold a valid class-I Electrical Contractors licence and shall employ licensed supervisors and skilled workers with valid permits as per the Indian Electricity rules and requirements as stipulated by the Electrical Inspectorate.

1.3 STANDARDS AND REGULATIONS

The installation shall be carried out in conformity with the relevant IS Codes of Practices and with the requirements of Indian electricity Act, 1910 as amended upto date the latest Indian Electricity and Regulations of the State Electricity Board and Inspectorate Rules.

Further, the various components, cables switch boards etc., shall conform to the respective Indian Standards for the particular items.

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Wherever this specification calls for a higher standard of materials and/or workmanship than those required by the Regulations mentioned under this clause, this specification shall be deemed to be valid over the said standards and regulations.

The contractor shall carry out his work complying with the standards and regulations mentioned above and shall bring to the notice of the Engineer-in-charge any rules as and when framed in order to make the installation comply with the regulations. In case of any failure on the part of the contractor to do so leading to rectification / modification of any part of the installation in order to make the installation comply with the regulations, no claim for any extra costs would be entertained by engineer-in-charge/owner towards such rectification / modification.

1.4 Feeds / Deposits to KEB / Inspectorate :

Any deposits/fees required to be paid to KEB and /or local inspectorate in connection with the electrical works, would be reimbursed to the contractor on furnishing of relevant receipts towards the above.

1.5

1.7 FOREMAN / SUPERVISOR

The contractor shall employ competent, licensed, qualified full time electrical foremen / supervisors to direct the work of electrical installation in accordance with the drawings and specifications. The foreman/supervisor shall be available at all times on the site to receive instructions from the engineer-in-charge / employer in the day activities throughout the duration of the contract. The foreman / supervisor shall co-ordinate the progress of work in co-ordination with other agencies at site.

1.8 UNIT RATES

The unit rates quoted shall include all materials, labour, supervision, scaffolding etc., wherever required and shall include all sundry and miscellaneous items as necessary for completion of the installation though the same may not have been specifically brought or mentioned in the bill of quantities.

The unit rate shall be applicable and payments shall be made for the exact quantities installed at site.

1.10 INSPECTION :

It will be the responsibility of the contractor to arrange for inspection of all electrical installations by the local Electrical Inspectorate and see that they are passed by him.

The switchboards, sub-distribution boards, metering boards and all other fabricated works shall be got inspected by the engineer-in-charge with advance intimation prior to installation.

The engineer-in-charge shall have full powers to get the materials and the workmanship etc., inspected and tested by an independent agency at the contractors expense in order to ascertain soundness and adequacy of the same. The engineer-in-charge shall have full powers to get the materials and the workmanship etc., inspected and tested by an independent agency at the contractors expense in order to ascertain soundness and adequacy of the same. The

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engineer-in-charge shall also have the powers to call for samples of any components of the installation such as switches, MCB, wire, cable etc., which the contractor proposes to use to ensure proper conformity with the specification.

PART-II-MATERIALS

Note : All materials shall conform to IS specifications.

2.1 CONDUIT PIPES

Types and Size of Conduits :

All conduits pipes shall be of approved gauge (not less than 16 gauge for conduits of size upto 32 mm dia and not less than 14 wg for conduits above 32mm diameter). Lap welded and finished with stove enamel surfaces. All conduit accessories shall be of threaded type and under no circumstances pin grip type or clamp grip type accessories shall be used. No conduit less than 19 mm in diameter shall be used IS:1653-1972.

2.2 OUTLET BOXES USED IN CONDUIT WIRING

The switch or regulator box shall be made of metal on all sides, except on the front. In the case of welded mild steel boxes the wall thickness shall not be less than 16 gauge for all size of boxes. Except where otherwise stated 4mm thick clear white acrylic sheets shall be fixed on the front with countersunk cadmium plated M.S. screws. Clear depth of the box shall not be less than 60 and this shall be increased suitably to accommodate mounting of fan regulator in flush pattern. All the MSD boxes shall have a brass earthing threaded stud with nut on one of the sides. IS 5133 Part-I 1969.

2.3 LIGHT SWITCHES AND SOCKETS

Piano-key type flush mounting switches and sockets of 5A and 15A ratings. All sockets shall be of 3 pin type on IS : 1293-1967.

2.4 CEILING ROSE

White/Cream colour PVC ceiling rose. IS 371-1966.

2.5 WIRES FOR CONCEALED WIRING

PVC insulated with electrically annealed copper conductor wires of 1.1 KV grade and size as mentioned in bill of quantities.

2.6 15 VOLTS 3-PHASE SWITCH BOARDS

The switch boards shall be sheet steel clad, floor mounting or wall mounting type as required and built out of 14 gauge sheet steel. The switch boards shall comply with the various Indian standards as applicable for switch gear and the various components mounted therein.

The salient features of the Panels shall be as follows :

- i) Sheet steel 2mm thick for frames and equipment mounting plates 1.6mm thick for partitions.
- ii) Welded construction with transport sections bolted together. All such joints to be gas kettled.

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- iii) The cubicles shall be totally dust and vermin proof conforming to IP-54 as per IS 2147.
- iv) All doors to be hinged type except busbar chamber covers which shall be of bolted type. The panels shall be of flush front design, suitable for access from front and rear, except where the boards are mounted against the wall in which case the boards shall be designed for maintenance with front access only.
- v) The construction shall be such as to facilitate easy extension at both ends.
- vi) The design shall be such as to have individual feeders in segregated compartments, with proper barriers between adjacent feeders, busbar chamber and cable termination chambers.
- vii) All routine tests as specified in the India Standards shall be carried out in the presence of the engineer-in-charge and test certificates submitted for approval.
- viii) Test certificates shall also be submitted for all major components of the switch boards like ACBs, CTS, Relays etc.,
- ix) Prior to fabrication of the panels, the contractor has to submit the following drawings.

For Approval :

- a) Single line diagram-power circuit
- b) Control circuit diagrams,
- c) Front view showing layout of components
- d) Sectional view
- e) Foundation drawing

2.7. METERING CUM-POWER DISTRIBUTION BOARDS

The metering-cum-power distribution boards shall basically comply with the requirements and regulation of the KEB and Inspectorate authorities.

The metering-cum-power distribution shall be designed to suit the space conditions at site and shall be tailor made for each of the buildings.

Guidance in this respect shall also be obtained from the present KEB regulations in force.

Prior approval has to be obtained by the contractor from the Engineer-in-charge / KEB for the layout and design of the metering-cum-power distribution board and no additional claim shall be entertained for any modification work required to be done at a later stage, to conform to KEB / Inspectorate's requirements.

2.8. EARTH LEAKAGE CIRCUIT BREAKERS

Earth leakage circuit breaker shall be 2 pole or 4 pole as specified in the bill of quantities and shall have a sensitivity of 30 MA.

The exact locations of these ELBs in circuits can be had from the single line diagrams.

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2.9. "SUPERTRIP" MCBS

The 2 pole super trip breakers mentioned in the bill of quantities are of English.

Electric make or equivalent and combine functions of both earth leakage as well as over current protection. The sensitivity shall be of 30MA.

The breakers shall have trip free mechanism visible indications for fault, trip feature for interchange between phase and neutral connections.

The ratings can be had from the bill of quantities and the relevant drawings.

2.10. MINATURE CIRCUIT BREAKERS

Miniature circuit breakers shall be of the makes as specified and shall have minimum rupturing capacity of 6 KA.

2.11. MCB DISTRIBUTION BOARDS

The MCB distribution boards shall be of wall mounting built out of 16 gauge sheet steel Industrial type with proper gaskets and removable gland plates for conduit entries.

The busbars shall be of tinned electric grade copper and rated for 200A both phases and neutral. The MCB distribution boards shall be either SPN or TPN or as required and makes as specified.

The TPN distribution boards shall be of compartmentalised type with phase segregation.

The MCB, DBs shall be of the makes as specified and contractor has to obtain prior approval from engineer-in-charge for the exact makes he proposes to use prior to procurement/ supply.

PART-III-WORKMANSHIP

3.1 CONCEALED CONDUIT WIRING SYSTEM

3.1.1 CONDUIT LAYING

Conduits shall be laid on the finished centering with atleast 3mm cover and this may be achieved by supporting the conduits on spacers kept at regular intervals. Conduits shall be laid as far as possible in straight runs.

Open ends of the conduits/junction boxes shall be well sealed with waste/wooden plugs to prevent entry of concrete slurry. The conduits and the junction boxes shall be tied to the reinforcement with binding wires at regular intervals to prevent them from getting dislodged while the concrete vibrator is applied for consolidating the concrete.

3.1.2 DRAWING OF WIRES

Guidelines as stipulated in IS shall be followed and the contractor shall also obtain approval from Engineer-in-charge prior to commencement of work.

3.1.3 BUNCHING OF CABLES

Cables carrying alternating current shall be so bunched that outgoing and return cables are always drawn into the same conduit.

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3.1.4 CONDUIT JOINTS

Conduit pipes shall be joined by means of screwed couplers and screwed accessories only. In long distance straight run of conduit, junction boxes/inspection boxes at intervals not exceeding 5 mtrs. Shall be approved, where there are bends / curves, the same shall be reduced suitable, as directed by the engineer-in-charge. Threads on conduits pipes in all cases shall be between 13mm to 19mm long, sufficient to accommodate pipes to full threaded portion of couplers or accessories. Cut ends of conduit pipes shall have no sharp edges nor any burrs left to avoid damage to the insulation of conductors while pulling them through such pipes. Each of the inspection box shall be flush with the finished surface of the wall.

3.1.5 BENDS IN CONDUITS

All necessary bends in the system including diversion shall be done by bending pipes as far possible or by inserting suitable solid or inspection type normal bends, elbows or similar fittings. Radius of bends in conduit pipes shall not be less than 7.5 cms. No dent/crack shall be made on the pipes while bending. Pipes shall be bent with pipe tender only.

3.1.6 FIXING OF CONDUIT IN CHASE

The conduit pipe shall be fixed by means of staple or by means of saddles not more than 60 cm apart or by any other approved means of fixing. Fixing of standard bends or elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with a long radius which will permit easy drawing in of conductors. All threaded joints of conduit pipes shall be treated with approved preservative compound 'ASIAN' Red oxide or any other equivalent approved by engineer-in-charge to secure protection against rust.

3.1.7 FISH WIRE

To facilitate easy drawing of wires in the conduit suitable size steel wire shall be provided along with laying of conduit.

3.1.8 ERECTION AND EARTHING OF CONDUITS AND BOXES

The conduit of each circuit or section shall be tested for mechanical and electrical continuity throughout and permanently connected to earth conforming to the requirements specified under chapter earthing by means of special approved type of earthing clamp efficiently fastened to conduit pipe in a workman like manner for a perfect continuity between the earth medium. If conduit pipes are liable to mechanical damage, they shall be adequately protected. In conduit wiring system the pipe must be continuous when passing through walls or floors.

3.1.9 TERMINATION OF CONDUITS

Wherever conduits are terminated in a outlet box or a distribution board, checknuts shall be fixed on either side of the box. After the conduits, junction boxes, outlets boxes etc., are fixed in position and wires are drawn, their outlets shall be properly plugged using PVC stopper or rubber bushing to prevent entry of mortar, vermins or any other foreign material into the conduit system.

3.2.0 WIRING DEFINITIONS

3.2.1 POINT WIRING

Point wiring shall include all works necessary in complete wiring of a switch circuit in

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concealed conduit wiring form the corresponding fuseway on the distribution fuse board to the following via the switch :

- a) Ceiling rose or connector (in the case of exhaust fan points)
- b) Ceiling rose (in the case of pendants)
- c) Socket outlet
- d) Lamp holder (in the case of batten points)
- e) Call bell / buzzer (in the case of words via the switch shall be read as : (via the ceiling rose/socket outlet or bell push) where no ceiling rose/socket outlet is provided).

The following shall be deemed to be included in the point wiring :

- a) Switch
- b) Ceiling rose or connector as required
- c) Earth wire form three pin socket outlet point/fan to the common earth including connection to earth dollies.
- d) All metal boxes required for mounting switch/fan regulator but excluding those under the main and distribution switch gears.
- e) All fixing accessories such as clips, nails, screws, phil plug, rawl plug, wooden plug etc., as required.
- f) Terminating in ceiling rose, connector, socket outlet, lamp holder, switch, fan regulator etc.,
- g) Loopings in the same switch board and interconnections between points on the same circuit, and any other item as specified in the bill of quantities.

3.2.2 SUBMAIN WIRING

Sub main wiring shall mean the length of wiring from one main distribution switchgear to another main / distribution switchgear.

3.2.3 SERVICE MAIN

Shall mean the length of cable from the nearest external feeder pillar upto the meter board

3.2.4 LOOPING IN SYSTEM

Unless otherwise specified the wiring shall be done in looping system phase or live conductors shall be looped at the switch box and neutral conductor can be looped from the light fan or socket outlet.

3.2.5 CAPACITY OF CIRCUITS

Lights, 5A socket points, call bell points and ceiling fans may be wired on a common circuit such circuit shall not have more than a total of ten points of light, fan and socket outlets or a load of 800 watts, whichever is less. Each 15A 3 pin socket outlet shall have its own circuit from the distribution board, unless shown otherwise in the drawing.

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3.2.6 WIRING OF DISTRIBUTION BOARD

In wiring a branch distribution board, the total load of the consuming devices shall be divided as far as possible, evenly between the number of way of the board.

Cables shall be connected to terminals by soldered lugs / by crimping, unless the terminals are of such a form that they can be securely clamped without cutting away the cable strands.

3.2.7 ACCESSORIES

Switches : All switches shall be placed in the live conductor of the circuit and no single pole switch or fuse shall be inserted in the earth or earthed neutral conductor of the circuit.

3.2.8 SOCKET OUTLETS

- Every socket outlet shall be controlled by a switch.
- The switch controlling the socket outlet shall be on the 'Live' side of the line.
- For locations of 5A socket outlets, corresponding drawings may be referred.
- The third terminal of the 3 pin socket outlet shall be connected to the general earth.

3.2.9 LTC CABLE LAYING

All outdoor LTC cables shall be laid in ground not less than 900 mm below ground level. Cables shall be laid in Class 'A' GI pipes at all entry to buildings. The open ends of the pipes shall be sealed at both ends after the cables are laid, using bituminous compound or any other suitable material to prevent entry of any foreign matter into the building. Wherever the cables are laid across the road/pathway, the same shall be drawn in a suitable size of home stoneware pipe.

3.2.10 CABLE AND TERMINATIONS

Cable terminations shall be provided at either ends of each cable using suitable glands, cable lugs, soldering material, insulating tape, etc.,

3.2.11 Strands of wires shall not be cut off for connection to terminals or lugs. The terminals shall have adequate capacity to take all the strands.

3.2.12 Wiring for KEB and DG circuits shall be done in separate conduits. The two shall not be mixed together.

3.2.13 The following colour codes for the wiring shall be applicable.

Phase-R : Red

Y : Yellow/White

B : Blue

Neutral : Black

Earth : Green

3.2.14 All switches, sockets, fan regulators etc., shall be housed in proper 16 gauge sheet steel enclosure and covered with 4mm acrylic sheet. The mounting heights and exact locations shall be decided at site in consultation with the engineer-in-charge.

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3.2.15 Wherever power supply is drawn from 3 phase, 415 volts, it shall be endeavoured to obtain a balanced loading on each of the 3 phases.

3.2.16 All circuits/points in any room (specially applicable to flats and residential blocks) shall preferably be fed by one phase only-either R or Y or B.

3.2.17 In case of single fluorescent fittings the bill of quantities stipulate an optional item for providing condensers.

Prior to installation of the fittings, the electrical contractor shall ascertain from KEB whether it would be mandatory to provide condensers for the particular installation and if so, the written clarification obtained from KEB shall be submitted to the Engineer-in-charge and clearance obtained for provision of this optional item.

If for default on the part of the contractor to obtain such a clarification which may necessitate installation of the condenser at a later date after the fittings are already installed by the contractor, no extra claim shall be entertained for removal and refixing of the fittings.

3.2.18 All 3 phase distribution boards shall have phase indication lamps for indicating availability of power supply.

3.2.19 All cables shall be laid neatly properly supported and clamped.

All materials and accessories such as clamps, supports, saddles and other accessories as required for installing and laying the cables shall be included in the rates quoted. Wherever the cables are buried in ground, the cost shall include excavation, supply and laying of bricks, sand, refilling and consolidation.

3.2.20 All fittings shall be complete with necessary brackets, hooks, clamps, supports etc., and complete with connection wires as required for the installation.

3.2.21 Fan hook boxes shall be provided for all ceiling fans.

3.2.22 Time position of light/fan fittings, distribution boards, switches, sockets etc., as shown in the drawing are indicative. If during execution the position of any of these fittings need to be changed, the same shall be carried out without any extra cost.

3.2.23 The contractor shall provide safety equipment as necessary and as required and insisted upon by the Electrical Inspectorate. Wherever a separate item has been foreseen in the bill of quantities for the same, the contractor shall quote for other items shall absorb the cost towards safety equipments.

3.2.24 In case of quarters and flats when have a layer number of 15A heating outlets, 3-phase power supply is foreseen though the present restriction from KEB is to sanction up to 3 KW only for an AEH connection.

In all such cases, the Electrical Contractor shall try to obtain special permission from KEB for obtaining sanction of higher power as required for the installation and consequently supply from 3 phase. If KEB does not permit 3 phase supply and the increased power sanction, the distribution, foreseen for such items shall have to be changed to suit single phase supply.

Hence in all such cases, the contractor is requested to approach KEB and obtain classification prior to supply /fabrication of distribution boards. Any revisions as necessary will

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have to be done and accordingly prices revised and agreed upon for which contractor has to furnish the price calculation to justify the revised prices. Approval shall be obtained for revised prices prior to fabrication/supply.

3.2.25 In case of light fittings suspended from the ceiling, the rates to be quoted shall include the cost of connecting stranded wires also.

3.2.26 The enclosures for housing the control switches connected on KEB circuits shall be different from that housing the switches on DG circuits though the two may be mounted side by side.

3.2.27 Generally, the 15A sockets provided in bath room shall be controlled separately by a two pole switch mounted at the bath room entrance as shown in the drawings. In case of 5+15A sockets provided in the kitchen, the same shall be of combined switch type.

3.2.28 Wherever exhaust fans have been shown, a 5A socket has to be provided near the exhaust fan from which supply shall be tapped. Such socket points for exhaust fans are clearly brought out in the bill of quantities.

3.2.29 Wherever street light fittings are to be mounted on street lighting poles, the street lighting poles shall be complete with fuses, terminal blocks for looping of armored heavy duty cables, connecting wires from the terminal block to the fitting and necessary clamping arrangement for fixing of pole in foundation. The rates quoted shall include civil works for foundation.

3.2.30 The bill of quantities clearly stipulate the interconnection wiring between the distribution boards to the control switch points which normally do not come in the purview of light points wiring. It may be noted that only such interconnection wirings. Shall be allowed for as specifically mentioned as a separate item in the bill of quantities.

Wherever any interconnections wiring is required but not mentioned, the same shall be absorbed in the rates quoted for the other items. No extra claims for interconnection wiring shall be allowed apart from what has been specifically mentioned in the bill of quantities.

3.2.31 In certain cases where fittings are located quite distant from the control points, the costs are reckoned on per meter basis for wiring. The bill of quantities and the relevant drawings clearly state the items which are allowed for wiring on meter basis.

3.2.32 All bill of quantities shall be read in conduction with the relevant drawings.

3.2.33 In certain cases, master control switches have been foreseen for lighting and power circuits. These switches are to be mounted at the entrance of rooms in order to externally switch of power supply to the particular rooms whenever they are vacant.

3.2.34 LIGHT AND FAN FIXTURES

All light and fan fixtures, call bells etc., shall be installed in locations, as shown in various drawings and as per the directions of the Engineer-in-charge using necessary fixing materials.

3.2.35 Wherever mentioned, two runs of cables together with change over switch at the incoming panel has been foreseen as being insisted upon by KEB at present. The contractor is

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requested to checkup whether it would be mandatory to lay two runs of cables at the time when the work is taken up. Prior clarifications shall be obtained by the Electrical Contractor by KEB before commencing this item of work.

The cost shall be suitably adjusted depending on the actual requirements at the time of execution.

3.2.36 Unless otherwise specified, all light fittings shown on ceiling shall be fixed directly to ceiling.

In specific cases where the ceiling lights are to be suspended from the ceiling, the costs towards the suspension conduits joints, wires etc., shall be quoted and prior approval obtained from the engineer-in-charge/owners.

3.2.27 EARTHING

a) All non current carrying metal parts of electrical installations shall be earthed as per IS:3043-1966. All metal conduits, trunkings, cable sheaths, glands,

b) Earth electrodes shall be measured in numbers and shall include :

- G.I. pipe/plate electrodes as specified.
- Making the required size of pit and refitting after insertion of earth electrode with salt and charcoal under the supervision of the Site Engineer.
- Chamber and R.C. cover.
- Water funnel with wire to the pipe electrode.
- Excavation and complete civil works.

**Annexure "A"
TESTING**

Date	D.B.No.	No. of Ways	All switches ON Consuming devices 'in' poles connected to earth	Between poles with consuming devices IN but switches OFF	Between poles with lamps/roves & switches 'ON'	Earth continuity Test	Power DBS phase and neutral	Phase to Earth
1	2	3	4	5	6	7	8	9

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KARNATAKA ELECTRICITY REGULATORY COMMISSION

(Electricity Supply and Distribution)
Code, 2000-01

1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39	1.40	1.41	1.42	1.43	1.44	1.45	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.88	1.89	1.90	1.91	1.92	1.93	1.94	1.95	1.96	1.97	1.98	1.99	2.00	2.01	2.02	2.03	2.04	2.05	2.06	2.07	2.08	2.09	2.10	2.11	2.12	2.13	2.14	2.15	2.16	2.17	2.18	2.19	2.20	2.21	2.22	2.23	2.24	2.25	2.26	2.27	2.28	2.29	2.30	2.31	2.32	2.33	2.34	2.35	2.36	2.37	2.38	2.39	2.40	2.41	2.42	2.43	2.44	2.45	2.46	2.47	2.48	2.49	2.50	2.51	2.52	2.53	2.54	2.55	2.56	2.57	2.58	2.59	2.60	2.61	2.62	2.63	2.64	2.65	2.66	2.67	2.68	2.69	2.70	2.71	2.72	2.73	2.74	2.75	2.76	2.77	2.78	2.79	2.80	2.81	2.82	2.83	2.84	2.85	2.86	2.87	2.88	2.89	2.90	2.91	2.92	2.93	2.94	2.95	2.96	2.97	2.98	2.99	3.00	3.01	3.02	3.03	3.04	3.05	3.06	3.07	3.08	3.09	3.10	3.11	3.12	3.13	3.14	3.15	3.16	3.17	3.18	3.19	3.20	3.21	3.22	3.23	3.24	3.25	3.26	3.27	3.28	3.29	3.30	3.31	3.32	3.33	3.34	3.35	3.36	3.37	3.38	3.39	3.40	3.41	3.42	3.43	3.44	3.45	3.46	3.47	3.48	3.49	3.50	3.51	3.52	3.53	3.54	3.55	3.56	3.57	3.58	3.59	3.60	3.61	3.62	3.63	3.64	3.65	3.66	3.67	3.68	3.69	3.70	3.71	3.72	3.73	3.74	3.75	3.76	3.77	3.78	3.79	3.80	3.81	3.82	3.83	3.84	3.85	3.86	3.87	3.88	3.89	3.90	3.91	3.92	3.93	3.94	3.95	3.96	3.97	3.98	3.99	4.00	4.01	4.02	4.03	4.04	4.05	4.06	4.07	4.08	4.09	4.10	4.11	4.12	4.13	4.14	4.15	4.16	4.17	4.18	4.19	4.20	4.21	4.22	4.23	4.24	4.25	4.26	4.27	4.28	4.29	4.30	4.31	4.32	4.33	4.34	4.35	4.36	4.37	4.38	4.39	4.40	4.41	4.42	4.43	4.44	4.45	4.46	4.47	4.48	4.49	4.50	4.51	4.52	4.53	4.54	4.55	4.56	4.57	4.58	4.59	4.60	4.61	4.62	4.63	4.64	4.65	4.66	4.67	4.68	4.69	4.70	4.71	4.72	4.73	4.74	4.75	4.76	4.77	4.78	4.79	4.80	4.81	4.82	4.83	4.84	4.85	4.86	4.87	4.88	4.89	4.90	4.91	4.92	4.93	4.94	4.95	4.96	4.97	4.98	4.99	5.00	5.01	5.02	5.03	5.04	5.05	5.06	5.07	5.08	5.09	5.10	5.11	5.12	5.13	5.14	5.15	5.16	5.17	5.18	5.19	5.20	5.21	5.22	5.23	5.24	5.25	5.26	5.27	5.28	5.29	5.30	5.31	5.32	5.33	5.34	5.35	5.36	5.37	5.38	5.39	5.40	5.41	5.42	5.43	5.44	5.45	5.46	5.47	5.48	5.49	5.50	5.51	5.52	5.53	5.54	5.55	5.56	5.57	5.58	5.59	5.60	5.61	5.62	5.63	5.64	5.65	5.66	5.67	5.68	5.69	5.70	5.71	5.72	5.73	5.74	5.75	5.76	5.77	5.78	5.79	5.80	5.81	5.82	5.83	5.84	5.85	5.86	5.87	5.88	5.89	5.90	5.91	5.92	5.93	5.94	5.95	5.96	5.97	5.98	5.99	6.00	6.01	6.02	6.03	6.04	6.05	6.06	6.07	6.08	6.09	6.10	6.11	6.12	6.13	6.14	6.15	6.16	6.17	6.18	6.19	6.20	6.21	6.22	6.23	6.24	6.25	6.26	6.27	6.28	6.29	6.30	6.31	6.32	6.33	6.34	6.35	6.36	6.37	6.38	6.39	6.40	6.41	6.42	6.43	6.44	6.45	6.46	6.47	6.48	6.49	6.50	6.51	6.52	6.53	6.54	6.55	6.56	6.57	6.58	6.59	6.60	6.61	6.62	6.63	6.64	6.65	6.66	6.67	6.68	6.69	6.70	6.71	6.72	6.73	6.74	6.75	6.76	6.77	6.78	6.79	6.80	6.81	6.82	6.83	6.84	6.85	6.86	6.87	6.88	6.89	6.90	6.91	6.92	6.93	6.94	6.95	6.96	6.97	6.98	6.99	7.00	7.01	7.02	7.03	7.04	7.05	7.06	7.07	7.08	7.09	7.10	7.11	7.12	7.13	7.14	7.15	7.16	7.17	7.18	7.19	7.20	7.21	7.22	7.23	7.24	7.25	7.26	7.27	7.28	7.29	7.30	7.31	7.32	7.33	7.34	7.35	7.36	7.37	7.38	7.39	7.40	7.41	7.42	7.43	7.44	7.45	7.46	7.47	7.48	7.49	7.50	7.51	7.52	7.53	7.54	7.55	7.56	7.57	7.58	7.59	7.60	7.61	7.62	7.63	7.64	7.65	7.66	7.67	7.68	7.69	7.70	7.71	7.72	7.73	7.74	7.75	7.76	7.77	7.78	7.79	7.80	7.81	7.82	7.83	7.84	7.85	7.86	7.87	7.88	7.89	7.90	7.91	7.92	7.93	7.94	7.95	7.96	7.97	7.98	7.99	8.00	8.01	8.02	8.03	8.04	8.05	8.06	8.07	8.08	8.09	8.10	8.11	8.12	8.13	8.14	8.15	8.16	8.17	8.18	8.19	8.20	8.21	8.22	8.23	8.24	8.25	8.26	8.27	8.28	8.29	8.30	8.31	8.32	8.33	8.34	8.35	8.36	8.37	8.38	8.39	8.40	8.41	8.42	8.43	8.44	8.45	8.46	8.47	8.48	8.49	8.50	8.51	8.52	8.53	8.54	8.55	8.56	8.57	8.58	8.59	8.60	8.61	8.62	8.63	8.64	8.65	8.66	8.67	8.68	8.69	8.70	8.71	8.72	8.73	8.74	8.75	8.76	8.77	8.78	8.79	8.80	8.81	8.82	8.83	8.84	8.85	8.86	8.87	8.88	8.89	8.90	8.91	8.92	8.93	8.94	8.95	8.96	8.97	8.98	8.99	9.00	9.01	9.02	9.03	9.04	9.05	9.06	9.07	9.08	9.09	9.10	9.11	9.12	9.13	9.14	9.15	9.16	9.17	9.18	9.19	9.20	9.21	9.22	9.23	9.24	9.25	9.26	9.27	9.28	9.29	9.30	9.31	9.32	9.33	9.34	9.35	9.36	9.37	9.38	9.39	9.40	9.41	9.42	9.43	9.44	9.45	9.46	9.47	9.48	9.49	9.50	9.51	9.52	9.53	9.54	9.55	9.56	9.57	9.58	9.59	9.60	9.61	9.62	9.63	9.64	9.65	9.66	9.67	9.68	9.69	9.70	9.71	9.72	9.73	9.74	9.75	9.76	9.77	9.78	9.79	9.80	9.81	9.82	9.83	9.84	9.85	9.86	9.87	9.88	9.89	9.90	9.91	9.92	9.93	9.94	9.95	9.96	9.97	9.98	9.99	10.00	10.01	10.02	10.03	10.04	10.05	10.06	10.07	10.08	10.09	10.10	10.11	10.12	10.13	10.14	10.15	10.16	10.17	10.18	10.19	10.20	10.21	10.22	10.23	10.24	10.25	10.26	10.27	10.28	10.29	10.30	10.31	10.32	10.33	10.34	10.35	10.36	10.37	10.38	10.39	10.40	10.41	10.42	10.43	10.44	10.45	10.46	10.47	10.48	10.49	10.50	10.51	10.52	10.53	10.54	10.55	10.56	10.57	10.58	10.59	10.60	10.61	10.62	10.63	10.64	10.65	10.66	10.67	10.68	10.69	10.70	10.71	10.72	10.73	10.74	10.75	10.76	10.77	10.78	10.79	10.80	10.81	10.82	10.83	10.84	10.85	10.86	10.87	10.88	10.89	10.90	10.91	10.92	10.93	10.94	10.95	10.96	10.97	10.98	10.99	11.00	11.01	11.02	11.03	11.04	11.05	11.06	11.07	11.08	11.09	11.10	11.11	11.12	11.13	11.14	11.15	11.16	11.17	11.18	11.19	11.20	11.21	11.22	11.23	11.24	11.25	11.26	11.27	11.28	11.29	11.30	11.31	11.32	11.33	11.34	11.35	11.36	11.37	11.38	11.39	11.40	11.41	11.42	11.43	11.44	11.45	11.46	11.47	11.48	11.49	11.50	11.51	11.52	11.53	11.54	11.55	11.56	11.57	11.58	11.59	11.60	11.61	11.62	11.63	11.64	11.65	11.66	11.67	11.68	11.69	11.70	11.71	11.72	11.73	11.74	11.75	11.76	11.77	11.78	11.79	11.80	11.81	11.82	11.83	11.84	11.85	11.86	11.87	11.88	11.89	11.90	11.91	11.92	11.93	11.94	11.95	11.96	11.97	11.98	11.99	12.00	12.01	12.02	12.03	12.04	12.05	12.06	12.07	12.08	12.09	12.10	12.11	12.12	12.13	12.14	12.15	12.16	12.17	12.18	12.19	12.20	12.21	12.22	12.23	12.24	12.25	12.26	12.27	12.28	12.29	12.30	12.31	12.32	12.33	12.34	12.35	12.36	12.37	12.38	12.39	12.40	12.41	12.42	12.43	12.44	12.45	12.46	12.47	12.48	12.49	12.50	12.51	12.52	12.53	12.54	12.55	12.56	12.57	12.58	12.59	12.60	12.61	12.62	12.63	12.64	12.65	12.66	12.67	12.68	12.69	12.70	12.71	12.72	12.73	12.74	12.75	12.76	12.77	12.78	12.79	12.80	12.81	12.82	12.83	12.84	12.85	12.86	12.87	12.88	12.89	12.90	12.91	12.92	12.93	12.94	12.95	12.96	12.97	12.98	12.99	13.00	13.01	13.02	13.03	13.04	13.05	13.06	13.07	13.08	13.09	13.10	13.11	13.12	13.13	13.14	13.15	13.16	13.17	13.18	13.19	13.20	13.21	13.22	13.23	13.24	13.25	13.26	13.27	13.28	13.29	13.30	13.31	13.32	13.33	13.34	13.35	13.36	13.37	13.38	13.39	13.40	13.41	13.42	13.43	13.44	13.45	13.46	13.47	13.48	13.49	13.50	13.51	13.52	13.53	13.54	13.55	13.56	13.57	13.58	13.59	13.60	13.61	13.62	13.63	13.64	13.65	13.66	13.67	13.68	13.69	13.70	13.71	13.72	13.73	13.74	13.75	13.76	13.77	13.78	13.79	13.80	13.81	13.82	13.83	13.84	13.85	13.86	13.87	13.88	13.89	13.90	13.91	13.92	13.93	13.94	13.95	13.96	13.97	13.98	13.99	14.00	14.01	14.02	14.03	14.04	14.05	14.06	14.07	14.08	14.09	14.10	14.11
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2.29 'Factory Premises' means the premises in which laboratories, repair shops stores, offices, reading rooms, libraries, yards, watch and ward, canteen and first aid centres belonging to the factory are housed, as defined in Factories Act.

2.30 'Faulty Meter' means a meter which does not record or which records with an error beyond the permissible limits prescribed under Rule 57 of I.E. Rules, 1956.

2.31 'High Tension' (HT) means supply voltages of more than 650 volts and upto and inclusive of 33000 volts.

2.32 'I.E. ACT' means Indian Electricity Act, 1910, as in force from time to time.

2.33 'Installation' means the whole of the electric wires, fittings, motors and apparatus installed and wired by or on behalf of the Consumer on one and the same premises starting from the point of commencement of supply.

2.34 'Licensee' means holder of a licence for Distribution or for Retail Supply or for both issued under Section 19 of the Karnataka Electricity Reform Act, 1999.

2.35 'Line Minimum Charges' means the monthly charges payable by the Consumer calculated at the rate of 1.25% per month (15% per Annum) on the entire cost of arranging Power supply to the consumer rounded off to the nearest rupee excluding the cost of Transformer and associated structure and switchgear.

Note : 1. This is applicable for the Initial guaranteed period of 7 years only.

2. Line minimum charges is not applicable where the prospective consumer pays the cost towards the service line or executes the works under self-execution.

2.36 'LOAD FACTOR' is the ratio of the total number of units consumed during a given period to the total number of units that would have been consumed had the load been maintained throughout the same period and is usually expressed as a percentage that is

$$\text{Load factor in percentage} = \frac{\text{Actual units consumed during a given period}}{\text{Load in KW} \times \text{Total no. of Hrs. during the given period}} \times 100$$

Note : Load means sanctioned load in KW in case of LT installation and contract demand in KW in case of HT installation.

2.37 'LOW TENSION' (LT) means supply voltages of 650V and below

2.38 'MAXIMUM DEMAND' means the average amount of kilowatts or ... kilovolt amperes as the case may be delivered at the point of supply of the consumer and recorded during the thirty minute period of maximum use in the month however, Subject to the Licensee reserving the right to shorten this period in special classes of consumers if necessary, with the approval of the commission.

2.39 'METER' means an equipment used for measuring electrical quantities like Energy in kilowatt hours maximum demand in kilowatts or kilovolt amperes, reactive energy in kilovolt ampere hours, etc., including accessories like current transformers and potential transformers when used in conjunction with such meter and any enclosure used for housing or fixing such meter or its accessories and any devices

like switches or fuses used for protection and testing purposes. Further 'METER' includes meters where more than one meter has been installed.

2.40 'METER READING DATE' means the date fixed for meter reading.

2.41 'MINIMUM CHARGES' means the higher of the line minimum charges of electricity charges payable under the Tariff schedule n force from time to time as per the terms of the Agreement and the code.

2.42 'MONTH' means the calendar month or the period between the meter reading date in a particular month and the corresponding meter reading date of the immediately succeeding month.

2.43 'OCCUPIER' means the owner or person in occupation of the premises where energy is used or proposed to be used.

2.44 'OHM' means a unit electric resistance.

2.45 'O&M Office' means the local office of the Licensee in charge supply and distribution of electricity.

2.46 'OFFICE OF ISSUE' means the office from which the claim for ... power supply charges or any other charges is made or any notice issued the Licensee.

2.47 'OUTLET' means in any electrical installation a point which electrical appliances is or is intended to be connected.

Note : For assessing the lighting load
a) 30% of Wall plugs shall be taken
b) Each outlet shall be taken as 40 watts. If Fluorescent lights (CFL) are used actual load shall be

2.48 'POWER FACTOR' means the ratio of watts to Volt -amperes or the ratio of KWH to KVAH, as applicable.

Note : Billing Power factor shall be the average PF recorded in Electronic Trisector Meter. In case the same is not available the ratio of KWh to KVAH consumed during the billing period and in case of non-availability of the above also. The PF obtained during the rating shall be used.

2.49 'PUBLIC LAMP' means an electric lamp used for lighting of any street or any public place.

2.50 'PREMISES' means the area / portion of the building / shed / field etc. For which the electric connection has been applied for or sanctioned for a single consumer.

2.51 'POINT OF COMMENCEMENT OF SUPPLY' means the outgoing terminals of the Licensee's cutouts fixed in the premises of the consumer in case of LT installations and the outgoing terminals of the Licensee's Metering cubicle placed before any consumer's apparatus in case of HT installations. In the absence of the any metering cubicle or the metering being on the LT side in case of HT installations, the point of commencement of supply will be the incoming terminals of the Consumer's main switchgear.

2.52 'RULES' means the India Electricity Rules, 1956 as in force from time to time.

2.53 'R.R.No' or Revenue Register Number' means the number assigned to the Consumer's installation.

2.54 'SANCTIONED LOAD' means the mutually agreed load in kilowatts (KW) / Horse power (HP) between the Licensee and the Low Tension Consumer as entered in the Agreement.

2.55 'SERVICE LINE' means any electric supply line through which energy is or is intended to be supplied by the Licensee from a distributing main to a single or group of Consumers from the same point of the distributing main.

2.56 'SERVICE MAIN' means the part of service line from terminal pole up to the point of commencement of supply whether overhead or underground.

2.57 'SUPERVISOR' means a person having a valid permit issued/ recognised by the Government of Karnataka under Rule-45 of IE 1956 but includes authorised employees of Central Government in case of works on Central Government installation in respect of which Rule-45 is exempted.

2.58 'SUPPLY ACT' means the Electricity (supply) Act, 1948 as in force from time to time.

2.59 'SUPPLIER' means any person who holds a power supply Licence under Section 19 of the KER Act 1999 or is granted exemption under Section 20 of the KER Act 1999.

2.60 'TARIFF' means a schedule of standard prices or charges for specified services which are applicable to all such specified services provided to the type of Consumers specified in the tariff approval.

2.61 'TRANSMISSION SYSTEM' means the system consisting mainly of extra high voltage electric lines having design voltage of 66 KV and higher and shall include all plant and equipment in connection with Transmission owned or controlled by the Licensee.

2.62 'Volt' means a unit of electromotive force and is the electric pressure which when steadily applied to a conductor, the resistance of which is one ohm will produce a current of one ampere.

2.63 'Voltage' means the difference of electric potential measured in volts between any conductors or between any part of either conductor and the earth as measured by a suitable voltmeter.

2.64 'Year' means year commencing on 1st of April of any year and ending on 31st of March of the succeeding year.

Note : The words or expressions occurring in this code but not defined herein above shall bear the same meaning as in the Karnataka Electricity Reform Act, 1999 or the Indian Electricity Act, 1910 or the Electricity (supply) Act, 1948 or in the I.E. Rules 1956 framed under the said Acts or in absence thereof, the meaning commonly understood in the electricity industry.

13.00 WIRING ON CONSUMER'S PREMISES AND MAINTENANCE

13.01 General Wiring Conditions

a) MAINS : The Consumer's mains shall in all cases be brought upto the Licensee's point of supply and sufficient cable shall be provided for Connecting up with the Licensee's apparatus.

b) SWITCHES AND FUSES : The Consumer shall provide linked quick break main switch and a single polefuse on each conductor except on the neutral Conductor which shall be fixed as near as possible to the Licensee's meter board Single pole switches controlling the lamps or fans or other apparatus shall be inserted in the phase wire and not on the neutral wire.

c) The Licensee's meter and mains cutouts shall be enclosed in a strong Teak wood box/ metal waterproof box suitably ventilated and provided with a hasp, staple and lock. All wires between which a difference of potential over 230 volts exists shall be made inaccessible to unauthorized persons or enclosed in an earthed metallic casing or conduit. A 'Caution' board printed in Kannada and Hindi/English shall be fixed therein.

d) EARTHING - Gas / water pipes shall on no account be used for earthing purposes. All wiring shall be kept as far as possible away from gas and water pipes.

e) DOMESTIC APPLIANCE : A special circuit solely or the use of domestic appliances, which will be approved by the Licensee, shall be run from the Licensee's point of supply. Wall plugs used on these circuits shall be fo the three-pin type, the third pin being an earth connection. Two pin plugs or lighting sockets shall not be allowed. All appliances used must be effectively earthed. The minimum size of earth wire permitted is No. 14 S.W.G. or 3.0 sq. mm.

Each equipment or apparatus installed shall have a nameplate indicating wattage.

f) PLUGS : Single pole switches controlling the plugs shall be inserted in the phase wire and not on the neutral wire.

g) WIRING : Single leads shall not be allowed to be run separately in iron conduit.

h) A.C. Motor Installations : Motors shall be provided with control gear fitted with a non-volt release and Triple pole fuses (overload release) so as to prevent satisfactorily the maximum starting current from the Consumer's installation exceeding the limits given in the following schedule at any time under all possible conditions. It is important that the releases shall be maintained in good working order. Failure to comply with this specification will render the Consumer's installation liable for disconnection from the supply on account of disturbance to the power supply to other Consumer.

Nature of Supply	Size of Installation	Limit of Maximum Current
Single phase	Upto and including 1 B.H.P.	Six times the full load current
Three phase	Above 1 B.H.P. & upto & including 10 B.H.P.	Three times the full load current.
	Above 10 B.H.P. & upto & including 15 B.H.P.	Twice the full load current
	Above 15 B.H.P.	One & half time the full load current

Each three phase motor circuit shall be protected by Moulded case current Breaker (MCCB). Wiring for motors shall be run with all three phase wires bunched in a single metallic conduit, which shall be efficiently earthed throughout and connected to the frame of the motor from which two separate earth wires of adequate size shall be run. The minimum size of the earth wire permitted is NO. 14 S.W.G. or 3.0 Sq. m.m. All motor wiring shall comply in every respect with the Indian Electricity Rules 1956 in force from time to time.

Motors above 1 B.H.P. shall be wound for 3 phases, 400 volts between phases.

Consumers intending to use non-standard apparatus, are advised to send to the Licensee full technical particulars of such apparatus before ordering it so that the Consumers can be informed about any special conditions that may be applicable to that type of apparatus, to enable it to be connected to the mains.

A) The L.T. Consumers shall provide current limiters of suitable capacity which must be erected with in one metre of the Licensee's meter board or in such other position shall be approved by the Licensee. No fuses shall be provided on the neutral conductor.

B) All AEH Consumers shall provide load limiter of required capacity for their installation, which shall be properly sealed. In addition to the load limiter the AEH Consumer shall provide suitable capacity earth leakage circuit breaker (ELCB).

C) Independent starters provided with over current and no volt devices shall be provided for motors as noted below :

- | | |
|---------------------------|---|
| 1. Upto & inclusive 5 HP | Direct online Starter |
| 2. Upto & inclusive 30 HP | Star-Delta starter / Auto transformer starter |
| 3. Above 30 HP | |
| a) Squirrel cage Motors | a) Auto Transformer Starter |
| b) Wound rotor motors | b) Rotor resistance starter. |

Note : However the Designated authority of the Licensee in special circumstances may relax the above requirements depending upon the location and conditions of the working of the installation by an order in writing.

D) In the case of H.T. Consumers, suitable protective devices approved by the Licensee shall be used so as to afford full protection to the Licensee's apparatus placed on the consumer's premises

14.0 HANDLING OF LICENSEE'S EQUIPMENT IN CONSUMER'S PREMISES

14.01 The meter, meter boards, service mains, main cutouts, load limiters etc., must on no account be handled or removed by any one who is not an authorised employee of the Licensee's apparatus, must on no account be broken. The responsibility for the safe custody of Licensee's equipments and seals on the meters/ metering equipments with in the Consumer's premises shall be on the Consumer.

14.02 In case of H.T. installations the Designated authority of the Licensee at his discretion may permit the Consumer on written request to operate Licensee's terminal switches, fuses or circuit breakers for the purpose of isolating the Consumer's apparatus in case of emergency. However the Consumer is solely responsible for any damage caused to life or property due to such operation.

14.03 All transformers, switchgear and other electrical equipment belonging to the Consumer and connected to the mains of the Licensee shall be maintained as per relevant IS.

14.04 In the event of any damage caused to the Licensee's equipments in the Consumer's premises by reason of any act, neglect or default of the Consumer or his employees the cost thereof as claimed by the Licensee shall be payable by the Consumer.

15.00 EXTENSIONS AND ALTERATIONS - L.T. INSTALLATIONS

15.01 Whenever a Consumer desires to change the machinery within the sanctioned load he shall intimate the details to the Licensee's Engineer with contractor's completion cum test report and licence of the local authority wherever required.

15.02 In case of LT installations provided with Electronic trivector meter and opted for Demand based Tariff, additional load may be connected to the installation subject to M.D. recorded being limited to the sanctioned load. However, the Consumer shall inform the Licensee the details of the additional machinery installed.

If the M.D. recorded in the electronic trivector meter exceeds the sanctioned load penal measures shall be applicable as per Section 42.01 (i)(a).

15.03 In all other cases, if the consumer desires to increase the number and capacity of connected machinery beyond sanctioned load he shall get the additional load sanctioned and furnish contractor's completion cum test report to the Licensee whose representatives will call and inspect the alterations and if necessary change the meters and fuses and alter the service line at the cost of the consumer. Failure to give notice to the Licensee shall render the installation liable for disconnection and action as per Section 42.01 (ii) and (iii).

15.04 The Consumer is not permitted to install additional machinery by providing alternate switch but can make use of the provisions under Section 15.02.

17.0 BALANCING OF LOAD

If the installation is required to be wired on three phases, wiring shall be done on group system separate neutral wires being brought back in each case to the Licensee's pint of supply. An approved type of a double pole linked switch shall control each main circuit. The lamps/fans or any other apparatus in the installation shall be so grouped that under normal working conditions the current in the three phases would be balanced and very little current will flow in the neutral wire and it shall not be more than 10% of the maximum phase current under full load conditions.

18.0 ACCESS TO CONSUMER'S PREMISES

18.01 Employees of the Licensee shall have access at all reasonable times to the premises of the Consumer for inspection, meter reading, testing and/or for any other purpose incidental to or connected with the proper maintenance of supply.

18.02 They shall have access to the premises at any time for inspection, if there is any reason to suspect breach of the provisions of the Act, the Rules, I.E. and Act and the supply Act, and this code.

18.03 They shall have access to the premises at any time for inspection, if there is any reason to suspect breach of the installation or any other legitimate act, the installation may be disconnected forthwith and may be kept disconnected till such time the Consumer affords necessary facilities for carrying out the inspection or testing.

19.0 PERIODICAL TESTING AND INSPECTION

19.01 The periodical inspection and testing of the Consumer's installation may be carried out by the Licensee or Electrical inspectorate in accordance with Rule 46 of the I.E. Rules 1956. The Charges for such inspection will be included in the power supply bill, following such inspection which shall be paid for by the Consumer.

19.02 Any defects observed during the inspection will be intimated to the Consumer and he shall get them rectified through a qualified Licensed electrical contractor within the time stipulated therein. The installation will be liable for disconnection if the defects are not rectified since the Consumer is responsible for any defects in the internal wiring.

20.0 DANGER DUE TO DEFECTS IN CONSUMER'S PREMISES

In the event of any danger due to defect being discovered in the Consumer's wiring or apparatus connected to the system or any section of the Consumer's circuit or apparatus the Consumer shall in the absence of the employees of the Licensee disconnect the same forthwith and notify the same to the Licensee and shall reconnect the same only with the consent of the Licensee and after the defects are rectified. The Licensee reserves the right to disconnect he installation should any defect come to this notice.

21.0 FAILURES OR VARIATION IN SUPPLY

In the event of failure or variation in the voltage / frequency of the supply the Consumer shall lodge a complaint with the jurisdictional service station / section office.

Such complaints will be attended to in the shortest possible time free of charges. If supply has failed due to defect in the Consumer's system, the Consumer shall be advised to rectify the defect. Keeping the installation disconnected if the situation so warrant. The installation will be reconnected after the rectification of the defect is duly certified by a qualified Licensee electrical contractor and reported to the Licensee.

The Licensee shall not be liable for any claims for loss or damage whatsoever arising out of failure or variation in supply. However, if the damage or loss occurred to the Consumer's equipment consequent to the proved lapses of the Licensee or his representatives, compensation may be awarded by the Commission.