

GENERAL SPECIFICATIONS FOR ELECTRICAL WORKS

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SPECIFICATIONS FOR ELECTRICAL WORKS IN GOVERNMENT BUILDING
SUBJECT TO THE GENERAL CONDITION OF CONTRACT IN FORCE
(1986)

GENERAL

1. Wiring Rules :

The installation generally shall be carried out in conformity with relevant Indian Standard Specifications and code of practices prevalent, Indian Electricity Rules, 1956 and Indian Electricity Act, 1910 as amended from time to time.

2. Definition :

The definition of terms shall be in accordance with Indian Standard code of Practice for Electrical wiring Installation IS- 732-2019 (Fourth Revision) except for the definition of point circuit and submain wiring which are defined in this specification

3. Voltage and Frequency of Supply :

All current consuming devices shall be suitable for frequency of 50 C/s and system of voltage meant for unless otherwise specified.

4. Layout of wiring and its description :

(i) The wiring shall be carried out as per Schedule "power" wiring must be in screwed conduit and shall be kept separate and distinct from lighting wiring. All wiring must be done on the distribution system with main and branch distribution boards at convenient centers and without isolated fuses. All conductors shall be run as far as possible along the walls and ceiling as to be easily accessible and capable of being thoroughly inspected. The balancing of circuits will be arranged before hand by the Ex. Engineer Electrical Division.

(ii) Within one month of the taking over the installation, the contractor shall supply to the Ex. Engineer, Elect. Division a complete set of wiring diagrams of the same on drawings to be supplied when available by the Executive Engineer, Electrical Division, and to the satisfaction of the Ex. Engineer, Elect. Dn, and these wiring plans shall be "Drawings" within the meaning of the term as used in the General Conditions of contract.

5. Conductors :

All conductors unless otherwise specified shall not be less than 1.5 Sq. mm for point wiring and 2.5 Sq. mm for mains Conductors for power and lighting circuits shall be of adequate size to carry the designed circuit load without exceeding the permissible thermal limits for the installation, and such sizes will be stipulated in specifications and or drawings.

6. Cables :

6.1 All cables shall conform to relevant Indian Standards.

6.2 Conductors of all cable except the flexible cable shall be of copper. The smallest copper conductors for the final circuit shall have nominal cross sectional area of not less than 4.0 Sq. mm. The minimum size of the copper conductors for power wiring shall be 4 sq. mm. unless otherwise not mentioned.

6.3.1 Conductors of flexible cables shall be of copper. The minimum cross sectional area of such a cables shall be 14.0193 mm. The flexible cable shall have uniform and adequate insulation.

6.3.2 Unless the flexible cables and conductors are protected by armour or though rubber or PVC Sheath, these shall not be used in workshops and other places where they are liable to mechanical damage.

6.3.3. Core flexible cables shall be used for connecting single phase Appliances for phase, neutral & earth connections.

7. Fall of Potential:

The cross sectional area of all conductors inside buildings shall be so proportioned to their lengths that the drop in voltage between main fuses and the farthest point or any lamp shall not exceed three percent of the voltage of the consumer's with all the consuming devices in use.

7.1 If the CABLE SIZE is increased to avoid the voltage drop in circuit current rating of the cable shall be more than that for which the circuit is designed. 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 for current higher than the full load current.

8. Ratings of lamps and fans socket outlets : Points and exhaust fans

- 8.1 LED lamps installed in residential and non-residential buildings shall be rated at 3 watt & 8 watt respectively.
- 8.2 Table fans and ceiling fans shall be rated at 60 watts, exhaust fan shall be rated according to their capacity.
- 8.3 5 Amp. socket outlet points and 15 Amp. sockets outlet points shall be rated at 100 watts and 1000 watts respectively for the purpose of load assessment unless actual values of the load are known or specified.

9. Tests :

- 9.1 Before the installation is commissioned following tests shall be carried out.

- (1) Insulation Resistance test
- (2) Polarity Tests of Switches
- (3) Earth continuity
- (4) Earth electrodes Resistance test

- 9.2.1.1 The insulation resistance shall be measured between earth and the whole system of conductors or any section thereof with all fuses in place and all switches closed, and except in earthed concentric wiring all lamps in position or both poles of the installation otherwise electrically connected together a direct current pressure of not less than twice the working pressure provided that it need not exceed 500 volts for medium voltage circuits where the supply is derived from the three wire a poly phase A.C. System, the neutral pole of which is connected to earth either direct or through added resistance, the working pressure shall be deemed to be that which is maintained between the phase conductor and the neutral.

- 9.2.1.2 The insulation resistance shall also be measured between all conductors to one pole or phase conductor of the supply and all the conductors connected to the neutral or to the other pole or phase conductors of the supply with all lamps in position and switches in 'OFF' position and its value shall be not less than in that specified in Sub-Clause 9.2.1.3.

- 9.2.1.3 The insulation resistance in Megohms measured as above shall not be less than 50 Megohms divided by the number of outlets or when PVC insulated cables are used for wiring 12.5 megohms number of outlets.

- 9.2.1.4 Where a whole installation is being tested, a lower value than that given by the formula, subject to a minimum of 1 megohm is acceptable.

- 9.2.1.5 A preliminary and similar test may be made before lamps, etc. are installed and in this event the insulation resistance to earth should be not less than 100 megohms divided by the number of outlets or when PVC insulated cables are used for wiring 25 megohms divided by number of outlets.

- 9.2.1.6 The term "Outlet" includes every switch except that a switch combined with a socket outlet, appliance or lighting fitting is regarded as one outlet.

- 9.2.1.7 Control rheostat heating and power appliance and electric sign may, if required, be disconnected from the circuit during the test, but in that event the insulation resistance between the case or frame work, and all live parts of each rheostat, appliance and sign, shall be not less than that specified in the relevant Indian Standard Specification or where there is no such specification shall be not less than half a megohm.

9.2.2 Polarity Test :

- 9.2.2.1 In a two wire installation a test shall be made to verify that all switches in every circuit have been fitted in the same conductor through out & such conductor shall be labelled or marked for connection to the phase conductor or to the non- earthed conductor of the supply.

- 9.2.2.2 In a three wire or a four wire installation a test shall be made to verify that every non-linked single pole switch is fitted in a conductor which is labelled or marked for connection to one of the phase conductor of the supply.
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9.2.2.3 The installation shall be connected to the supply for testing. The terminals of all switches shall be tested by a test lamp one lead of which is connected to the earth. lamp to its full brilliance, when the switch is in 'on' position irrespective of appliance in position or not shall indicate that the switch is connected to the right polarity.

9.2.3. Earth Continuity Test :

The earth continuity conductor including metal conduits and metallic envelops of cables in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earthing lead but excluding any added resistance or earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

9.2.3.1 Earth Electrode Resistance Test :

Earth electrode Resistance test may be carried out by Megger Earth Testers containing a direct reading ohm-meter, a hand driven generator and auxillary electrodes.

9.3 On completion of an electric installation (addition and alteration) a certificate shall be furnished by the contractor countersigned by the certified Supervisor under whose direction supervision the installation was carried out. This certificate shall be in the prescribed form as given in Appendix-'B' in addition to the test certificate required by Local Electrical Supply Authorities.

10. Joint and looping back :

Unless with the sanction of Ex. Engineer Electrical Divisions all joints in conductor shall be means of approved mechanical connectors in suitable and approved junction boxes but looping back system shall be preferable. In wiring unless otherwise specified Phase and live conduct shall be looped at the switch box where a neutral conductor can be looped from light, fan or socket. In non-residential buildings, neutral and earth continuity wire shall be brought to each of the switch boards should be of adequate size to accommodate at least one number of 5 Amps. socket outlet and control switch in future.

11. Switches :

Main Switchgears, Switch Board and their location :

11.1 All main switches (other than those of iron clad pattern) carrying current of 10 Amp. and above shall be fitted for back connections and shall be suitably protected.

11.2 All switches and circuit breakers shall be constructed in accordance with the I.S. 4237-1982. General requirement for switchgear and control gear for voltage not exceeding 1000 Volts and other relevant I.S. provided also that spring shall be either of phosphor bronze or if steel shall be copper or Nickel plated and that handle shall be so fastened that they do not tend to unscrew or become loose.

11.3 All main switches 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.

11.4 Switch boards shall not be erected above gas, stoves, or sinks as per CPWD advisor as per below.

11.5 Switch boards, if unavoidably fixed in places likely to be exposed to weather, to drip or to abnormal moist temperature the outlet casing shall be weather proof and shall be provided with glands or bushing of adopted to receive screwed conduit according to the manner in which cables are run. PVC and double flanged bushes shall be fitted in the holes of the switches for entry and exit of wires.

11.6 A switch board not be installed so that its Top is within 1.25 m above the floor unless the front of the switch board is completely enclosed by a door or the switch board is located in a position to which only authorised persons have access.

11.7 Switch boards shall be recessed in the wall if so specified in the schedule of work or in the special specification. The front shall be fitted with hinged panel of other suitable material such as bakelite in wood frame with locking arrangement, the outer surface of door being flush with the walls. Ample room shall be provided at the back for connections and at the front between the switchgear mountings and the door.

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- 11.8 Equipment's which are on the front of a switch board shall be so arranged that inadvertently personal contact with live parts is unlikely during the manipulation of switchgears, changing of fuses or like operations.
 - 11.9 No holes other than the holes by means of which the panel is fixed shall be drilled closer than 1.3 cms. from any edge of the panel.
 - 11.10 The various live parts, unless they are effectively screened by substantial barriers of non-hygroscopic, non-inflammable insulating material, shall be so spaced that space shall not be maintained between such parts and earth.
 - 11.11 The arrangement of gear shall be such that they shall be readily accessible and their connections to all instruments and apparatus shall also be traceable.
 - 11.12 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.
 - 11.13 No fuses other than fuses in instrument circuit shall be fixed on the back of or behind a switch board panel or frame.
 - 11.14 All the metal switchgears and switch boards shall be painted, prior to erection with one coat of antirust primer, After erection they shall be painted with two coats of approved enamel or aluminium paint as required on all sides wherever accessible.
 - 11.15 **All switch boards connected to medium voltage and above shall be provided with 'Danger Notice Plate' conforming to relevant Indian Standards.**

12. Control at Point of Commencement of Supply :

- 12.1 There shall be a linked main switchgear with fuse on each live conductor of the supply mains at the point of entry. The wiring through out the installation shall be such that there is no break in the neutral wire except in the form of a linked switchgear. The neutral shall also be distinctly marked. In this connection **Rule 32(2) of the Indian Electricity Rules, 1966 (See Appendix- 'A') shall also be referred.**
- 12.2 The main switchgear shall be situated as near as practicable to be termination of service line and shall be easily accessible without the use of any external aid.
- 12.3 On the main switchgear, where the 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.

13.0 Switch Board & Distribution Boards :

Metal clad switch gear shall preferably be mounted on any of the following types of Board.

13.1 Hinged type Metal Boards :

These shall consist of a box made of sheet metal not less than 2 mm thickness and shall be provided with a hinged type cover to enable the board to swing open for examination of the wiring at the back. The joints shall be welded. A teak wood board, thoroughly protected both inside and outside with good insulating varnish conforming to IS : 1347-1952 specification for varnish shellac, for General purpose, and of not less than 6.5 mm thickness, shall be provided at the back for attachment of incoming and outgoing cables. There shall be a clear distance of not less than 2.9 cm between the teak wood board and the cover, the distance being increased for larger boards in order that on closing of the cover, the insulation of the cables is not subjected to damage and no short length of cables is subjected to excessive twisting or bending in any case. The board shall be securely fixed to the wall by means of rag bolts, plugs or wooden Gutties and shall be provided with a locking arrangement and an earthing stud. All wires passing through the metal board shall be bunched. 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 switch-boards for mounting metal-clad switchgear connected to supply at low voltages.

13.2 Fixed type Metal Boards :

These shall consist of an angle or channel of iron frame fixed on the wall or on floor and supported on the wall at the top if necessary. There shall be a clear distance of one metre in front of the switch board. If there are attachments of base connections at the back of the switch board Rules 51(1) (c) of Indian Electricity Rules, 1956 shall apply.

Noten : Such type of boards are particularly suitable for large switchboard for mounting large number of switchgears or higher capacity metal clad switchgears or both.

13.3 Teakwood Boards :

For small installations connected to a single phase 230 volts supply teak wood boards may be used as main boards or sub-board. These shall be of seasoned teak or other durable wood with solid back impregnated with varnish of approved quality with all joints dovetailed.

13.4 In large size medium voltage installations, before proceeding with the actual construction of the boards, a proper drawing showing the detailed dimensions and design including the disposition of the mountings, which shall be symmetrically and neatly arranged for arriving at the overall dimensions, shall be prepared and approved by the Engineer-in-charge.

13.5 Recessing of Boards :

Where so specified the switch boards shall be recessed in the wall. The front shall be fitted with a hinged panel of teak wood or other suitable materials. such as bakelite, or with unbreakable glass doors in teak wood frame with locking arrangement, the other surface of the doors being flush with the walls. Ample room shall be provided at the back for connection and at the front between the switchgear mountings.

13.6 Arrangement of Apparatus :

- a) Equipment which is on the front of a switch board shall be so arranged that inadvertently personal contact with live parts is unlikely during the manipulation of switches, changing of fuses or like operation.
- b) No apparatus shall project beyond any edge of panel. No fuse body shall be mounted within 2.5 cm. of any edge of the panel and no hole other than holes by means of which the panel is fixed shall be drilled closer than 1.3 cms 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 instrument circuit shall be fixed on the back of or behind a switchboard panel or frame.

13.7 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.

Alternating Current

Three-phase-red,
Yellow, & blue,
Neutral-black

Direct Current

Three wire system-2 outer wires
Positive red & negative blue
Neutral-black

Where fuse-wire three phase wiring is done, the neutral shall be in one colour and the other three wires in another colour.

- b) Where a board has more than one switch each such switch shall be marked to indicate which section of the installation it controls.
- c) All markings required under the rule shall be clear permanent.

13.8 Main & Branch Distribution Board :

- 13.8.1 Main and branch distribution boards shall be of any type mentioned in 13.1
- 13.8.2 Main distribution boards shall be provided with a switch or air circuit breaker on each pole of each circuit, a fuse on the phase or live conductor and a link on the neutral or earthed conductor of each circuit. The switches shall always be linked.

13.8.3 Branch Distribution Board :

- 13.8.3.1 Branch distribution boards shall be provided with a fuse or a miniature circuit breaker or both the adequate rating- setting chosen 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. At least one spare circuit of the same capacity shall be provided on each branch distribution board.
- 13.8.3.2 In residential installations, lights and fans may be wired on a common circuit such sub circuit shall not have more than total of ten points of lights, fans and socket outlets. The load of such circuit shall be restricted to 800 watts. If a separate fan circuit is provided, the number of fans in the circuit shall not exceed ten. Power sub-circuits shall be designed according to the load but in no case shall there be more than two outlets on each sub-circuits.
- 13.8.3.3 In industrial and other similar installations requiring the use of group control of switching operation, circuits, for socket outlets may be kept separate from fans and lights. Normally fans and lights may be wired on a common circuit, however, if need is felt separate circuits may be provided for the two. **The load on any low voltage sub-circuit shall not exceed 3000 Watts. In case of new installation, all circuits and sub-circuits shall be designed by making provision of 20 per cent increase in load due to any future modification. Power sub- circuits shall be designed according to the load but in no case shall there be more than four outlets in each sub-circuits.**

13.9 Installation of Distribution Boards :

- 13.9.1 The distribution fuse-boards shall be located as near as possible to the center of the load they are intended to control.
- 13.9.2 These shall be fixed on suitable stanchion or wall and shall be accessible for replacement of fuses.
- 13.9.3 These shall be of either metal-clad type, or all insulated type. But, if exposed to weather or damp situations, they shall be of the weather proof type and, if installed where exposed to explosive dust, vapour or gas, they shall be of flame proof type.
- 13.9.4 Where two or more distribution fuse boards feed low voltage these distribution boards shall be :
- (1) Fixed not less than 2 m apart or,
 - (2) Arranged so that it is not possible to open two at a time, namely they are interlocked and the metal case is marked 'Danger 415 Volts', or
 - (3) Installed in a room or enclosure accessible to only authorised persons.
- 13.9.5 All distribution boards shall be marked 'Lighting', 'Power', as the case may be and also marked with the voltage and number of phases of the supply. Each 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.
- 13.9.6 Triple pole distribution boards shall not be generally used for final circuit distribution unless specific approval of Engineer-in-charge is obtained. In special cases where use of Triple pole distribution boards are inevitable they shall be of H.R.C. fuse type only.

13.10 Wiring and Distribution Board :

- 13.10.1 In wiring a branch board, total load of the consuming devices shall be divided, as far as possible, evenly between the number of ways of the boards leaving the spare circuit for future extension.
- 13.10.2 All connections between pieces of apparatus or between apparatus and terminals on a board shall be neatly arranged in a definite sequence following the arrangement of the apparatus mounted thereon, avoiding unnecessary crossing.
- 13.10.3 Cables shall be connected to a terminal only by soldered or welded or crimped lugs using suitable sleeve, lugs or ferrules unless the terminal is of such a form that it is possible to securely clamp them without the cutting away of cable strands.
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- 13.10.4 All bare conductor shall be rigidly fixed in such a manner that a clearance of atleast 2.5 cms. is maintained between conductor of opposite polarity or phase and between the conductors and any material other than insulating material.
- 13.10.5 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.
- 13.10.6 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 switch board 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°

14.0 Capacity of Circuits :

- 14.1 Lights and fans may be issued on a common circuits and such a circuit shall not have more than a total of ten points of lights, fan and socket outlets, or a load of 800 watts whichever is less. **The power circuits shall be designed with a maximum of two outlets per circuits generally when load is not known or specified. In non-residential buildings at important District centers however one outlet per circuit may be preferred. The circuit shall be designed based on the loading of the circuit where not specified the load shall be taken as 1 KW per outlet, Where the load is more than 1 KW it should be controlled by a isolater switch or miniature circuit breaker.**

15.0 Passing Through Walls and Floors :

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

- (a) A teak wood 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 cms air space on three sides, of the casing conductor.
- (b) The conductor shall be carried either in a rigid steel conduit conforming to *IS : 1653-1964 specification for Rigid Steel conduits of Electrical wiring (Revised) or a rigid non-metallic conduit conforming to *IS : 2509-1963 specification for Rigid Non-Metallic conduits for Electrical Installations, or in a porcelain tube of such size which permits easy drawing in. The end of conduit shall be neatly bushed with porcelain, wood or other approved material.
- (c) **Insulated conductors while passing through floors shall be protected from mechanical injury by means of rigid steel conduit (see *IS 1653-1964) 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.**

- 15.2 Where a wall tube passes outside a building so as to be exposed to weather, the outer end shall be belt mounted and turned down wards, and properly bushed on the open end.

16.0 Fixing to Walls and Ceilings :

Plugs for ordinary walls or ceilings shall be of well seasoned teak or other approved hardwood not less than 5 cm long 2.5 cm. square on the inner end and 2 cm. square on the outer end. They shall be cemented into walls to within 7.5 mm of the surface, the remaining being finished according to the nature of the surface with plaster or lime punning.

- 16.1 Where owing to irregular crossing or other reasons the plugging of the walls or ceiling with wood plugs presents difficulties, the wood casing, wood batten, metal conduit, or cleat (as the case may be) shall be attached to the wall or ceiling in an approved manner. In the case of new building, wherever possible teak wood plugs shall be fixed in the walls before they are plastered.

- 16.2 To achieve neatness, plugging of walls or ceiling may be done by an approved type of asbestos, metallic or a fiber fixing plug.
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17.0 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 knob is down.

18.0 Fittings :

Where conductors are required to be threaded through tubes or channels formed in the metal work of fittings these must be free from sharp angles or projecting edges and such size that will enable them to be wired with the conductors used for the final sub Circuits without removing the boarding, taping or outer covering. As far as possible, all tubes and channels should be of sufficient size to permit 'Looping back' of wires cables and flexible cords other than those designed for high temperature shall not be used for wiring fittings except for portable fittings. All fittings must have not less than a half inch male nipple. Fittings and lamp holders for gas filled lamps shall be adequately ventilated.

18.1 Where light fitting is supported by one or more flexible cords, the maximum weight to which the twin flexible cords may be subjected shall be as follows :

Nominal cross sectional Area cord. mm ²	No. & Dia in mm of wires.	Max. Permissible weight Kg.
0.5	16/0.2	1.7
0.75	24/0.2	2.6
1.5	32/0.2	3.5
2.5	48/0.2	5.3
3.5	80/0.2	8.8
4	128/0.2	14.0

18.2 No inflammable shade shall form a part of light fitting unless such shade is well protected against all risks of fire. Celluloid shade or light fitting shall not be used under any circumstances.**18.3 Fitting of Wire :**

The use of fitting wire shall be restricted to the internal wiring and the lighting fittings. Where fitting wire is used for wiring, for the sub-circuit loads shall be terminated in a ceiling zone or connector from which they shall be carried into the fittings.

19.0 Lamp Holders :

Lamp holders may be batten, angle, pendant or bracket holder type as required. The holder shall be made of brass and required enough to maintain shape on application of nominal external pressure.

20.0 Outdoor Lamps :

External and road lamps shall have weather proof fittings of approved design so as to effectively prevent the admission of moisture. An insulating distance piece of moisture proof materials shall be inserted in the fittings. Flexible cord and cord grip lamp holders shall not be used where exposed to weather. In verandahs and similar exposed situations where pendants are used, they shall be of fixed rod type.

21.0 Lamps :

All led lamps, unless otherwise required and suitably protected, shall be hung at a height of not less than 2.5 m above the floor level. They shall be in accordance with IS : 418 : 1957 specification for Tungsten Filament General Service electric lamps/ LED Lamp.

22.0 Fans, Regulators and Clamps :**22.1.0 Ceiling fans :**

Ceiling fans including their suspension shall conform to *IS 374-2019(4th revision) or revised standard specification for electric ceiling fans and regulators (Revised) & to the following requirements :

- (a) All ceiling fans shall be wired to ceiling roses or to special connector boxes, to which fans rod wires shall be connected and suspended from hooks or shackles with insulators between hooks and suspension rods. There shall be no joint in the suspension rod, but if joints be avoidable then such joints shall be screwed to special couplers of 5 cm minimum length and both ends of pipes shall touch together within couplers, and shall in addition be secured by means of split pins; alternatively, the two pipes may be welded.
- (b) Fans clamps shall be of suitable design according to the nature of construction of ceiling on which these clamps are fitted. In all cases fan clamps shall be fabricated from tested new metal of suitable sizes and they shall be as close fitting as possible. Fan clamps for reinforced concrete roots shall be buried with the casting and due care shall be taken that they shall serve the purpose. Fan clamps for wood beams shall be of suitable flat iron fixed on two sides of the beam and according to the size and section of the beam one or two mild steel bolts passing through the beam shall hold both flat irons together. Fan clamps for steel joint shall be fabricated from tested flat iron to fit in rigidly to the bottom flange of the beam. Care shall be taken during fabrication that the metal does not crack while hammering to shape. Other fan clamps shall be made to suit the position, but in all cases care shall be taken to see that they are rigid and safe. Energy efficient fans with BEE star rating or complying with IS 374:1979, shall be used. The min. service value of fans shall be 4 x 10 CMM/min/wand air delivers 210m³ /min.

Note : All fan clamps shall be so fabricated that fans revolve steadily.

- (c) Canopies on top and bottom of suspension rod shall effectively hide suspensions and connections to fan motors, respectively.
- (d) The lead-in-wire shall be of nominal cross-sectional area not less than 1.0 mm² with copper and 1.5 mm² with aluminum and shall be protected from abrasion.
- (e) Unless otherwise specified, the clear distance between the ceiling fan and the floor shall be hung 2.75m above the floor. The height of ceiling fan shall not be more than 3.0mtr.

22.2.0 Exhaust Fans :

For fixing of an exhaust fan, a circular hole shall be provided in the wall to suit the size of the frame which shall be fixed by means of rag-bolts embedded in the wall. The hole shall be neatly plastered with cement and brought to the original finish of the wall. The exhaust fan shall be connected to exhaust fan point which shall be wired as neat to the hole as possible by means of a flexible, cord, care being taken that the blades rotate in the proper direction. For alluminium or teak wood ventilation. Civil agency has to keep except provision of space considering size of black grill and fixing hole on frame.

23.0 Attachment of fittings and accessories :

23.1 In other than conduit wiring, all ceiling crosses, brackets, pendants and accessories attached to walls or ceilings shall be mounted on substantial teak wood block twice Varnished after all fixing holes are made in them. Blocks shall be not less than 4 cms. deep, Brass screws only shall be used for attaching fittings and accessories to their base blocks.

24.0 Interchangeability :

Similar part of all switches, lamp holders, distribution fuse- boards ceiling roses, brackets, pendants, fans and all other fittings of the same type shall be interchangeable in each installation.

25.0 Conduit Wiring System :

25.1.1 Type and size of conduit - All conduit pipes shall be conforming to *IS : 1653-1964, furnished with galvanised 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. No steel conduit less than 16 mm in diameter shall be used. The number of insulated conductors that can be drawn into rigid steel conduit are given in Table II.

25.1.2 Bunching of cables - Unless otherwise specified, insulated conductors of AC supply and DC supply shall be bunched in separate conduits.

25.1.3 Conduit-joints-Conduit pipes shall be joined by means of screwed couplers and screwed accessories only (*IS : 2667-1964).

Specification for Fittings for Rigid Steel Conduits for Electrical Wiring). In long distance strance straight runs of conduit, inspection type couplers at reasonable intervals shall be provided or running threads with couplers and jam-puts (in the latter case the bare threaded portion shall be treated with anti-corrosive preservative) shall be provided. Thread on conduit pipes in all cases shall be between 11 mm to 27 mm 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 or buries left to avoid damage to the insulation of conductors while puling them through such pipes;

TABLE-II MAXIMUM PERMISSIBLE NUMBER OF 250-V
GRADE SINGLE CORE CABLES THAT CAN BE DRAWN INTO
RIGID STEEL CONDUIT
(CLAUSE 6.5.1.1)

Size of cable		Size of conduit (mm)													
Nominal	Number	16	:	20	:	25	:	32	:	40	:	50	:	60	:
Crosssectional	and	(No. of cable Max)													
	Diameter in	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	mm of wires														
		S	B	S	B	S	B	S	B	S	B	S	B	S	B
1.0	1/1.12	5	4	7	5	13	10	20	14	—	—	—	—	—	—
1.5	1/1.40	4	3	7	5	12	10	20	14	—	—	—	—	—	—
2.5	1/1.80	3	2	6	5	10	8	18	12	—	—	—	—	—	—
4	1/1.24	3	2	4	3	7	6	12	10	—	—	—	—	—	—
	(3/1.06*)														
	(7/0.85)														
6	1/2.80	2	—	3	2	6	5	10	8						
	7/1.06*)														
10	1/3.55+	—	—	2	—	5	4	8	7	—	—	—	—	—	—
	7/1.40*	—	—	2	—	4	3	6	5	8	6	—	—	—	—
16	7/1.70	—	—	—	—	2	—	4	3	7	6	—	—	—	—
25	7/2.24	—	—	—	—	—	—	2	—	4	3	7	6	9	7
35	7/2.50	—	—	—	—	—	—	—	—	2	—	5	4	6	5
50	7/3.00+	—	—	—	—	—	—	—	—	2	—	5	4	6	5

* For Cu. Conductors only.

+ For Al. Conductors only.

NOTE : 1. The cable shows the maximum capacity of conduits for the simultaneous drawing-in of cables. The table applies to 250 volts grade cable. The columns headed 'S' apply to runs of conduit which have distance not exceeding 4.25 M between draw in boxes, and which do not deflect from the straight by angle of more than 150. The columns headed 'B' apply to runs of conduit which deflect from the straight by an angle of more than 150.

NOTE : 2. In case of inspection type draw-in box has been provided and if the cables is first drawn through one straight conduit, then through the drawn box, and then through the second straight conduit, such systems may be consid-ered as that of a straight conduit even if the conduit deflects through the straight by more than 150.

25.1.4 **Protection against dampness** - In order to minimize condensation or seating 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.

-
- 25.1.5 **Protection of conduit against rust** - The outer surface of the conduit pipes, including all bends, unions, tees junction boxes, etc., forming part of the conduit system shall be adequately protected against rust particularly when such system is exposed to weather. In all cases, no bare threaded portion of conduit pipe shall be allowed unless such bare threaded portion is treated with anti-corrosive preservative or covered with approved plastic compound.
- 25.1.6 **Fixing of conduit** - Conduit pipes shall be fixed by heavy gauge saddles, secured to suitable wood plugs or any other approved plug with screws in an approved manner at an interval of not more than one meter but on either side of couplers or bends or similar fittings, saddles shall be fixed at a distance of 30 cm. from the center of such fittings.
- 25.1.7 **Bends in conduit** - All necessary bends in the system including diversion shall be done by bending pipes, or by inserting suitable solid or inspection type normal bends, elbows or similar fittings; or by fixing cast iron inspection boxes whichever is more suitable. Conduit fitting shall be avoided as far as possible. On conduit system exposed to weather, where necessary, solid type fitting shall be used. Radius of such bends in conduit pipes shall be not less than 7.5 cm. No length of conduit shall have more than the equivalent of four quarter bends from outlet, the bends at the outlets not being counted.
- 25.1.8 **Outlets** - All outlets for fitting switches etc., shall be boxes, of suitable metal or any other approved outlet boxes for other surface mounting or flush mounting system.
- 25.1.9 **Conductors** - All conductors used in conduits wirings shall preferably be stranded. No single -core cable or nominal Cross-sectional area greater than 130 mm² shall be enclosed in a conduit and used for alternating current.
- 25.1.10 **Erection and earthing of conduit** - The conduit of each circuit or section shall be completed before conductors are drawn in. The entire system of conduit and permanently connected to earth conforming to the requirements specified under pipe in a workman like manner for a perfect continuity between each wire and conduit. Gas or water pipes shall not be used as earth medium. If conduit pipes are liable to mechanical damage, they shall be adequately protected.
- 25.2 **Recessed Conduit wiring system with Rigid Steel conduits** - Recessed conduit wiring system shall comply with all the requirements for surface conduit wiring system specified in 6.5.1.1 to 6.5.1.10 and in addition, conform to the requirements specified in 6.5.2.1 to 6.5.2.4.
- 25.2.1 **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.
- 25.2.2 **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.
- 25.2.3 **Inspection boxes** - Suitable inspection boxes shall be provided to permit periodical inspection and to facilitate removal of wires, if necessary. These shall be mounted flush with the wall Suitable ventilating holes shall be provided in the inspection box covers.
- 25.2.4 **Type of accessories to be used** - All outlets such as switches and wall sockets, may be either or flush mounting type or surface mounting type.
- (a) **Flush mounting type** - All flush mounting outlets shall be of cast iron mild steel boxes with a cover of approved insulating material or shall be a box made of a suitable insulating material. The switches and other outlets shall be mounted on such boxes as would be approved. The metal box shall be efficiently earthed with conduit by an approved means of earth attachment.
- (b) **Surface mounting type** - If surface mounting type outlet box is specified, it shall be of any approved insulating material and outlet mounted in an approved manner.
- 25.2.5 When crossing through expansion joints in buildings, the conduit sections across the joint may be through flexible conduits of the same size as the rigid conduit.
-

25.3 Conduit Wiring System with Rigid Non-Metallic Conduits :

Rigid Non-Metallic conduits are used for surface, recessed and concealed conduit wiring.

25.3.1 Type and size - All non-metallic conduits used shall conform to IS : 2509-1963 and shall be used with the corresponding accessories (See IS : 3419-1965) specification for Fittings for Rigid Non-Metallic Conduits).

25.3.2 Bunching off cables - Conductors of AC supply and DC supply shall be bunched in separate conduits. The number of insulated cables that may be drawn into the conduits are given in Table III. In this table space factor does not exceed 40 percent.

TABLE-III MAXIMUM PERMISSIBLE NUMBER OF 250 VOLTS GRADE SINGLE- CORE CABLE THAT MAY BE DRAWN INTO RIGID NON-METALLIC CONDUITS

Size of cable Nominal Crossectional area. mm ²	No. Diameter in mm of wires	Size of conduit (mm)					
		16	20	25	32	40	50
		(No. of cable Max)					
1.0	1/1.12*	5	7	13	20	–	–
1.5	1/1.40	4	6	10	14	–	–
2.5	1/1.80	3	5	10	14	–	–
	3/1.06*						
4	1/1.24	2	3	6	10	14	–
	7/0.85*						
6	1/2.80	–	2	5	8	11	–
	7/1.06*						
10	1/3.55+	–	–	4	7	9	–
	7/1.40*–						
16	7/1.70	–	–	2	4	5	15
25	7/2.24	–	–	–	2	2	6
35	7/2.50	–	–	–	–	2	5
50	7/3.00+	–	–	–	–	2	3
	19/1.80						

* For Cu. Conductors only.

+ For Al. Conductors only.

25.3.3 Conduit joints - shall be joined by means of screwed or plain couplers depending on wheather the conduits are screwed or plain. Where there are long runs of straight conduit. Inspection type couplers shall be provided at intervals. For conduit fittings and accessories reference may be made to IS : 3419-1965.

25.3.4 Fixing of conduits - The provision of 25.1.6 shall apply except that the spacing between saddles or supports is recommended to be 60 cms for rigid non-metallic conduits.

25.3.5 Bends in conduit - Wherever necessary, bends or diversions may be achieved by bending the conduits (See 6.5.3.9) or by employing normal bends, inspection bends, inspection boxes, elbows or similar fittings.

25.3.6 Conduit fittings shall be avoided, as far as possible on outdoor system.

25.3.7 Outlets - All the outlets for fittings, switches, etc.. shall be boxes of substantial construction. In order to minise condensation or sweting inside the conduit, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects, etc. as far as possible.

25.3.8 For use with recessed conduit wiring system the provisions of 6.5.2.1 to 6.5.2.4 shall apply.

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

PVC INSULATED AND P.V.C. SHEATHED OR T.R.S. WIRING SYSTEM

26.0 GENERAL :

This system of wiring, is suitable for low pressure installation, and shall not be used in places exposed to sun and rain nor in damp places, provided they are sheathed in the special approved protective covering and well protected to withstand dampness.

26.1 Attachment to walls and ceiling :

- 26.1.1 All cables on brick walls, stone or plastered walls and ceiling shall be run on well seasoned, perfectly straight and well seasoned, perfectly straight and well varnished on four sides, teak wood or any approved hardwood battens not less than 10 mm finished thick, width of which shall be such as to suit total width of cables laid on the batten, prior to election, these shall be painted with one coat of varnish or approved paint of colour to match with surrounding. These battens shall be secured to wall and ceilings by flat head wood screws to rows plug or phill plug at an interval not exceeding 75 cm. Wood plug can be used only with special approval of the Engineer-in-charge. The flat head wood screws shall be counter within wood batten and smoothed down with file.

- 26.1.2 Where wiring is to be carried out along the face of the rolled steel joints a wooden batten of adequate width shall first be laid on the same and dipped to it as in conspicuously as possible. The wiring should then be fixed to this backing shall be suitably bushed to prevent the abrasion of the cables.

- 26.1.3 Attachment to false ceiling : **In no case, the open wiring shall be run above the false ceiling without the approval of Engineer-in-charge.**

- 26.20 **Link dips :** Only aluminium alloy clips/joint clips shall be used. The thickness shall be 0.32 mm (30 SWG) for lengths of 25 mm to 40 mm and 40 mm (28 SWG) for lengths of 50 mm to 80 mm. The width shall not be less than 8 mm in all these cases. Link clips/joint clips shall be so arranged that one single clip shall not hold more than two core or three single core TRS of PVC insulated and PVC sheathed upto 2.5 sq. mm above while a single clip shall hold a single twin core or two single core cables. The clips shall be fixed on varnished wood batten with iron pins and space at interval of 15 cm both in the case of horizontal and vertical runs.

- 26.3.0 **Bends in wiring :** The wiring shall not in circumstances be bent so as to form an abrupt right angle but must be rounded off at the corners to a radius not less than six times the overall diameter of the cable.

26.4.0 Protection of wiring from Mechanical Damage :

- 26.4.1 In cases where there are chances of any damage to wiring, such wiring shall be drawn complying with all the requirements of conduit wiring system.

- 26.4.2 Such protective covering shall in all cases be fitted on all down drops within 1.5 m from the floor, or from floor level upto the switch board whichever is less.

- 26.5.0 **Passing through floors :** All cables taken through floor shall be enclosed in heavy gauge steel conduit extending 1.5 m above the floor or upto the switch board whichever is less and flush with the ceiling below or by means of any approved type of metallic covering. The ends of all conduits or pipes shall be neatly bushed with porcelain wood or other approved material. The conduit pipes, shall be security earthed.

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

-
- (a) A box of teak wood or approved hard wood extending through the hole thickness of the wall shall be buried in the wall and casings or conductors and casing or conductors shall be carried so as to allow 1.3 cm air space on the three sides of the casing or conductor.
 - (b) The conductors shall be carried in an approved heavy gauge solid drawn or lap weld conduit or in a porcelain tube of such a size that it permits easy drawing in, the ends of conduit shall be neatly bushed with porcelain, wood or other approved material.
- 26.6.1** Where a wall tube passes outside a building so as to be exposed to weather, the outer end shall be mounted and turned downwards and properly bushed on the open end. **The conduit shall be neatly arranged so that the cables enter them without bending.**
- 26.7.0 Buried cables :** The TRS or PVC sheathed cable shall not normally be buried directly in plaster. Where so specified in the special specification they may be taken in teak wood channeling of ample capacity or conduit pipe buried in the wall.
- 26.8.0 Stripping of outer covering.** While cutting and stripping of the outer covering of the cable care shall be taken that the sharp edge of the cutting instrument does not touch the inner insulation of the conductors. The protective outer covering of the cables shall be stripped off near connecting terminal and this protective covering shall be maintained upto the close proximity of connecting terminals as far as practicable. Care shall be taken to avoid hammering on link clips with any metal instrument after the cables are laid. Where junction boxes are provided they shall be made moisture proof with a plastic compound.
- 27.0 PAINTING WORK IN GENERAL :**
- 27.1 Paints :** paints, oils varnishes, etc, of approved make in original to the satisfaction of the Engineer-in- charge shall only be used.
- 27.2 Preparation of surface :** The surface shall be thoroughly cleaned and dusted before painting is started. The proposed surface shall be inspected by Engineer-in-charge or his authorised agent and shall have received the approval before painting is commenced.
- 27.3 Application :** Paint shall be applied with brush. The paint shall be spread as smooth & even as possible. Particular care shall be paid to revets, nuts, bolts and cover lapping. Before drawing cut, it shall be continuously stirred in the smaller containers with a smooth stick while it is being applied. Each coat shall be allowed to dry out sufficiently before a subsequent coat is applied.
- 27.4 Scope :** Painting on old surface in indoor situations will not include primer coat except where specially mentioned in the schedule of work or special specification. However, where rust has formed on iron and steel surfaces the spots will be painted with one anti-rust primer coat.
- 27.5 Precautions :** All furniture fixtures. glazing floors, etc, shall be protected by covering. All stains, smears, plashing, dropping of every kind shall be removed. While painting of wiring etc. it shall be ensured that painting of wall ceiling etc. is not spoiled in any way.
- 27.6 Painting of conduit and accessories :** After installation surface of conduit pipes, fittings switch and regulator boxes, etc. shall be painted with two coats of approved enamel paint or aluminium paint as required to match the finish of surrounding wall, trussed etc.
- 28. link clip :**
- The clip for batten wiring shall be of Aluminium conforming to I.S. specification No. 2415-1975.
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APPENDIX - 'A'

Important Clauses of Indian Electricity Rules, 1956. Following clauses of Indian Electricity Rules, 1956 shall in particular be taken care of in the execution of electrical works

Clause No	Subject
3.	Authorization :
29.	Construction, installation, protection, operation and maintenance of electric supply lines and apparatuses.
31.	Cut-out on consumer's premises.
32.	Identification of earthed and earthed neutral conductors and position of switches and cutouts therein.
33.	Earthed terminal on consumer's premises.
34.	Handling of electric supply lines and apparatus.
41.	Distinction of circuits of different voltages.
42.	Accidental charge.
43.	Provisions applicable to protective equipment.
44.	Instructions for restoration of persons suffering from electric shock.
45.	Precautions to be adopted by consumers, owners, electrical contractors, Electrical workmen and suppliers.
46.	Periodical inspection and testing of consumer's installation.
48.	Precautions against leakage before connection.
50.	Supply to consumers.
51.	Provisions applicable to medium, high voltage installations.
58.	Point of commencement of supply.
59.	Precautions against failure of supply; Notice of failures.
61.	Connection with earth, (low and Medium Voltage system).
64.	Use of energy at high and extra-high voltage system.
67.	Connection with earth. (High & Extra-high voltage system).
68.	General conditions as to transformation and control of energy.
All clauses under Chapter VIII on Overhead Lines.	
137.	Mode of entry.
138.	Penalty for breaking seal.
139.	Penalty for breach of rule 45.
140.	Penalty for breach of rule 82.
141.	Penalty for breach of rules.

APPENDIX - 'B'

Form of 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 Indian Electricity Rules, 1956, as well as the C.P.W.D. General Specification for Electrical Works, 1972.**

Electrical Installation at Voltage and system of supply

(1) Particulars of works :

- | | | |
|--------------------------------------|---------------------------|----------------|
| (a) Internal Electrical Installation | No. Total Load of wiring. | Type or system |
| (i) Light point | | |
| (ii) Fan point | | |
| (iii) Plug point | | |
| (a) 3 pin 5 Amp. | | |
| (b) 3 pin 15 Amp. | | |

(b) Others :

Description HP/KW

(a) Motors : (i)

(ii)

@ X1 = (iii)

(c) Other Plants :

(d) If the work involves installation of over head line/or under ground cable :

- | | | | |
|-----|-------|--|---------------------------------|
| (a) | (i) | Type & Description of overhead line. | |
| | (ii) | Total length & No. of spans. | |
| | (iii) | No. of street light & its description | |
| (b) | (i) | Total length of under ground cable & its size. | (ii) No. of joint. |
| | | End joint : | Tee joint : St. through joint : |

(2) Earthing :

- (i) Description of earthing electrode :
 (ii) No. of earth electrodes :
 (iii) Size of main earth lead :

(3) Test Results :

- | | | |
|-----|---|----------|
| (a) | Insulation Resistance : | |
| | (i) Insulation resistance of the whole system of conductors to earth. | Megohms. |
| | (ii) Insulation resistance between the phase conductors and neutral. | Megohms. |
| | Between phase R and neutral | Megohms. |
| | Between phase Y and neutral | Megohms. |
| | Between phase B and neutral | Megohms. |
| | (iii) Insulation resistance between the phase conductors in case of polyphase supply. | |
| | Between phase R & phase Y | Megohms. |
| | Between phase Y & phase B | Megohms. |
| | Between phase B & phase R | Megohms. |
| (b) | Polarity Test : Polarity of non linked single pole branch switches. | |
| (c) | Earth continuity Test : Maximum resistance between any point in the earth continuity conductor including metal conduits & main earthing lead. | |
| d) | Earth Electrode Resistance : Resistance of each electrode. | |
| | i) ohms | ii) ohms |
| | iii) ohms iv) | ohms |
| e) | Lighting Protective System : | |
| | Resistance of the whole of lighting-protective system to earth before any bonding is effected with electrode and metal in/on the structure. | |

ohm

Signature of Supervisor
Name & Address

Nominated Supervisor by
Electrical Agency

Nominated Electrical
Agency by civil agency

Signature of Contractor
Name & Address

SPECIFICATIONS

All Specification, standard. publication etc. specified mean the latest standards, publication etc. pertaining to Electrical Installation and should conform to the following wherever applicable.

VARIOUS CODES FOR ELECTRICAL WORKS

- | | | |
|-----|---|------------------|
| A. | APPLICABLE IS STANDARDS | |
| 1. | METERS (MEASURING) FOR ANALOG METERS | IS:1248-1986 |
| 2. | INSTALLATION AND MAINTENANCE OF SWITCH GEARS | IS:3072-1975 |
| 3. | CODE OF PRACTICE FOR EARTHING | IS:3043 |
| 4. | H.D. AIR BREAKER, SWITCH GEARS AND FUSES FOR
VOLTAGE NOT EXCEEDING 1000 VOLTS | IS:4047-1977 |
| 5. | SELECTION, INSTALLATION AND MAINTENANCE OF FUSES
UP TO 650 VOLTS | IS:8106-1966 |
| 6. | GENERAL REQUIREMENTS FOR SWITCH GEAR AND
GEAR FOR VOLTAGE NOT EXCEEDING 1000 VOLTS | IS:4237-1967 |
| 7. | DEGREE OF PROTECTION PROVIDED BY ENCLOSURES FOR LV S/GEARS | IS:2147-1962 |
| 8. | INSULATED CONDUCTOR RATING | IS:8084-1972 |
| 9. | ENCLOSED DISTRIBUTION FUSE BOARDS AND CUT-OUTS
FOR VOLTAGE NOT EXCEEDING 1000 VOLTS | IS:2675-1983 |
| 10. | MINIATURE CIRCUIT BREAKER | IS:8828-1978 |
| 11. | FUSE WIRE USED IN RE-WEARABLE TYPE ELECTRIC FUSES
UP TO 650 VOLTS | IS:9926-1981 |
| 12. | PVC INSULATED ELECTRIC CABLES HEAVY DUTY | IS:1554 (PART I) |
| 13. | RECOMMENDED CURRENT RATING FOR CABLES | IS:3961(PART II) |
| 14. | COPPER CONDUCTOR IN INSULATED CABLES AND CORES | IS:2982 |
| 15. | CONDUCTOR FOR INSULATED ELECTRIC CABLES AND FLEXIBLE CORDS | IS:8130 |
| 16. | MILD STEEL WIRES, STRIPS AND TAPES FOR ARMOURING CABLES | IS:3975 |
| 17. | PVC INSULATION AND SHEATH OF ELECTRIC CABLES | IS:5831 |
| 18. | ALUMINIUM CONDUCTOR FOR INSULATED CABLES | IS:1753 |
| 19. | PVC INSULATED AND PVC SHEATHED SOLID ALUMINIUM CONDUCTOR
CABLES OF VOLTAGE RATING NOT EXCEEDING 1100 VOLTS | IS:4288 |
| 20. | RECOMMENDED CURRENT RATING FOR CABLE | IS: 961 |
| 21. | CODE OF PRACTICE FOR ELECTRICAL WIRING INSTALLATION SYSTEM
VOLTAGE NOT EXCEEDING 650 VOLTS | IS: 732 |
| 22. | CODE OF PRACTICE FOR FIRE SAFETY OF BUILDINGS
GENERAL)ELECTRICAL INSTALLATION | IS: 1646 |
| 23. | RIGID STEEL CONDUITS FOR ELECTRICAL WIRING | IS:1653 |
| 24. | FITTINGS FOR RIGID STEEL CONDUITS FOR ELECTRICAL WIRING | IS:2667 |
| 25. | FLEXIBLE STEEL CONDUIT FOR ELECTRICAL WIRING | IS:3480 |
| 26. | ACCESSORIES FOR RIGID STEEL CONDUITS FOR ELECTRICAL WIRING | IS:3837 |
| 27. | PVC INSULATED CABLES (WIRES) | IS:694 |
| 28. | RIGID NON-METALLIC CONDUITS FOR ELECTRICAL WIRING | IS:2509 |
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29.	FLEXIBLE (PLAYABLE) NON-METALLIC CONDUITS FOR ELECTRICAL INSTALLATION	IS:6946
30.	THREE PIN PLUGS AND SOCKETS	IS:1293
31.	CONDUCTORS FOR INSULATED ELECTRICAL CABLES AND FLEXIBLE CODES	IS:8180
32.	SPECIFICATION FOR CONDUIT FOR ELECTRICAL INSTALLATION	IS:9537-1980
33.	ACCESSORIES FOR NON-METALLIC CONDUITS FOR ELECTRICAL WIRING	IS:3419
34.	SWITCHES	IS:3854
35.	PLUGS	IS:6538
36.	SHUNT CAPACITORS FOR POWER SYSTEMS	IS:2834-1954
37.	HRC CARTRIDGE FUSES AND LINKS UP TO 660 VOLTS	IS:2208
38.	GENERAL AND SAFETY REQUIREMENT FOR LIGHTING FITTINGS	IS:1913-1969
39.	CODE OF PRACTICE FOR LIGHTING PUBLIC THOROUGHFARES	IS:2944-1981
40.	WATERPROOF ELECTRIC LIGHTING FITTINGS	IS:3528
41.	WATER TIGHT ELECTRIC LIGHTING FITTING	IS:3553-1966
42.	MILD STEEL TUBULAR AND OTHER WROUGHT STEEL PIPE FITTING	IS:1239-1958
43.	LUMINARIES FOR STREET LIGHT	IS:2149-1970
44.	HRC FUSES HAVING RUPTURING CAPACITY OF 90 KA	IS:9224
45.	EXHAUST FAN	IS:2312-1967
46.	CLASS I CEILING FAN	IS:374-1979
47.	DANGER NOTICE BOARDS	IS: 2551
48.	Cabinets and Boxes	UL 50
49.	Smoke Detectors for Fire Protective Signaling Systems	UL 268
50.	Control Units for Fire Protective Signaling Systems	UL 864
51.	Smoke Detectors for Duct Applications	UL 268A
52.	Thermal Detectors for Fire Protective Signaling Systems	UL 521
53.	Door Closers-Holders for Fire Protective Signaling Systems	UL 228
54.	Audible Signaling Appliances	UL 464
55.	Manually Activated Signaling Boxes	UL 38
56.	Water flow Indicators for Fire Protective Signaling Systems	UL 346
57.	Power Supplies for Fire Protective Signaling Systems	UL 1481
58.	Proprietary Burglar Alarm Units and Systems	UL 1076
59.	Visual Notification Appliances	UL 1971
60.	General and safety requirements for luminaires: Part-1 Tubular fluorescent lamps.	IS: 1913 (Part-1)
61.	Luminaire with metal reflectors	IS : 1777
62.	Lighting fittings with plastic reflectors	IS : 3287
63.	Luminaires	IS : 10322(Part-1 to 5)
64.	Code for lighting of public thoroughfare	IS : 1944(Parts-1&2)
65.	Dust proof electric lighting fittings.	IS : 4012
66.	Dust tight electric lighting fittings.	IS : 4013
67.	Decorative lighting outfits.	IS : 5077

68	Cast acrylic sheets for use in luminaires.	IS : 7569
69	Emergency lighting units.	IS : 9583
70	General and safety requirements for Luminaires.	IS: 1913(Part 1)
71	Cross-linked Polyethylene insulated PVC sheathed cables : Part II for working voltages from 3.3 KV upto and including 33 KV.	IS : 7098 (Part II)
72	Mild steel wires, strips and tapes for armouring of cables.	IS : 3975
73	Recommended current ratings for cables : Part II PVC insulated and PVC sheathed heavy duty cables.	IS : 3961 (Part II)
74	Extruded solid dielectric insulated power cables for rated voltages from 1 KV upto 30 KV.	IEC : 502
75	Flame Retardant Test	IS : 10810 (Part 61)
76	Flame retardance test for bunched cables.	IS : 10810 (Part 62)
77	Drums for electric cables.	IS : 10418
78	Rotating electrical machines- Part-1 : Rating and performance.	IEC 34-1:1983
79	A.C. metal-enclosed switchgear and control gear for rated voltages above 1 KV and up to and including 52 KV	IEC 298:1990
80	Low-voltage switchgear and control gear assemblies- Part-1: Requirements for type-tested and partially type-tested assemblies	IEC 439-1:1985
81	Low-voltage switchgear and control gear assemblies- Part-2: Particular requirement for bus bar trucking system busway.	IEC 439-2:1987 -

The DG set shall meet the requirements of the following standards and rules

1	Designation for type of construction and mounting arrangement of rotating electrical machines.	IS: 2253
2	Degree of protection providing by enclosures of rotating electrical machinery.	IS: 4691
3	Terminal marking of rotating electrical machines.	IS: 4728
4	Guide for testing 3 phase synchronous machine.	IS: 7132
5	Turbine type generator.	IS: 5422
6	Method of determination of efficiency of rotating electrical machines.	IS: 4889
7	Insulating materials for Electric machinery and apparatus in relation to their thermal stability service, classification.	IS: 1271
8	Specification for rotating electrical machines.	IS: 4722

NOTE : All codes and standards means the latest where not specified otherwise the installation shall generally follow the Indian Standard codes of practice or relevant British Standard Codes of Practice in the absence of corresponding Indian Standards.

PLEASE FOLLOW :

- Indian Electricity Act of 1910 and rules issued there under revised up to date.
 - Special Attention should be given to Rule No. 50.
 - Regulations for electrical equipment in building issued by The Bombay Regional Council of insurance Association of India.
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ANNEXURE I

Abstract of the Wiring Rules of the Institution of Electrical Engineer (referred to in the specification) DEFINITIONS (See Clause 2 of the Specification)

Systems :

All electrical system in which all the conductor and apparatus are electrically connected to a common source of supply.

- 1) **Earthed** : Effectually connected to the general mass of the earth. Solidly earthed means earthed without the intervention of a fuse, switch, circuit-breaker, resistor reactor or solenoid.
 - 2) **Uninsulated Conductor** : A conductor without provision, by the interposition of a dielectric or otherwise, for its insulation from earth.
 - 3) **Bare** : Not covered with insulating material.
 - 4) **Dielectric** : any material which offers high resistance to the passage of an electric current.
 - 5) **Bunch Conductor** : When more than one conductor is contained within a single duct or groove or when they are run enclosed and not spaced apart from each other.
 - 6) **Points** : In wiring as per measurements of electrical installation in buildings.
 - 7) **Switch board** : An assemblage of switchgear with or without instruments, but the term does not apply to a group of local switches in a final sub-circuit where each switch has its own insulating base.
- Note :** In the electricity (Factories Act) special regulations, 1908 and 1944 the term "Switchboard" includes "Distribution board".
- 8) **Single pole switch** : A switch suitable for closing and or opening a circuit on one phase or pole only.
 - 9) **Linked switches** : A switch the blades of which are so linked mechanically as to make or break all poles simultaneously or in a definite sequence.
 - 10) **Fuse Switch** : A switch the moving part of which carries one or more fuses.
 - 11) **Three Wire System** :

- a) **Outer Conductor** : Those between which there is the greatest difference of potential. This use of the word outer must not be confused with the use of the word when applied to the external conductor of a concentric main.
- b) **Neutral Conductors** : The term includes the neutral conductor of a 3 phase 4 wire system, the conductor of a single phase or d.c. installation which is earthed by the supply undertaking (or otherwise at the source of the supply) and the middle wire or common return conductor of a 3 wire d.c. or single phase a.c. system.

- 12) **Semi enclosed machine** : One in which the ventilating openings in the frame are covered with-
 - a) Grids expanded metal or wire gauge, with openings of less than 1/4 inch so as to obstruct free ventilation.
 - b) Wire gauge, in which the openings are less than 1/4 inch but not less than 3/32 inch (diameter or width) :
 - c) Screens with smaller openings than the above.
- 13) **Totally - enclosed Machine** :
One in which the enclosing case and bearings are dust proof and which does not allow circulation of air between the inside and outside of the case.
- 14) **Pipe Ventilated Machine** : An enclosed machine in which the frame is so arranged that the ventilating air may be conveyed to it through a pipe attached to the frame, the ventilation opening maintained by the fanning action produced by the machine - itself.
- 15) **Forced draught machine** : An enclosed machine in which the ventilating air supply is maintained by an independent fan external to the machine itself.
- 16) **Protected Machine** : One having end shield bearings and in which there is free access to the interior without opening doors or removing covers.

SWITCHES AND CIRCUIT BREAKERS (See clause II of Specifications)

- 17) **Switches and Circuit Breakers** :
Switches and circuit breakers (rules 2b. 36 and 37) whether fixed separately or combined with lamps, holders or fittings, must comply with the following requirements :
 - (a) Overheating must not take place at the point of contact or elsewhere, when the full current flows continuously.

- (b) They must be so constructed or arranged that the contracts cannot accidentally close when left open.
- (c) The basis must be of incombustible, non-conducting and moisture proof material.
- (d) Circuit breaker as must be so arranged and placed that no combustible material is endangered by their action.
- (e) Unless placed in an engine room or in a compartment especially arranged for the purpose, they must their live parts covered. The covers must be of incombustible material and must be either non-conducting or of rigid metal and clear of all internal mechanism. For more than 6 amperes, at pressures exceeding 125 Volts metal covers must be lined with insulating material.
- (f) In positions where they are liable to injury or come into contact with goods, they must be further protected by an open fronted box or other suitable guard.
- (g) Handles must be insulated and so arranged that the hand cannot touch live metal, or be injured through and adjacent fuse blowing.
- (h) Switches having a handle projecting through an open slot in the cover, must not be used.

Signature of Contractor/s

Executive Engineer

SECTION F-1A

GENERAL REQUIREMENTS

1.1 Scope of works :

The work covered by electrical specification consists supplying and installing, electrical wiring system complete in strict accordance with this specification **and the applicable drawing and subject to the terms and conditions of the contract. It includes.**

- (a) **Conduit and wiring system for fans, lighting points bells, clocks sockets, etc. including fixing of lighting fixtures and fans etc. and miscellaneous points.**
- (b) **Conduit and wiring system for exhaust fans, power sockets etc.**
- (c) **Panel boards, distribution boards. switch fuse units.**
- (d) **Complete power and lighting cable systems.**
- (e) **Grounding system.**
- (f) **Conduits system.**
- (g) **Street lighting system.**
- (h) **Other miscellaneous electrical work.**

1.2 Completeness of Contract :

Any work fittings accessories or apparatus which may not have been specifically mentioned in the specification but which are necessary in the equipment for efficient working of the plant should be deemed to be included in the contract and should be executed and provided by the contractors. All plant and apparatus should be complete in all the details, where such details, are mentioned in the specifications or not.

Three prints and one permanent negative of each of the finally approved drawings incorporating all the modifications proposed by the Department should be submitted. No modifications should be made in a drawing already approved by the Engineer-in-charge without his prior consent.

Approval of the contractor's drawing will not relieve the contractor of any part of his obligation to meet all the requirements of the contract.

1.3 Guarantee :

The performance of all the equipments and the installations should be guaranteed at least for defect liability of period from the date final bill payment as per tender clause. All equipments must comply with the relevant IS-BS specifications.

1.4 Interchangeability :

All corresponding parts of similar plant and equipment should be interchangeable in every way.

1.5 Tools :

All special tools required for dismantling and assembly of the equipment covered by the contract shall be supplied as obligation under the contract.

A list of items to be supplied by the Contractor should be submitted along with the tender.

SECTION F-2A

1. GENERAL :

Specifications for Electrical Installation in Buildings

- 1.1 These specifications relate to the electrical installations in the buildings of KU. The specifications cover general requirements to be full filled. **These general specifications are supplemented by the specifications for the particular buildings separately attached.**

1.2 **These specifications are governed by the General conditions of the contract attached hereto.**

1.3 **APPLICABLE RULES AND REGULATIONS :**

- 1.3.1 Installation shall be carried out in conformity with the regulations for electrical equipments of buildings, published by the Institute of Electrical Engineers London (14th Edition 1966 and as amended upto date) herein after referred to as the I.E.E. wiring regulations. Where these specifications, or the special specifications for the particular building attached hereto are at variance with the I.E.E. regulations these specifications or special specifications as the case may be, shall be followed. The installation shall also comply with the requirements of the Indian Electricity Act-2003-2007, as amended upto date and rules issued thereunder and also the regulations for the Electrical Association of India. Where not specified otherwise, the installation should generally follow the Indian standard codes of practice and in their absence the relevant British Standard of practices. All the materials shall comply with the relevant Indian Standard of British Standard specifications.

1.4 **DEFINITIONS :**

- 1.4.1. The definitions of terms in the I.E.E. Regulations shall apply in general.

1.5 **DRAWINGS :**

- 1.5.1 **The preliminary drawings only indicate the general scheme of requirement. The exact position of all points, control switch boxes, runs of wiring and/or conduits joint boxes, inspection boxes, mains, and sub-distribution boards, mains etc. shall be got approved by the Engineer-in-charge. All circuits shall be clearly numbered in wiring diagrams and building plans. The detailed design of a switch-board, special fixture or any other part of the electrical installation as may be called for by the engineer-in-charge shall also be supplied by the Contractor and should be got approved by the Engineer-in-charge. Three sets of completion drawings and wiring diagrams showing the installations as executed shall be supplied by the contractor alongwith the completion certificate.**

1.6 **MATERIALS :**

All materials shall be new brand and of the best quality conforming to the relevant I.S.B.S. specifications. They must be the products of reliable manufacturers of many years or standings. All like parts of materials shall be interchangeable. In case of equipments such as circuit breakers, switch fuses etc. a descriptive and illustrated literature shall accompany the tender. The names of manufacturers of various materials shall be furnished in proforma in Appendix-I. Samples of materials wherever required should be approved by the Engineer- in-charge before use in the installation. One set of such approved samples shall be deposited with the Engineer-in-charge. All materials shall be rust-proof or rendered rust proof by application of suitable paints. The supply of all equipments, switchgears etc. shall be complete with accessories, fittings and mountings as may be required for their proper performance, and as specified in the relevant IS-BS Code of Practice and standards.

1.7 **WORKMANSHIP :**

- 1.7.1. **Good workmanship and neat finished appearance are the prerequisites for complying with the clauses of these specifications. With a view to ensure fine workmanship the tenderers shall employ licenced wiremen, with an experience of not less than 5 years in the type of work they are engaged. The work should be done under supervisions of licenced Electrical Supervisors with good educational qualifications and considerable experience.**
- 1.7.2 **Tenderers shall furnish the names of Supervisor and their wiremen who will be engaged in this work with details of their experience.**
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1.8 CO-OPERATIVE WITH CIVIL AND OTHER WORKS CONTRACTORS :

- 1.8.1. The tenderer, after the award of the contract, shall co-operate with the civil and other contractors and shall co-ordinate his work with the work of other contractors with the least amount of dislocation and interference to the other works. Tenderers shall go through the drawings carefully and shall furnish the Engineer-in-charge with all the details of openings in the walls etc. they may be required for concealing any of the electrical equipment's or accessories. Where the contractor fails to furnish such information as may be required for the purpose of concealing the equipment's etc. they shall be made at his (Contractor) cost and expense. Any alteration to parts of the building shall be carried out with prior permission of the competent authority. **All chaises of the structural work shall be made good at the contractor's expense and brought to the original shape finish and colour.**

1.9 TESTING :

The electrical contractor shall be completely responsible of the testing and commissioning of those installations covered by these specifications in compliance with the standard procedure, in obtaining permission of the Government Electrical Inspector. Any modification which is demanded by Government Electrical Inspector shall have to be carried out within the scope of the contract. The contractor shall submit four copies of drawings of installations as per regulations for shall be provided by the contractor for carrying out the installation work. All tests shall be carried out in the presence of the Engineer-in-charge or his authorised representative and his approval obtained for the test results.

1.10 COMPLETION CERTIFICATE AND MAINTENANCE GUARANTEE :

- 1.10.1 After the completion of the installation and testing, the contractor should furnish a certificate in the proforma in Appendix-III, at the time of taking over the installation by the Department. The installation shall be guaranteed for period of Defect liability from the date of taking over by the Department. During the period of guarantee all defects in material or in workmanship shall be rectified or replaced free of cost to the Department.

1.11 TENDERER'S ABILITY :

- 1.11.1 In order to enable the Department to assess the ability of the tenderer to execute the work, the tenderer shall furnish evidence of his experience and capacity to carry out the work of the magnitude and nature.

1.12 RATES :

- 1.12.1 The rates of items shall include all taxes, transport, loading and unloading charge and all such charges that may be required to be incurred for the supply and installation of the materials at site. The rates shall be firm and variations in the market are not entertained. Break up figures as required in the schedule of work shall also be furnished. As far as possible indigenous materials only shall be included for supply. Where it is unavoidable, imported items may be included and tenderer should clearly indicate materials, quantity, rate and amount of these items.

1.13 STORAGE SPACE :

No covered storage space will be provided by the Department. The contractor has to make his own arrangement. However, the Department may give an open space near the place of execution where the contractor can build his own stores for executing the work.

1.14 DEPARTURE FROM SPECIFICATIONS :

The tenderer should clearly indicate departure, if any, from the specifications with reasons for the same.

1.15 EXTRA ITEMS :

Rates for extra items shall generally be derived from the rates already available in the schedule. Where it is not possible, the rates shall be mutually agreed upon and the contractor shall furnish a detailed analysis of the rates claimed by him.

2. TECHNICAL SPECIFICATION :**2.1 Supply System :**

The wiring installation shall be suitable for 3 phase 4 wire, 400-440 V 50 cycles system of supply. **Colour code of different phase shall be followed as per standard.**

2.2 Wiring for Lights and Fans :

2.2.1 Looping system of wiring shall be adopted. No joints shall be made at intermediate runs of cables and where they are unavoidable, such joints shall be through approved mechanical connections.

2.2.2 Point wiring :

Point wiring shall consist of the branch wiring from the switch board together with the controlling switch or push as far as and including the ceiling rose or any other approved connector or socket, outlets. In case of more than one light being controlled by one switch, the wiring upto the ceiling rose of the first light including the switch shall be considered as a 'Primary point. Loop wiring from light shall be considered as a 'Secondary' point and rates shall be quoted separately, including final connections to fixtures and plugs.

2.2.3 Conductors :

No conductor for final sub circuit wiring for light and socket outlets shall have across-section less than that of 2.5 sq. m (copper).

2.2.4 Loading :

No final sub-circuit radiating from the fuse board of a sub- distribution board and wires with 2.5 sq.mm cable shall carry more than 10 lights, fans or socket outlets or a connected load of 800 watts whichever is greater. The following wattages may be assumed for estimating the load on each sub-circuit unless otherwise known or specified.

Incandescent Lampts	100 watts
Ceiling fans	60 watts
5-A Socket Outlets (lighting)	100 watts
4. ft. fluorescent tube.	50 watts
5 ft. fluorescent tubes.	100 watts

In each sub-distribution board at least one way preferably two ways shall be left spare for future requirement. A wiring diagram giving the details of the exact utilization of the ways shall be prepared and fixed in the sub- distribution board itself or any other easily accessible place. The ways of sub-distribution boards shall be accordingly numbered.

2.2.5 Local Control Switches (General) :

Local control switches for circuit carrying not less than 5-5 shall be piano type and shall conform to relevant I.S. Standards. The switch shall be 'ON' when the knob is in the down position. All local control switches shall be connected in the phase or live conductor only and not in the neutral conductor, switches shall be fixed in iron clad **box and shall be so placed that the centre of the switch box is 1.3 mtr. from the finished floor level unless otherwise stated. All switch boxes shall be provided with 1/8" thick Perspex cover fixed to the switch box with chromium plated counter sunk screws (brass).**

2.2.5 A Switches (Two way) :

- (a) Two way switches shall be piano type single pole, double throw, 250V, suitable for flush mounting and of 5A capacity as per the drawings. All switches shall be recessed in an embeded metal box.
- (b) Each box shall have suitable outlet for fixing conduits directly.
- (c) Each box shall have press fit cover painted inside with the wall colour, if required.
- (d) Each switch shall be suitable for the position in a corridor stairway wiring.

2.2.5 B Switch Boxes (General) :

Electrical circuits shall be written suitably on the cover of all switche boxes, as approved by the Engineer-in-charge (Elect) whenever different phase are terminated in a switch box bake lite partition shall be provided. Each case shall be provided with a G.I. Earth stud nut and washers for earth connectors.

2.2.6 Ceiling Rose :

Ceiling rose shall be used on circuits having a voltage normally exceeding 200V. Only one flexible cord shall be attached to a ceiling rose. **Only 3-pin 5A socket outlet shall be provided in lighting circuits.** All socket outlets shall be provided with a control switch and they shall be mounted in switch boxes in an approved manner.

2.2.7 Fittings :

These shall be of approved type as specified in the tender schedule. The subcircuits leads should terminate in a ceiling rose or conductor in the fitting and internal connection made therefrom. Wherever these fitting are suspended they shall be done so through the conduits and ball and socket joints. All fittings shall be grounded by a G.I. conductor not less than 16 S.W.G.

2.2.8 Flexible wiring :

Flexible cords of not less than 23/0076 size shall be used. The weight of suspension shall be governed by I.E.E. Regulations.

2.2.9. Ceiling Fans :

All ceiling fans shall be wired to ceiling rose and suspended from a hook shackle or clamp and insulated from the same. All joints in the suspension road shall be screwed and secured by means of split pins. The fan clamps supplied by the Contractor shall be suitable for the ceiling or proof member as the case may be. **For concrete roofs, fan hooks shall be buried in concrete during construction in an approved manner and securely bound to the reinforcement.**

2.2.10 Conduits and Earthing :

All conduits feeding lighting and fan circuits shall be provided with earth continuity G.I. conductor as specified for power wiring. All conduits shall be as specified for power wiring.

2.3.1. Point wiring :

Point wiring for power shall be as defined under section 2.2.2 and shall include the switches and sockets.

2.3.2. Loading :

All distribution board for power wiring shall be not less than 15A per way. Loading per way shall not exceed normally 100 watts. The following loads may be assumed if exact figures are not known.

3-Pin 15A Outlets	1,000	Watts
3-Pin 5A Outlets	100	Watts

2.3.3 Wiring for Motors :

2.3.3.1. Final sub-circuits loop in motors shall be connected to separate ways of the Distribution board even if the current in the sub-circuit is less than 15A. No looping is permissible.

2.3.3.2 All wiring shall be carried in H.G. conduit as specified in I.S. specification for gauge for different sizes of conduits. When the motor is resiliently mounted flexible conduit with approved adopters shall be used for the last few feet. Where cables are used sufficient loop shall be left.

2.3.3.3 All switch fuse units controlling circuits feeding motor shall be provided with H.R.C. fuses or as specified.

2.3.3.4 The frame of every motor and its association control gear shall be earthed by two separate and distinct connections to earth connector shall be capable of carrying 3 times the rating of fuse or 1.1/2 time the setting of the circuit breakers but in no case less than No. 8 S.W.G. or 7064" or equivalent cross section of copper. Where practicable, the earth connections shall be visible for periodical inspection. Gas or water pipes shall not be used for earth connections.

2.3.3.5 Socket Outlets and Control Switches 5A and 15A :

All socket outlets shall be of 3 pin type, the third pin being connected to the earth stud of nearest distribution board by separate earthing wire. The socket shall conform to I.S. : 1293/1938, single pole, piano type. Each socket outlets shall be provided with a control switch of appropriate rating and as specified. The switch and socket shall be mounted inside the iron clad box provided with 1/8" prespex cover as directed by the Engineer-in-charge or as specified in schedule of quantities. **Inside switch box ample space shall be available around switches for connecting wires to switches. All socket outlets for power shall be mounted at the skirting level unless otherwise specified or as directed by the Engineer-in-charge.**

The three phase plug receptacles shall have their earth terminals connected by independent earth wires to ring main earth strips on the building. In buildings where explosion proof fixtures are installed single phase plug receptacles as well as light points shall be connected to ring main ground bus installed in the building by separate earth wires of approved size.

Socket outlet shall have some provision not to receive the matching plug unless the grounding pin is in correct position. The grounding pin of the plug shall make the contact first and break the contact last at the time of inserting or removing the plug respectively.

The grounding terminal shall be connected to the enclosed metal body by providing G.I. stud. nut washers welded to the box.

Each unit shall be suitable for flush mounting as required and indicated in the applicable drawings. Combination unit of socket outlet and switch shall be complete with necessary internal wiring. The switch/socket shall be mounted on M.S. bracket enclosed in a box.

2.4 Conduit Wiring :

2.4.1 Where conduit wiring is adopted the type and size of the conduit shall be as indicated in the drawing. The minimum of the conduit shall be 19 mm.

2.4.2 The contractor shall thoroughly study the structural arrangements of the buildings and wherever, necessary shall in consultation with Department's representatives at site, make suitable adjustments in the cable routings, earthing arrangements, and location boxes, fitting etc. with a view to avoid interference with any part of the building, structure, equipment or any other work in the building or to effect any improvement in the arrangement.

2.4.3 Protection of conduit against rust :

Conduit shall be given two coats of oxide paint before they are placed in position. All exposed conduit shall be painted after installation with the colour as approved by the Engineer-in-charge. This do not apply to galvanised conduit.

2.4.3.A Protection against insects and damp :

In order to minimize condensation or sweating inside the conduit, system shall be properly drained any ventilated in such a manner as to prevent the entry of insects.

2.4.4 Conduit shall first be installed as a complete system without cables and shall be continuous from outlet to outlet from fitting to fitting and mechanically and electrically connected to all boxes and fittings.

2.5 SPECIFICATION FOR POWER CONTROL AND TELEPHONE CABLES :

1. SCOPE :

- i. The specifications cover the supply and installation of medium voltage power and control cables either in ground or trench depending on the conditions at site including accessories for the same. The work in general, consists of supplying, laying, jointing terminating and connecting all. 1.1 KV 'APLSTS' PVC power and control cables.
- ii. The contractor shall supply all accessories including jointing and terminating materials, compound, tapes supporting materials, cleats cables lugs, concrete stabs, bricks sand, cable markers etc, as required to make the installation work including digging and back filling of the trenches as required.

II. SPECIFICATION :

- i. All power cables to be supplied mentioned as 'APLSTS' in the Schedule should be mass impregnated, non-draining, paper insulated lead sheathed, double steel tape armoured and must comply with the latest ISI BS specifications.
- ii. All cabling materials such as cable compound, cable lugs, tapes shall be of approved quality acceptable to the type recommended by the manufacturer of the cable for which it is used and approved by the Department.
- iii. Installation of all equipment shall also conform to the applicable. Codes and practice as per the IS and shall be executed to comply with the latest Indian Electricity rules as regards the safety, earthing of equipment's and other essential provisions specified therein.
- iv. **Only approved make of cable shall be used. ICC and CCI will be preferred.**
- v. **The cables shall generally be laid as per is Code of practice.**

III. GENERAL RULES CABLE LAYING :

- i. Installation shall be carried out in a neat, workmen like manner by skilled experienced and competent workmen in accordance with the standard practices.

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- ii. Cables shall be laid preferably in one piece length to avoid joints. If straight joints are found necessary, these can be introduced with prior approval of the Engineer-in-charge. The cost of the straight joint however, shall not be borne by the Department. But in no case joint shall be within the conduit G.I. pipe and duct.
 - iii. Proper care should be exercised in handling the cable to avoid formation of kink etc. and should it become **Necessary a cable be bent to a radius not less than 20 times the overall diameter of the cable.**
 - iv. **Method of installation, routing of cable etc. shall in every case be subject to the Department's approval and the contractor shall modify and or certify at no extra cost to the Department any portions of the installation which do not meet with the Department's approval. All damages to the civil and other works on this account shall be made good by the contractor at no extra cost to the Department.**

The electrical contractor while notifying the building contractor for such work shall furnish the proper drawings, fully explaining the work involved or indicate at site actual work to be carried out as may be required by the building contractor. The electrical of any such work as soon as the electrical work with respect to the same has been completed.
 - v. **Where cables pass through hume pipes, contractor shall fix hard wood bushed round the cables at the ends of hume pipes. Where the cables pass through the floors or chambers and in such other situations as the Engineer shall require, the contractor shall seal cable holes in a manner approved by Engineer-in-charge.** Where cable pass through roads nallahs, etc. cables must be protected by Class 'A' Hume pipe of diameter not less than 6" (15cms.)
 - vi. The cable route shall be the shortest and these shall be minimum interference with built up areas, lawns etc.
 - vii. Care shall be exercised for providing suitable props for supporting other service lines on earth at the time of excavation. Where cutting of a lawn become inevitable it should be with the approval of the Engineer-in-charge.
 - viii. Excavation of the trenches shall be executed with vertical sides and the trenches shall be kept as straight as possible. The exact location of each trench shall be settled by the Engineer-in-charge. On the site when the contractor is in a position to commence each portion of the work. **The trench shall be not less than 1/2 meter wide and 90 cms deep. If more, cables are to be laid, the width should be suitably increased.**
 - ix. After the cables are laid, the trench shall be filled in layers, the earth in each layer being well rammed by spraying water and consolidated and sufficient allowance made for settlement. The extra earth over the trench should be removed from the place of trench to a place as decided by the Engineer-in-charge at site.
 - x. Ends of cables shall be properly sealed to prevent entry of moisture prior to installation.
 - xi. Where it is as specified as 1/2 core cables the 1/2 core shall be a neutral conductor having reduced section.
 - xii. For all multicore cables each core and tails shall be brought out, marked and or coloured in on approved manner.
 - xiii. Cables termination shall be done with suitable compression brass glands in the case of PVC cables and cast iron trifurcating boxes in the case of 'APLSTS' cables. The armour should be connected to the right main earth in building with duplicate earth wires as per the relevant IS/BS specification.
- The core insulation over each conductor shall however be retained through out the run of the conductor upto the end where lugs shall be fitted thereon for connections. The lugs shall be fitted by means of approved solder and flux such as aleap, and Eyre No. 7 liberally used. The joint shall be mechanically strong and pressure tested.
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2.6 DISTRIBUTION BOARDS AND PANELS :**General Requirements :**

- 2.6.2 All distribution panels shall comply with I.E.E. Rules 60- 61. A clear distance of 0.91m meter in front of the switch board shall be kept. Where bare connections or attachments are provided at the back of the switch board the space behind the panel shall be either less than 0.299 meter or more than 0.762 main width there shall be a passage way from the further rest outstanding part of any attachment or conductor. If the space behind the switch board exceeds 0.70 main width there shall be a passage way from either end of the switch board clear to height of 1.928 m width 0-299 m. All wiring connection shall be made neatly and securely.
- 2.6.2 For circuits carrying more than 10 Amps. tinned cable sockets shall be used. All connections shall be so made as to form their own diagram Circuit shall be clearly numbered to correspond to wiring diagram Names of the distribution boards shall be painted as directed by the Engineer-in-charge. All the switch fuse units and isolators D.Bs. shall be complete with earthing studs lugs neutral bar link, H.R.C. fuses and of approved make.
- 2.6.3 Skeleton type panels shall have a rigid form work adequately braced and supported. The switch and distribution boards shall be neatly arranged in the frame. The details of the frame work and the arrangement of switches shall be got approved by the Engineer-in-charge before the panel is fabricated.
- 2.6.4 All cubical type panels shall have rigid supporting frames adequately braced over which sheet metal shall be neatly secured. All switches, distribution boards etc. shall be neatly arranged on the panels and all connections made from the back of switches. The panels shall be rendered dust and vermin-proof. The interior of the panels shall not be accessible to unauthorised persons.
- 2.6.5 The recess type boards shall be embedded in wall in a cupboard with a metal hinged door with locking arrangement. In all recessed conduit work all distribution boards shall be recessed. Where recessing is not possible, free standing panel may be provided as approved by the Engineer-in-charge.
- 2.6.6 All individual components i.e. switch fuse units D.Bs. etc. shall be connected by earth continuity wire of appropriate size with the main earth bus of the panel D.B. etc. The panel switches or D.Bs. shall be earthed by the less than 2 distinctive paths to earth. Earthing of metallic parts of exposed metal shall not be effected through any structural metal work which houses the installation. Where metallic parts are not required to be earthed and are liable to become alive should the installation of the contractor become defective such metallic parts shall be separated by durable non-conducting material from any structural work.
- (a) Power panels shall be 3 phase, 4 wire, 400/230 volts for the distribution of 3 phase or single phase power loads. Lighting panels shall be 3 phase 4 wire 400/230 volts for single phase lighting load distribution on all 3 phase.
 - (b) All panels shall be done or protected front type with no mechanical or electrical defects.
 - (c) Bus bars shall be of electrolytic copper or aluminium as specified and the properly tinned sizes as indicated on applicable drawings as required.
 - (d) All knock outs for branch circuits, conduit entries shall be drilled in and filled as required. For lighting panels the top and bottom cover plates shall be removable type.
 - (e) Main disconnect device for all panel boards shall be of switches of disconnect type and of the size as indicated shall be mounted directly below the panel or through a short thread conduit of required size.
 - (f) The main disconnect for all panel boards shall have an entry suitable for PVC armoured cable from bottom.
 - (g) All panel boards shall be provided with an earthing terminal and lug for connection to the grounding system.
 - (h) Temperature rise of all electrical parts shall not be more than 3000 with full load amperes at room temperature.
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- (i) Buses shall be securely supported so that ordinary vibrations will not cause any of the parts to become loose.
 - (j) All barriers and supports of current carrying parts shall be of moisture resistant insulating material and shall not be adversely affected by arcing.
 - (k) The locations of panels shown in the drawings are only tentative, Panels may be located at a place approved by the Engineer-in-charge.
 - (l) All civil works connected with fixing such as grouting, chasing and making good shall be the tenderer's responsibility.
 - (m) Wires adequate capacity with proper size of lugs shall be used for inter connections.
 - (n) Panel should be self supported on angle channel iron frame work. It should be preferably of bolted construction in case of transportation and flexibility. The frames shall be of the required size for the mounting of the equipment on it. It shall be bolted or grouted rigidly after levelling and alignment.
 - (o) The cupboard and D.B. should be of such size so to be accommodated in the existing room as per I.S. rules and I.S. codes of practice for installations of Medium voltage switch gear.
 - (p) Fabrication drawing showing the detailed dimensions and panels and its components indicating the frame work. Earthing positioning of switches, D.Bs. cable boxes, adopter chambers etc. shall be furnished to the Engineer-in-charge for his approval. All material to be got approved by the Engineer-in-charge. Panel should be guaranteed for satisfactory operations for a period of one year after handing over.
 - (q) The panel should be painted with anticorrosive paint suitable for humid and salty atmosphere on two coats of primer.

Switch Gears, Powers Panels D.B. and S.F.U.s.

- 2.6.8 The main bus bar shall have continuous current rating as specified with neutral bar having half of full load rating of the phase bus bar. The sizes of the bus bars shall be so selected that the current density in bar does not exceed 150 amps. per sq.m. for copper. The length of bus-bar chamber should be as suitable length to fix all the switches etc. as per the prevailing standards, clear spacing of two adjacent buses shall be 1 1/2" minimum bar should be tapt all along with colour coated 11KV grade PVC tape. The maximum internal of support for each unsupported length shall exceed 600 mm.

The bus bar shall be of copper/aluminum and fabricated to the relevant standards specification. In case aluminum bus bar is used special with high conductivity aluminum bus bar alloy E 91 C frame conforming to E.S.S. 2898 shall be used. The current density shall not exceed 800A per sq. inch. Hylam barriers will be provided over the joints to prevent any short circuit.

The bus enclosures shall be made out not less than 16 gauge M.S. sheet construct on with angle iron support. All interconnections between bus bars S.F. Us. and D. Bs. shall be of adequate size and details of such inter connection shall be furnished to the Engineer-in-charge for his approval.

The bus bar shall be air insulated extensible type rectangular one. The bus bars chamber shall be dust tight by providing gaskets secured properly so as to render it vermin proof.

The Combination Fuse-switch unit should comply with IS 4064 BS 861 and BBS 2510 wherever applicable. It should be suitable to accommodate High Rupturing Capacity Cartridge Fuse links complying with IS 2208 or BS 88 and having a certified rupturing capacity of not less than 35 MVA at 440 volts (AC5 duly). The switch gear (panels, D. Bs. etc.) shall be installed generally as per IS-Part-I 3072 and as specified and shown in drawings.

All fuse switch units shall be provided with non-deteriorating HRC fuse links complying with IS 2208-1962 and having rupturing capacity of 35 MVA at 415 volts or as specified.

All switches above 60 amps. rating shall be provided with suitable size adapted boxes. All switches mounted on the top of the bus bars shall be provided with detachable type reverse entry adapter boxes. Suitably engraved labels shall be provided for each circuit as well as for the board.

A meters sector switches and LMH meter shall be provided where specifically mentioned. Small wiring

for the inter-connecting shall be colour coded and provided with numbered fuses for easy identification of circuits.

- (a) The distribution boards should be totally enclosed metal clad complying with B. S. 214. The M. S. sheet steel enclosures for recessed D.Bs. shall be of not less than 16 gauge.
- (b) The DB shall be with hinged door and the locking arrangements as approved by the Engineer-in-charge.
- (c) All the components shall be enclosed in the enclosure. The mounting of D. B. shall be got approved by the Engineer-in-charge before carrying out the installation.
- (d) The DBs. shall have proper size cut outs for conduits entry or cable entry as required and these shall be made on site.
- (e) Adequate spacing shall be provided inside the DBs. for easy removal of the fuses/MCB and carry out the inter connection.
- (f) A set of insulating barriers have to be provided between incoming breakers switches and fuses.

Switch fuse Units :

- (a) All the D.P.MCB and F.P.MCB switch fuse units shall be totally enclosed 6"x5" box, approved make, quick break type to best Indian make conforming to the I.S. or B.S. 3185 specifications. All the switch fuse units shall have mechanical interlock with a door, so that the door cannot be opened when the switches are in 'ON' position. The switches should be of double break isolation type to ensure safely.
- (b) Each T.P. & T.P.N. switch fuse unit shall be earthed with two distinct each connections.
- (c) Suitable insulator shall be provided between phase.
- (d) There shall be suitable neutral link in the fuse box.
- (e) All T. P. & T.P.N. switch fuse units shall be rated for 500 volts and D. P. (required for single phase supply) and S.P.N. switches for 250 volts.
- (f) The H.R.C. cartridge fuse shall conform to H.S. 88 (1952).
The O.C.Bs. ACB shall be suitable for 400/440 volts 3 phase 50 cycle supply capable of interrupting a fault MVA of not less than 31. The circuit breaker shall conform to the BSS-936-1940 BSS 3659 with such tripping arrangement as may as required under special specifications for the building. Efficient and fool-proof mechanical interlocking shall be provided for the safe operation and maintenance. The rate shall be inclusive of the first filling of oil.

2.7 Instrumentation :

The instruments and meters wherever necessary shall be housed in special sheet steel box located between switch fuses units and bus bar chambers. The instruments etc. shall be mounted on the hinged cover with their dial flushed. All instruments shall have protective H. R. C. fuse links. All interconnections and small wiring shall be neatly dressed , arranged and duly coloured for easy identification of circuits.

Meters shall be provided as required in the Schedule, Meters shall be dead head and be suitable for 400/440 volt 3 phase 4 wire 50 cycle (in balanced load) supply.

Each selector switch shall be 3 point and of minimum 250 volts grade with silver tipped contacts suitable for metering circuits, current transformers shall be of 5VA burden and commercial metering accuracy. Indicating lamps shall be panel mounting type preferably of 250V grade. Every unit shall be prewired and interconnected to the system for its required indicating performance. Indicating lamps shall have independent circuit fuse.

2.8 FIXING OF LIGHTING FIXTURES :

- 1. Location of fixtures their manner of fixing mounting height etc. are indicated in relevant drawing. Actual location and levels shall however be arrived at site in co-ordination with other service etc. and prior approval of the Engineer-in- charge regarding the actual location. Manner of fixing shall be obtained

before the work is taken up in hand.

2. In all cases the contractor shall provide necessary interconnection wiring earthing painting etc. all necessary for complete installation. The contractor shall also test and commission the fixtures during completion of the work.
3. General arrangement of fixtures layout is indicated in drawings. Care shall be taken to see that all light fixtures are in a row in a room or particular area, are in absolute line and plump and are symmetrically disposed with respect to finished surfaces of walls columns beams etc.
4. The inter-connections wiring from the light outlet point upto the fixture shall be carried out by means of flexible copper wire of section not less than 1.5 mm² in less & otherwise not stated.
5. All fixtures suspended by means of conduits shall be done with all and socket joints or as per approved design.

2.9 Telephone System :

1. Empty conducting shall be done, recessed or exposed to surface along with pull boxes, junction boxes and telephone outlet boxes, in areas and location as indicated in the relevant drawing as per materials and methods as described in regard to conducting under section "Wiring in Conduits" except the G.I. pull wires of gauge not less than 20 SWG shall be kept pulled through conduits in all sections so that in future telephone wires can be pulled easily.
2. Location shown on the drawing are approximate and final location shall be decided in the field by the Engineer-in-charge & contractor.

SECTION G

SPECIFICATION FOR EARTHING.

1. Installation of Earthing Plates :

All installation of earthing shall conform to Indian Electricity Rules, IS-3043 latest edition and I.E.E. The copper earth plates should be tinned before installation. The earth plates of copper 60 cm x 60 cm x 3.515 mm thick size as mentioned in the schedule be in separate pits at least 150 cms to 300 cms. away from the building at a depth necessary to reach moist earth surface but with a minimum depth of 2.5 mtr from the finished ground level upto the top vertical edge of earth electrode. The earth plate shall be thoroughly cleaned to remove all dirt from the surface and be tinned properly for electrical contact with the main ground. Each earth pit should be provided with 38 mm. dia G.I. pipe 2.5 Mts. long or more depending upto the depth of pit, put over the vertical edge of earth plate (with top end of pipe provided with a closed to coupler). Alternative layers of salt and coke shall be provided surrounding the plate. The pits shall be filled when the plates are in position and with the approval of Engineer-in-charge.

To facilitate watering the pit, a concrete compartment should be made with funnel with mesh and cover plate as per rules provided in ISI regulation. The masonry enclosures shall be 25 cm x 25 cm x 25 cm (deep) with C. I. lid of 23 cm x 30 cms size. After installation, the earthing resistance of each earth plate should be measured by resistance meggar in the presence of Engineer-in-charge, three days after the completion of earthing work, and the value should conform to regulations.

2. Installation of Chemical pipe Earthing :

Chemical Earthing installation procedure. Bore a hole of 8"-10" in diameter at a place where earthing is to be done with a suitable depth of 1.5-2 mtr. Place the earthing electrode inside the pit. Mix the soil resistivity improvement powder compound (total 12.5 Kg./25kg. chemical per pit) nicely with the soil. Re-fill the empty space around the earthing electrode. while re-filling the space, pour water in the pit. Pack the soil around electrode tightly and nicely with necessary Excavation & Filling as per original with Earthing Chamber & CI/precast cover. Necessary test certificate shall be produced.

Chamber shall be finished with road/ paver block/ existing surface.

Signature of contractor/s

Executive Engineer,
Division.

GUIDE LINES

1. **MODE OF MEASUREMENT FOR ELECTRICAL INSTALLATION WORKS.**
 - 1.1 **POINT WIRING :**
 - 1.2 **CIRCUIT MAINS**
Circuit Mains shall be measured from the distribution board of sub-distribution board upto the taping point of the first switchboard.
 - 1.3 **RENTAL CHARGES FOR TEMPORARY ELECTRICAL INSTALLATION WORKS :**
 - (A) The rent for the items of temporary illumination are separately incorporated in S.O.R. Chapter VI. The items which are not seen in this chapter the rental charges shall be taken as following.
 - (i) Full rate shall be paid for the first day at 10% of capital cost of the complete item.
 - (ii) 50% rate of first day rate shall be paid for the second day.
 - (iii) 10% of first day rate shall be paid for subsequent days or part there of beyond two days.
 - (B) The items for temporary works, where the rates are given for two days in S.O.R. the rates shall be taken for additional each day at 10% of full rate for two days.
2. List of approved materials under each category should be enclosed with the tender documents and the tenderer should mention the brand name of material selected for use in the said tender and the same should be finalised before acceptance of the tender. Placing of the order for such category materials should be started after acceptance of the tender. At the time of recording measurements in the measurement book, specific brand name of actual make of material used should be written in place of approved make borne on the list of approved materials.
3. **NON S.O.R. ITEMS :-**
Rates items Viz. Transformer, Lifts, Air-Conditioning plants are based on the capacity and design parameters adopted by the different firm depending on R & D workshop colorations. These items are not very frequently used for Electrical Installation works, so the budgetary price should be considered while preparing the estimate and the D.T.P. for such Non S.O.R. items the ranges of capacity for different makes while framing the estimate reputed manufactures including the price escalation likely to occur between preparation of the estimate and the actual tender. Non S.O.R. items which are required to be used frequently should be proposed by the field officers for inclusion for ensuring Latest S.O.R. All the proposals or modification in the existing S.O.R. items should be proposed along with supporting data before the end of calendar year.
4. **PLANTS & MACHINERIES :**
For plants and machineries requirements of civil construction works should be ascertained in consultation with Design Unit (Elect.) During execution of civil construction work, co-ordination should be positively sought from Architects, Design Engineers and Field Officers.
5. **LIST OF APPROVED MATERIALS FOR USE ON WORKS : CONTRACTS**
Some items frequently under use are incorporated in this S.O.R. The makes of following accessories, equipment's, switch gears etc. are approved for use on E.I. works (Surface/Concealed) in this Dept, subject to the condition that the said materials do confirm to requisite I.S.S. requirements or do have I.S.I. Certification / I.S.I. or Marks. The brand names & material on list are applicable only for use on works by contractors and in departmental tendering works for procurement directly on works by offices of this department. In respect of purchase under D.G.S. & D. Rate Contract, the rate contract shall hold good. Any material required for use on works etc. and not on approved list shall be approved by the appropriate authority of the Department, looking to the merits of use. **This shall be within preview of concerned Dy. Executive Engineer (E) & Superintending Engineer as shown in tender clauses.**
6. **APPROVAL OF MATERIALS ON WORK :**
The Samples of Materials to be used in a work should be approved by the officer not below the rank of Dy. Executive Engineer (Electrical).
7. **EARTHING :**
The Section officer (A.E./A.A.E.) in charge of work should remain present during the execution of item of earthing and the certificate to the effect should be given accordingly and be preserved in Divisional office with record of such work.
8. **LAYING OF PIPES FOR CONCEALED WORKS :**
For the concealed wiring in large buildings where the formalities for sanction and tendering works may delay the laying of concealed pipes alongwith the civil works will be carried out departmently. The rates for pipes and concealed boxes are given in the S.O.R. The concealed pipes must be laid alongwith 16 Gauge fish wire. No reduced rates **shall be proposed for detection of fish wires. Zero measurements** shall be proposed for such cases. For the remaining works of wiring in existing pipes, the rates shall be adopted as per the items mentioned in this S.O.R. which includes the wires, accessories, laminated sheets and remaining all except pipe and boxes.

Agency has to quote the rate considering following Condition.**Special Condition for Permanent & Temporary Vij
connection & Necessary N.O.C / License**

1. The agency shall get the electrical works executed through competent authorized Government approved licensed electrical persons / firm in appropriate category in accordance to contractual provision.
 2. The electrical works shall progress strictly in accordance to the directives issued by Deputy Executive Engineer (Electrical).
 3. Agency shall have to make all suitable arrangements to procedure power to the building on completion.
 - (a) Agency is required to take-up the matters of getting & submission of G.E.B. / A.E.C. applications, deposition of funds and final release of power.
 - (b) All the application, agreements shall be got discharged by the beneficiaries and authorized amounts payable to G.E.B. / A.E.C. shall be borne by KAMDHENU UNIVERSITY
 - (c) NO extras shall be payable for the services rendered. The quoted rates includes for the services required to be rendered by the agency to make the power available for the beneficiaries.
 4. Agency has to prepare G.E.B. /A.E.C. application for power connections with all respects get signed of concern Officer and submit to G.E.B. /A.E.C. office with all legal documents and drawings and follow-up G.E.B. / A.E.C. office to get a power within specified time limit. Agency shall have of submit estimate amount by cheque / D.D. which shall be given by KU and submit the same to G.E.B./ A.E.C. office. Application registration charges and estimate charges will be given by KU. No any further charges will be given by the KU to release power connection. Agency shall have to complete agreement formalities for 3 (three) phase power to G.E.B. /A.E.C.
 5. After completion of electrical work, agency has to prepare test reports and they have to submit the same of concern electricity board / company. The test report fees shall be born by contractor/Agency.
 6. If required agency has to provide single phase and three phase energy meter to concern electricity board / company/laboratory for testing. After completion of testing agency has to fix the energy meter has shown by site in charge.
 7. If required agency has to provide necessary hard were material for GEB supply service cable and keep necessary hole for the same without any cost.
 8. Agency has to take high rise building permission from concern authority well in advance so GEB/ Torrent application can be submitted in time. For that necessary drawings & liasoning with electric inspector must be done by electric agency. Electric agency has quote/ gives the rate to civil/ electrical agency no extra payment will be done for that.
 9. Qualified & experience associated agency has to study schedule item description & detail tender specification and other terms & condition of contract as well as reference IS/IEC/IER.
It is fully responsibility of main & associates agency to supply the all material as per tender specification & item description, if agency fails to do so, KU can replace any material which is not as per tender specification at any state of contract also defective, very old & damage materials shall be replaced by agency at the risk & cost of agency.
Following NOC shall be taken by main associated agency.
 - Agency has to get GEB/ torrent temporary power connection and switchgear network to each block & floor with necessary safety precaution for construction purpose. All the payment shall be paid by contractor / Agency. The cable/ wire/ switchgear used in temporary connection shall not be reused in project work.
 - To get permanent power connection for project. Agency has to submit test report and its fee and get the connection from concern vij-company with lessoning work.
 - For vij line, pole, transformer shifting, underground cable shifting civil & electric agency has to showing existing pole, transformer etc in architect & MD sir approved layout and also show the location & route of vij line, pole & transformer etc. where line to be shifted. So that the shifted line do not obstruct the construction of compound wall or any other building. Which is to be built in future. Also ensure the location of vij pole distance from state/ national highway center line. Agency has to co-ordinate & co-operate with vij company and complete the shifting work as early as possible.
 - To get high rise permission if required.
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- DG set NOC including fee & lessening work.
 - Fire Pre-NOC & final NOC including fee & lessening work.
 - Lift license including all fee & erection permission fee, lift license fee.
 - Any other statutory permission / NOC as per latest Government rules.
10. i) Agency responsibilities to get approval of material as per tender specification with TDS/Sample.
- ii) To get the necessary conceptual drawings for architecture etc. and make good for construction drawings w.r.t. architect/structure/plumbing/road-parking/garden drawing which is to be received from civil agency.
- iii) Prepare the sample for each activities as per tender specification and get approval for KU.
- iv) Co-operation between different agencies to complete the elect related work in a good manner in specified time limit.
- v) Procurement of material and manpower as per site requirement stage.
- No time limit shall be given to agency for above reason.

Agency has to consider following points while quoting the rate and executing the work.

(Open type wiring)

1. Agency has to quote the rate sticky according to make, model, specification, workmanship, testing of materials & installation mention in tender at any where. Agency has to consider the supervision & co-ordination arrangement by electrical engineer & site visit as & when require and responsibility during defect liability period.
2. For open type wiring, open teak wood board having, good quality of polish shall be used. The sample of board, laminated sheet and screw with switch socket shall be approved. Necessary round hole of pipe size shall be provided by manufacturer. The fixing with necessary size & no of screw shall be decided by EIC. Board shall be minimum 40mm deep, frame width shall be 15mm & having cross joint at four ends. For small board no joint shall be permitted in back side. For big board only one joint shall be permitted.
3. Maintain distance between saddle is minimum 2 feet and six inch at tee, junction etc. route & sequence of PVC pipe shall be confirmed and print the line with thread & colour So, there is no overlapping of pipe & maintain line & level of pipe & distance between two or more parallel pipe.
4. The sample of accessory teak wood board, saddle & laminated sheet shall be approved as per tender specification.
5. For SR work wiring is to be done in existing qtrs or office. So, necessary arrangement of material, manpower shall be planned so that much portion of work can be put in working every day, earthing shall be done before starting wiring. So, there will be no live parts / equipment remain without earthing.
6. Tube light, ceiling fan, MCBDB, bell shall be erected as per instruction of EIC at a safety & operating height.
7. For pipe access core cutler / hammer drill shall be used for RCC/ masonry wall.
8. All the hole & broken plaster shall be filled up with necessary materials & done as per original.
9. Open location of concealed wiring
 - MCBDB shall be erected in such a way that minimum steel of beam may be crossed while laying pipe drop. It should be at a operating height with small table and aesthetically looks good. MCBDB shall be in line & level w.r.t Plaster around it. and good finishing around it. Neutral & earthing link, busbar screw shall be free from rusting so necessary masking with tape shall be done. The outgoing pipe shall be directly going inside the MCBDB.
 - Each and every electrical point & plug point shall have earthing wire (green) of appropriate size & connected it to equipment's.

The colour code shall be maintained. (Open & Concelled wiring)

- **For single phase wiring**

Earthing	- Green
Neutral	- Black
Main phase	- Red
OFF wire for light point	- Yellow
OFF wire for fan point	- Blue
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Two way wiring - Gray

- **For 3 phase wiring**

Three phase - Red, Blue, Yellow
Earthing - Green
Neutral - Black

- The location of electrical gyser plug point, R.O plant, Micro oven, Freeze, A.C, T.V, Washing machine shall be decided by considering CPWD guide line for safety & operating purpose.
- All the electrical accessories, equipment, switchgear shall be marked with permanent marker in appropriate size & necessary operating & safety instruction shall be provide in electrical/ server room with SLD, layout etc. No extra payment shall be done for that.
- Civil & electrical agency has to submit the layout showing pole, transformer, underground cable, pipe etc. Which are to be shifted for construction purpose. Civil engineer (KU) & civil agency has to provide new location & route of cable, pole etc. Where they are to be shifter. Delay in submitting above documents may results in delay in work. For that KU shall not be responsible for that and no extra time limit will be given for that.
- Agency has to do the construction work where no pole or electrical line are directly obstacle the construction.
- Any genuine time limit will be proposed if vij company takes more time than as per consumer right statements.

Contractor Sign & Stamp
Date:-

Executive Engineer
