SPECIFICATIONS FOR ELECTRICAL WORKS IN GOVERNMENT BULDING SUBJECT TO THE GENERAL CONDITIONS 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 by Indian Standard code of Practice for Electrical wiring Installation IS-732-1982 except for the definition of point in case of Internal Electrical Installation. For definition of point wiring and measurement of Electrical works IS-59008-1970 shall be referred to.

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 conducted 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 handover by the Executive Engineer Electrical Division.

(ii) Within one month of the taking over the installation, the Contractor shall supply to the Executive Engineer, Electrical 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 Executive 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 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 aluminum. The smallest aluminium conductors for the final circuit shall have nominal cross sectional area of not less than 1.5 Sq. mm. The minimum size of the aluminium conductors for power wiring shall be 4 Sq. mm.

6.3.1 Conductors of flexible cables shall be of copper. The minimum cross sectional area of such 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 armor 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 signle 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 lenghts that the drop in voltage between main fuses and the farthest point of any lump shall not exceed three percent of the voltage of the conusmer's with all the consuming devices in use.

7.1 It 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 out lets : Points and exhaust fans

8.1 Incodescent lamps installed in residential and non-residential buildings shall be rated at 60 watts & 100 watts 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 valuse of the load are known or specified.

9. Tests :

9.1 Before the installation is commissioned following tests shall carried out :

(1) Insulation Resistance test
(2) Polarity Tests of Switches
(3) Earth Continuty tests
(4) Earth Electrods Resistance test

9.2.1.1 The insulation resistnce shall be measured between earth and the whole system of conuctors or any section there of with all fuses in palce and all switches closed, and except in earthed concentric wiring all lamps in position or both poles of the installation otherwise electrically connected together direct current pressuere 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 that it need not exceed. 500 volts for medium voltage circuits where the supp is derived from the three wire D.C. or 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 order pole or phase conductors of the supply with all lamps in position and swithches 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 outlet or when PVC insulated cables are used for wiring 12.5 Megohms divided by number of outlets.

9.2.1.4 Where a whole installtion 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 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 outlet 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, applicance 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 wokr, 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 throughout & such conductor shall be labelled or marked for conection 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 installtion a test shall be made to verify that every non-

linked single pole swich is fitted in a conductor which is labelled or marked for connection to one of the phase conductor of the supply.

9.2.2.3 The installtion shall be connected to the supply for testing. The terminals of all swiches shall be tested by a test lamp one lead of which is connected to the earth. Glowing of test lamp to its full brilliance, when the switch is in 'on' position irrespective of appliance in position or not shall indicate that the swich 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 leakagecircuit 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 Elecrode Resistance Test :

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

9.3 On completion an electic installtion (addition and alteration) a certificate shall be furnished by the Contractor countersigned by the certified Supervisor under whose direct 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 Executive Engineer Divisions all joints in conductor shall be means of approved mechnical connectors in suitable and approved junction boxes but looping back system shall be preferable. In wirig unless otherwise specified Phase and live coduct shall be looped at the switch box where as a neutral conductor can be looped from light, fan or socket. In non-residential buildings, neutral and earth coutinuity wire shall be brought to each of the switch boards should be of adequate size to accommedate at least one number of 5 Amps. socket outlet and control switch in future.

11. Switches :

Main Switchears, 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 sutiably protected.

11.2 All swiches and circuit breakers shall be constructed in accordance with the I. S. 4237-1967. General requirement for switchgear and control gear for voltage not exceeding 1000 valts and other relevant I.S. provided also that spring shall be either of phospher 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 or within 2.5 m. of any washing unit in the washing rooms of laundries or in the bath rooms, lavatories, toilets or kitchens.

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 borad not be installed so that its bottom 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 pannel 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.

11.8 Equipments which are on the front of a switch board shall be so arranged that inadvartantly personal contact with live parts is unlikey during the mainpulation of switchagears, 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. form any edge of the pannel.

11.10 The various live parts, unless they are effectively screened by substantial barriesrs of non-hydroscopic, no-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 pannel 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 whenever accessible.

11.15 All switch board 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 throughout the installation shall be such that there is no break in the neutral wire except in the form of a linked switchegear. 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 earthel neutral conductor of a multi-wire system or a conductor which is to be connected thereto, an indication of a permanet nature shall be provided to identify the earther neutral conductor. In this connectio Rule 32 (1) of Indian Electricity Rules, 1956 (See Appendis 'S') 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. thick and shall be provided with a hinged cover to enable the board to swing open ofr examination of the wiring at the back. The joints shalll be welded. A teak wood board, thorughly protected both inside and outside with good insulating conforming to IS-347-1952 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 beard and the cover, the teak wooe board and the cover, the distance being incressed 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 securily fixed to the wall by means of rag bolts, pulgs of wooden Gutties and shall be provided with a locking arrangement and and earthing stud. All wires passing through the metal board shall be bunched. Alternatively, hinged type metal boards shall be made of sheet munted on channel or angle iron freme.

Note : *Subh 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 of 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 meter 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.

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

13.3 **Teakwood Boards :** for small installitons connected to a single phase 230 volts supply teak wood boards may be caused as main boards or sub-board. These shall be of seasoned teak or other durable wood with solid back imprenated with varnish of approved quality with all joints dovertailed.

13.4 In large size medium voltage installations, before proceeding with 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 overal 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 hinged pannel of teak wood or other suitable materials such as balelite, or with unbreakable glass doors in teak wood frame with loocking arrangement, the other surface of the door 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 switch board shall be so arranged that inadevertenty 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 pannel. 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 pannel.

(c) The various live parts, unless they are effectively screened by substantial barriers of non-hydroscopic, non-inflammable isulating 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 evety 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 switch board pannel or flame.

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 of its different terminals may have been connected.

Alternating Current	**Direct Current**
Three-phase-red	Three wire system-2 outer wires
Yellow & Blue	Positive red & Negative Blue

Natural-Black Natural-Black

Where fuse-wire three pahase wiring is done, the neutral shall be in on 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 setion of the installation it controls.

(c) All markings required ounder 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 conducor of each circuit and the earthed neutral conductor shall be connected to acommon 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 distibution board.

13.8.3.2 In residential installations, lights and fans amy be wired on a common circuit, such sub, circuit shall not have morethan 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 othe similar installations requiring the use of group control of switching operation, circuits, for socket outlets amy be kept separate form fans and lights. Normally fans and lights may be wired on a common circuit, however, if need 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 percent increase in load due to any future modification. Power sub-circuits shall be designed according to the 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 outles 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 te centre of the load they are intended to control.

13.9.2 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 explosed to explosive dust, vapur 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 interiocked 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 distributio unless specific approval of Engineer-i-charge is obtained. In special cases where use of Tripple 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 diivided, as far as possible, evently between the number of ways of the boards leaving the spare circuit for future extension.

13.10.2 All connection between peices of apparatus or between apparatus and terminals on a board shall be neatly arranged in a definete sequence following the arrangemet of the appartus mounted thereon, avoiding unnecessary crossing.

13.10.3 Cables shall be connected to a terminal only be 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 stands.

13.10.4 All bare conductor shall be rigidly fixed in such a manner that clearance of atlteast 2.5 cms. is maintained between conductor of oposite polarity or phase and between the conductors and any matrial other then insulating material.

13.10.5 If required a pilot lamp shall be fixed and connected through on independent singlepole switch and fuse to the bus-bars of the board.

13.10.6 In a hinged type board, the incoming and outgoing calbes 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 pannel. The cables between these points shall be arranged to on the switch board pannel. 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 pannel to swing through an angle of not less then 90^0.

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 centres 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 emplyed. Care shall be taken to see that wires pass very freely through protecitve pipe or box and that the wires pass through in a straight line without any twist or cross in wires, on either ends of such holes.

(a) A teak wood box entending through the whole thickness of the wall shall be buried in he 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 Metalic conduits for Electrical Istallations, 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 pasing through floors shall be protected from mechanical injury by means of rigid steel conduit (see * IS 1653-1964) to 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 thrned 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 c. 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 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 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, meatilic or a fibre fixing plug.

17.0 Branch Switches :

Where the supply is derived from a three-wire of 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-pahase switch or fuse shall be inserted in the middle wire, earth or earthed neutral conductor of the circuit, Single-pole swiches (other than for multiple control) carring not more than 15 apmperes may be of tumbler type which shall be 'ON' when the handle known is down.

18.0 Fittings :

Where conductors are required t be threaded through tubes or chanels 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 wierd 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 suffcient 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 ventiated.

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 Araea cord. mm²	**No. & Dia in mm of wires.**	**Max Permissible wight Kg.**
0.5	16/0.2	1.7
0.75	24/0.2	2.6
1.0	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

8.2 No inflammable shade shall form a part of light unless such shade is well protected against all riskes of fire. Celluloid shade or liight fitting shall not be used under any circumstances.

8.3 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, the sub-circuit loads shall be terminated in a ceiling zone or connector from which they shall be carried into the fitting.

9.0 Lamp Holders :

Lamp holders for use on brackets and the like shall be in accordance with "IS : 1258-1967, specification ofr Boyonet lampholder and all those for use flexible panants shall be provided with cord grips. All lampholders shall be provided with shade carriers.

Where centre contac edison screw lampholders are used, the outer or screw contacts shall be connected to the middle wire, the netural, and the earthed conductor of the circuit.

20. Outdor Lamps :

Extrnal 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 shallbe inserted in the fittings. Flexible cord and cord grip lampholders shall not be used where exposed to weather. In verandahs and similer exposed situations where pandants are used, they shall be of fixed road type.

21.0 Lamps :

All incondescent lamps, unless otherwise required and sutiably protected, shall be hung at a height fo not less than 2.5 m abovethe floor level, They shall be in accordance with IS : 418 : 1957 specification for Tongster Filament General service electric lamps.

22.0 Fans, Regulators and Clamps :

22.1.0 Celling fans :

Ceiling fans including their suspension shall conform to * IS 374-1960 specification for electric ceiling fans and regulators (Revised) & to the following requirements :

(a) All ceilling 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 supension rods. There shall be no joint in the supension rod, but if joints be unavoidable then such joints shall be screwed to sepecial 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 amy be welded.

(b) Fans clamps shall be of suitable design accroding 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 reinforeced concrete roots shall be buried with the casting end 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 togeher. Fan clamps for steel jjoint 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.

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 nominal cross-sectional area not less than 1.0 mm2 with copper and 1.5 mm2 with aluminium and shall be protectd from abrasion.

(e) Unless otherwiise specified, the clear distance between the ceiling fand and the floor shall not beless than 2.75 m.

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 holes as possible by means of a flexible cord, care being taken that the blades rotate in the proper direction.

23.0 Attachment of fittings and acessories :

23.1 In other than conduit wiring, all ceiling crosses, brackets, pendants and accessories attached to walls or ceilings shall be mounted on substanitial 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 only shall be used for attaching fittings and accessories to their base blocks.

24.0 Interchargeability :

Similar part of all swiches, lampholders, distribution fuse-boards ceiling rosed, breackts, pendants, fans and all other fittigs of the same type shall be interchangeabale 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 gieven in Table II

25.1.2 Bunching of cables - Unless otherwiise specified, insulated ocnductors 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 accessories only (*IS L 2667-1964).

Specification for Fittings for Rigid Steel Conduits for Electrical Wiring) : In long distance stance stright runs of conduit, inspection type couplers at reasonable intervals shall be provided or running thereads 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 of full threaded portion of couplers or accessories Cut ends of conduit pipes shal have no sharp edges nor any of buries left to avoid damage to the insulation of conductors while puiiling them through such pipes :

TABLE - II
MAXIMUM PERMISSIBLE NUBER 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 Crossect-ional area.	No. and Dia. in mm of wires	16 : 50 : : :		20 :		25 : (No. of cables, Max) : :		32 :		40 :	
		S	SB	BS	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	1/2.24	3	2	4	3	7	6	12	10	-	-
		(3/1.06*) (7/0.85)									
6	1/2.80	2 (7/1.06*)	-	3	2	6	5	10	8		
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	-	-	-	-	-	-	3	2	5	4	7
		6	9	7								
35	7/2.50	-		-	-	-	-	2	-	4	3	7
		5	8	6								
50	7/3.00+	-	-	-	-	-	-	-	-	2	-	5
		4	6	5								
	19/1.80	-	-	-	-	-	-	-	-	-	2	-
	5	4	6	5								

For Cu. Conductors only. + For Al. conductor only.

NOTE 1 *The cable shows the maximum capacity of conditions 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 form the straight by angle of more than 15^0 The columns headed 'B' apply to runs of conduit which deflect from the straight by an angle of more than 15^0.*

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 considered as that of a straight conduit even if the conduit deflects through the straight by more than 15^0.*

25.1.4 **Protection against dampness -** In order to minimise condensation ro sweating inside the tube, all outlets of conduit system shalll be property 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 particulary 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 metre but on either side of couplers bends or similar fittings. Saddles shall be fixed at a distance of 30 cm. from the centre fo such fittings.

25.1.7 **Bends in conduit -** All necessary bends in the system including diversion shall be done by bendign pipes. or insering suitable solid or inspection type normal bends, elbows or similar fittings; or by fixing cast iiron inspection boxes whichever is more suitable. Conduit fitting shall be avoided as far as possibe. On conduit ststem 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 ofr 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 **Conductor -** All conductor used in conduits wiring shall preferably be stranded. No single-core cable or nominal Corss-sectional area greater than 130 mm2 shall be enclosed in a couduit and used for alternating current.

25.1.10 **Erection and earthing of coduit -** The conduit of each circuit or section shall be completed before conductors are drawn in. The entrie syste of conduit after erection shall be tested for mechanical and electrical continuity throughout and permanently connected to earth conforming to the requirements specified under 7 by means of special approved tupe earthing clamp effeciently fastened to conduit pipe in a workman like manner for a perfact 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 addition, conform to the requirements specified in 6.52.1 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 disired. 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 or 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 longe radius which will permit easy drawing in of conductors. All theraded joints of rigid steel conduit shall be treated with some approved preservative compund 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 suitable insulating material. The switches and other outles 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-Metalic 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-The conduit may be either threaded type or plain type as specified in IS : 2509-6913* 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 isulated 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		Size of conduit (mm.)					
Nominal Cross Sectional Area mm^2	No. & Diameter in mm. of wires	16	20	25	32	40	50
		(Numbe of Cables, 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	1/2.24	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	7/300+ 19/1.80	-	-	-	-	2	3

*** For copper conductors only.**

+ For aluminium conductors only.

25.3.3 Conduit joints - Conduit joints shall be jointed 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 diverisons may be achieved by bending the conduits (See 6.5.3.9) or by employing normal bends, inspection bends, inspection boxes, elabows 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 minimuse condensation or sweting inside the conduit, all outlets of conduit system shall be properly drained and vantilated, but in such a manner as to prevent the entry of inspects, etc. as far as possible.

25.3.8 For use with recessed conduit wiring system the provisions of6.5.2.1 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 plaint conduits. As the material soften when heated, fitting of conduit in close proximity ot hot suraces should be avoided. Caustion should be exercised in the use of the conduit in locations where the ambient temperature is 500 C or above. Use of such conduits in place where ambient temperature is 600 C or above is prohibited.

PVC INSULATED 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 ceilling :

26.1.1 All cables on brick walls, stone or plastered walls ceiling shall be run on 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 of which shall be such as to suit total width of cables laid on the betten, prior orerection, 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 raws 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 inconspicuously as possible. The wiring should then be fixed to this backing in the ordinary way. Where wiring passes through structural steel work, the hole 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.

26.2.0 **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 allthese 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 sw. mm. above while a single clip shall hold a single twin core or two single core cablbes. The clips shall be fixed on varnished wood batten switch iron pins and spaced 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 any circumsatances be bent so as to form an abrupt right angle but must be ruouded off at the corners to radius not less than six times the overall diameter of the cable.

26.4.0 **Protection of wiring form Mechanical Damage :**

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

26.4.2 Such protective covering shall in all ceses 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 trough 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 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 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 property 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 specific 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 efter the cables are laid. Where junction boxes are proided they shall be made misture 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 statred. 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 rivets, 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 promer 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 protecteed by covering. All stains, smears, oplashings, 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 trusser, etc.

28 **Link clip :**

The clip for batten wiring shall be of Aluminium conforming to I. S. specification No.2415-1975.

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.	**Authorisation.**
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 cut-out therein.
33.	Earthed terminal on consumer's premises.
36.	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 of high and extra-high voltage system.
67. Connection with earth. (High & Extra-high voltage system).
68. Gerneral conditions as to transformation and control of tenergy.

All Clauses under Chapter VIII on Overhead Lines.

137. Mode of entry.
138. Penalty for braking 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, if complies with Indian Electricity Rules 1956 as well as the C.P.W.D. Geenral Fpecification for Electrical Works 1972.

Electrical Installation at _____ Voltage.

(1) Particulars of Works :

(a) Intrnal Electrical Installation No. Total Load Type of system of wiring.

(i) Light point

(ii) Fan point

(iii) Plug point

(a) 3 pin 5 Amp.

(b) 3 pin 15 Amp.

(b) Others :

Description	HO/KW	Type of starting
(a) Motor:	(i)	
	(ii)	
	(iii)	

(c) Other Plants:

(d) if the work involves installation of overhead line/or underground 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. ohms

(d) Earth Electrod 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 bounding is effected with electrode and metal in/on the structure. ohms

Signature of Supervisor Signature of Contractor

Name & Address Name & Address

SPECIFICATION

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

(1) Indian Electricity Act. 1910 with its amenudments.
(2) Indian Electricity Rules, 1956 and its emendments.
(3) Indian Electricity supply Act. 19948.
(4) Regulation for Electrical Equipment in building by I.E.F. London.
(5) The Factory Act, 1948 and its amendments.
(6) I. S.-732-1982 Part-I, II & III code of practice for Electrical wiring and fittings in buildings for low and medium voltages.
(7) I. S. 4064-1967 H. D. Air break switches and fuses for Voltages not exceeding 1100 volts.
(8) I.S. 3043 - Earthing code of practice for
(9) I.S. - 1554 Part-I 1970 PVC insulated (Heavy duty) Electrical Cables for working voltages upto and including 1100 volts.
(10) I.S. : 694 - 1964 Part - II - PVC insulated cable with Alluminium conduits (revised) for voltages upto 1100 volts.
(11) I.S. : 5908-1970 Electrical installations in buildings method of measurements of.
(12) I.S. : 4237-1967 General requirement for switchgear and control for voltage not exceeding 1000 volts.
(13) I.S. 1653-1964 - Rigid steel conduits for electrical wiring (revised)
(14) I.S. : 2509-1973 - Rigied steel conduits for electrical installation. (First revision)
(15) I.S. : 1258 - 1967 - Beyonet lampholders (First revision)
(16) I.S. : 418-1957 - Tungston-Filament General service electric lamps (Third revision)
(17) I.S. : 374-1966 - Fans and Regulators, ceiling type, electric (second revision)
(18) I.S. : 2667-1964 Fittings for rigid steel conduits for electrical wiring.
(19) I.S. : 3419-1976 - Fitting for rigid non-metallic conduits (First revision)
(20) National Electric Code, 1986

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 dieletric or otherwise, for its insulation from earth.

(3) **Bare :** Not covered with insulating material.

(4) **Diaelectric :** Any material which offers high resistance to the passage of the an electric current.

(5) **Bunch Conducter :** 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 I.S. : 5908-1970-Method of 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 work 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 of 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 opening 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 producted 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) Overtheading 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 contacts cannot accidently close when left open.

(c) The basis must be of incombustible, non-conducting and moisture proof material.

(d) Circuit breaker 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 have their live parts covered. The covers must be of incombustible material and must be either non-conduction 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 contract 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

Executive Enginner
Ahmedabad Electrical Division No.1,
Ahmedabad

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 accordaance 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, clocks, sockets, etc., including fixing of lighting fixtures and fans etc., **and miscellaneous points.**

(b) Conduit and wiring system for **exhaust fans sockets etc.**

(c) Panel boards, distribution boards.

(d) Complete power and lighting

(e) Grounding system.

(f) Conduits system.

(g) Street lighting system

(h) Other miscellaneous electrical

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, whether 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 equipment’s and the installations should be guaranteed at least for a minimum period of one year from the date of taking over the installation by the Department. All equipments must comply with the relevent 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 contact shall be supplied as obligation under the contract.

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

SECTION F-2A

Specifications for Electrical Installation in Buildings

1 GENERAL :

1.1 These specifications relate to the electrical installations in the buildings of P.W.D. Electrical. The specifications cover general requirements to be fulfiled. 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 equipment's of buildings, published by the institute of Electrical Engineers London (14th Edition 1966 and as amended upto date) hereinafter 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. regualtions these specifications or special specifications as the case amy be, shall be followed. The installation shall also comply with the requirements of the Indian Electricity Act. 1910 as amended upto date and rules issued thereunder and also the regulations for the electrical equipments of buildings issued by the Bombay Regional Council of Engineer 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 or British Standard specifications.

1.4 DEFINITONS :

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 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 of 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 Sample of materials wherever required should be approved by the 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 prerequisities for complying with the clauses of these specifications. With a view to ensure fine workmanship the tenderers shall employ licensed wiremen with an experience of not less than 5 years in the type of work they are engaged. The work should be done under supervision of licensed Electrical Supervisors with good educational qualifications and considerable experience.

1.7.2 Tenderers shall furnich the names of Supervisior and their wiremen who will be engaged in this work with details of thier experience.

1.8 CO-OPERATION 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 in reference 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 equipments or accessories. Where the Contractor fails to furnish such information as may be required for the purpose of concealing the equipments 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 chases 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 for the testing and commissioning of those installtions 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 CERTIFIATE 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 guaranted for period of 12 months 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 asses 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, ransport, 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 form 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 SPECIFICATIONS :

2.1 Supply System :

The wiring installion shall be suitable for 3 phase 4 wire, 400-400 v 50 cycles sysem of supply. Colour code of different phase shall be followed as per standard.

2.2 Wring 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 form 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 primary, point, Loop wiring ffrom 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 a cross section less than that of 2.5 sq. m (aluminimum).

2.2.4 Loading :

No final sub-circuit radiating form the fuse board of a sub-distribution board and wires with 25 sq. m. (At.) cable shall carry more than 10 lights. fans or socket outlets or a connected load of 800 walts whichever is grater. The following wattages may be assumed for estimating the load on each sub-circuit unless otherwise know or specified.

Incandescent Lamps	100	watts
Ceiling fans	60	watts
5-A Socket Outlets (lighting)	100	watts
4. ft. flourencent tube	50	watts
5. ft. flourecent 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-disstribution board shall accordingly numbered.

2.2.5 Local Control Switches (Gerneral) :

Local control switches for circuit carrying not less than 5-A shall be piano type and shall conform torelevant 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 conducotr, switch box is 1.3 mtr. from the finished floor level unless otherwise stated. All switch boxes shall be provided with 1/8" thick prespex cover fixed to the switch box with chromium plated counter sunk screws (brass).

2.2.5A Swiches (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 prespex cover painted inside with the wall colour, if required.

(d) Eah switch shall be suitable for the position in a corridor stairway wiring.

2.2.5.BSwitch Boxes (General) :

Electircal circuits shall be written suitably on the cover of all switch boxes, as approved by the Engineer-in-charge (Elect). Whenever different phase are terminated in a switch box bakelite 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 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 thereform. 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 then 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 isulated form 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 burried in concrete during construction in an approved menner and securely bound to the reinforecement.

2.2.10 Conduits and Earthing :

All conduits feeding lighing 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	1000	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 fo the Distribution board even if the current in the sub-cricuit 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. specifition for gauge for different sizes of conduits. When the motor is resilienly mounted flexible conduit with approved adopters shall be used for the last few feet. Where cables are used sufficient loop shal 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 asociation 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 connection 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 receptanles shall have their earth terminals connected by independent earth wires to ring main earth strips on the building. In building where explosion proof fixtures are installed single phase plug receptanles 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 weldd to the box

Each unit shall be suitble 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 throughly study the sructural arrangements of the buildings and wherever necessary, shall in consulation 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 planted after installtion with the colour as approved by the Engineer-in-charge. This do not apply to galvanised conduit.

2.4.3.AProtection against insects and demp :

In order to minimise cocensatio or sweating inside the conduit, system shall be properly drained and 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 form 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 istallation of meduim 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 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, cables markers etc., as required to make the installation work including digging and back filling of the treanches as required.

II. SPECIFICATIONS :

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 IS BS specifications.

ii. All cabling materials such as cable compound, cable lugs, tapes shall be of approved quality aceptable to the type recommended by the manufacturer of the cable for which it is used and approved by the Department.

iii. Installation of all equipemnt 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 sarely, earthing of equipments and other essential provision specified therin.

iv. Only approved make of cable be used. ICC and CCI will be preferred.

v. The cables shall generally be laid as per IS Code of Practice.

III. GENERAL RULES FOR 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.

ii. Cables shall be laid preferebly in one piece length to avoid joints. If straight joint are found necessary, these can be introuduced 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 kind etc. and should it become necessary a cable be bent to a redius 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 protions of the installation which do not meet with the Department's approval. All damages to the civil an other works on this account shall be made good by the Contractor at no extra cost to the Department.

The electical Contractor while notifying the building Contactor for such work shall furnish the proper drawigns, fully explaining the work involved or indicate at site actual work to be carried out as may be required by the building Contractor. The electical Contractor shall also notify the buiding contractor in wirting, for finishing up as required, 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 cables pass thorugh roads nallahs, etc., cables must be protected by Class ‘A’ Hume pipe of diameter not less than 6" (15 cm)

vi. The calbe route shall be the shortest and there shall be minimum interfernce with built up areas, lawns etc.

vii. Care shall be exercised for providing suitable props for supporiting other service lines on earth at the time of excavation. Where cutting of a lown become inevitable it should be with the approval of the Engineer-in-charge.

viii. Excavation of the trenches shall be executed with verticle 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 specifiled as 1/2 core in multicore 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 an 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 APLSTS cables. The armour should be connected to the right main earth in building with duplicate earth wires as per the relevant IS/BS specifications.

The core isulation over each conductor shall however be retained throughout 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 as aleap, and Eyre No. 7 liberally used.

The joint shall be mechanically strong and pressure tested.

2.6 DISTRIBUTION BOARDS AND PANELS :

General Requirements :

2.6.1 All distribution panels shall comply with I.E.E. Rules 60-61. A clear distance of 0.91b 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 furtherest outstanding part of any attachment or conductor. If the space behind the switch board exceeds 0.76 main width there shall be a passage way from either end of the switch board clear to hight of 1.928 m width 0.299 m. All wiring connection shall be made neatly and securely.

2.6.2 For corciots 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 isolaters D.Bs. shall be complete with earthing lugs neutral bar link. H.R.C. fuses and of approved make.

2.6.3 Skeleton type panels shall have rigid framework adequately braced and supported. The switch and distribution boards shall be neatly arranged in the frame. The details of the framework 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 amde form the back of switches. The panels shall be rendered dust and vermin-proof. The interior of the panels shall not be accessible to unauthorized 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 in 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 not less than 2 distinctive paths to earth. Earthing of metalic 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 form 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 electircal 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 knockouts for branch circuits, conduit entries shall be drilled in and files as required. For lighting panels the top and bottom cover plates shall be removable type.

(e) Main disconnects device for all panel boards shall be of switches of disconnect type and of the size as indicated. It 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 plug for connection to the grounding system.

(h) Temperature rise of all electrical parts shall not be more than 300^0 C with full load measured at room temperature.

(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 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 interconnections.

(n) Panel should be self-supported on angle channel iron framework. It should be preferably of bolted construction in case of transportation and flexibility. The frame 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 as to be accommodated in the existing room as per I. S. rules and I. S. codes of practice for installations of medium voltage switchgear.

(p) Fabrication drawing showing the detailed dimensions and panels and its components indicating the frame work earthing positioning of switches, D. Bs. cable boxes, adopeter chambers etc. shall be furnished to 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. Us.

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.mm. for copper. The length of bus-bar chamber should be as suitable length to fix all the switches etc. as per prevailing standards. Clear spacing of two adjacent buses shall be 1.1/2" Minimum ber should be taped all along with colour coated 11 KV grade PVC tape. Te maximum internal support for each unsupported length shall exceed 600 mm.

The bus bar shall be of copper/alluminium and fabricated to the relevant standards specification. In case alluminium bus bar is used special with high conductivity alluminium 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 bar enclosing shall be made out of not less than 16 gauge M. S. sheets 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 interconnection 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 tender 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 Reptuing Capacity Catridege Fuselinks complying with IS 2208 or BS 88 and having certified returning 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 specifiled 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 adapter boxes. All switches mounted on the top of the busbars shall be provided with detachable type reverse entry adapter boxes. Suitably engraved lables shall be provided for eah circuit as well as for the board.

A meter with sector switches and LMH metre shall be provided where specifically mentioned. Small wiring for the inter-connecting shall be colour coded and provided with numbered figures for easy identification of circuits.

(a) The distribution boards should be totally enclosed metal clad complying with B. S. 214. The

M. S. shet steel enclosures for recessed D. Bs. shall be of not less than 14 guage.

(b) The D. B. 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 installion.

(d) The D. Bs. shall have proper size cut outs for conduits entry or cable entry or cable entry as required adn these shall be made on site.

(e) Adequate spacing shall be provided inside the D. Bs. for easy removal of the fuses and carry out the interconnection.

(f) A set of insulating barriers have to be porvided between incomming breakers switches and fuses.

Switchfuse Units :

(a) All the D.P.T.P. and T.P.N. switch fuse units shall be totally enclosed iton clad quick make, quick dreak 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) Eah T.P. & T.P.N. switch fuse unit shall be earthed with two distinct earth connections.

(c) Suitable insulator shall be provided between phase.

(d) There shall be suitable netural link in the fuse box.

(e) All T. P. & T.P.N. switch fuse units shall be rated for 500 valts and D.P. (required for single phase supply) and S.P.N. switches for 250-volts.

(f) The H.R.c. catridge fuse shall conform to H. S. 88 (1952).

The O.C. Bs. ACB shall be suitable for 400/440 volts 3 phae 50 cycle supply capable of interupting a fault MVA. of not less than 31. The circuit breaker shall conform to the BSS-936-1940 BSS 3659 with such tripping arrangements as may as required under special specifications for the building. Effecient and fool-proof mechanical interlocking shall be provided for he safe operation and maintencace. The rate shall be inclusive of the first filling of oil.

2.7 Instrumentation :

The instruments and meters wherever shall be housed in specail 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 insturments 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 cycles (in balanced load) supply.

Each selector switch shall be 3 point and of minimum 250 volts grade with siilver tippe contacts suitable for metering circuits. Current tranformer shall be of 5VA bruden and 250V grade. Eveny unit shall be prewired and interconncected 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. indicated iin relevant lrawing. Actual location and levels shall however be arrived at site in co-ordination with other services etc. and prior approval of the Engineer-on-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 fixtues layout ins indicated in drawings. Care shall be taken to see taht all light fiixtures are in a row in a room or particular area, are in absolute line and plump and are symterically 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 be means of flexible copper wire of section not less than 1.5 mm^2.

5. All fixtures suspended by means of conduits shall be done with all annd socket joints or as per approved design.

2.9 Telephone System :

1. Empty conduiting shall be done, receed 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 conduiting under section "Wiring in Conduits" except the G. I. pull wires of guage not less then 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 loacation shall be decided in the field by the Engineer-in-charge.

SECTION - G
SPECIFICATION FOR EARTHING

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 should be in separate pits at least 150 cms to 300 cms. away form the buidling at a depth necessary to reach moist earth surface but with a minimum depth of 2.5 mtr form the finished ground level upto the top vertical dodge of earth electorde. The earth plate shall be throughly cleaned to remove all dirt form the surface and be tinned property 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 upon the depth of pit 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 type 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 regualtions. The nasonary enclousures shall be 25 cm x 25 cm (deep) with C. I. lid of 23 cm x 30 cm 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.

Signature of Contractor **Executive Enginner**

IMPORTANT INDIAN STANDARDS

Sl. No.	Standard	Title
(1)	IS 732:2019	Code of practice for electrical wiringinstallations (fourth revision)
(2)	IS 4648:1968 (R 2017)	Guide for electrical layout in residential buildings
(3)	IS 8061:1976 (R 2016)	Code of practice for design, installation and maintenance of service lines upto andincluding 650 V
(4)	IS 8884:1978 (R 2002)	Code of practice for the installation ofelectric bells and call systems
(5)	IS 5578:1984/ IEC 60391(1972)	Guide for marking of insulated conductors(first revision)
(6)	IS 11353:1985/ IEC 60445 (1973)	Guide for uniform system of marking andidentification of conductors and apparatus terminals
(7)	IS 13234:1991/ IEC 60909: 1988	Guide for short circuit current calculations inthree-phase ac systems (superseding IS 5728)
(8)	IS 7752 (Part 1): 1975	Guide for improvement of power factor in consumer installation: Part 1 Low andmedium supply voltages
(9)	IS 3646 (Part 1): 1992	Code of practice for interior illumination: Part 1 General requirements and recommendations for working interiors (first revision)
(10)	IS 3646 (Part 2): 1966	Code of practice for interior illumination:Part 2 Schedule of illumination and Glare index
(11)	IS 3646 (Part 3): 1968	Code of practice for interior illumination: Part3Calculation of coefficients ofutilization by the BZ method
(12)	IS 4347:1967	Code of practice for Hospital Lighting
(13)	IS 6665:1972	Code of practice for industrial lighting
(14)	IS 2672:1966	Code of practice for library lighting
(15)	IS 10118 (Part 1):1982	Code of practice for selection, installation and maintenance of switchgear and controlgear : Part 1 General
(16)	IS 10118 (Part 2):1982	Code of practice for selection, installationand maintenance of Switchgear and control gear : Part 2 Selection
(17)	IS 10118 (Part 3):1982	Code of practice for selection, installationand maintenance of switchgear and control gear : Part 3 Installation
(18)	IS 10118 (Part 4):1982	ode of practice for selection, installation and maintenance of switchgear and controlgear : Part 4 Maintenance
(19)	IS 4146:1983	Application guide for voltage transformers(first revision)
(20)	IS 4201:1983	Application guide for current transformers(first revision)

(21)	IS 5547:1983	Application guide for capacitor voltagetransformers (first revision)
(22)	IS 2309:1989	ode of practice for protection of buildings and allied structures against lightning(second revision)
(23)	IS 3043:1987	Code of practice for earthing (SecondRevision)
(24)	IS 5216 (Part 1):1982	Recommendations on safety procedures andpractices in electrical work: Part 1 General
(25)	IS 5216 (Part 2):1982	Recommendations on safety procedures andpractices in electrical work: Part 2 Life saving techniques

Sl. No.	Standard	Title
(1)	IS 555:1979	Electric table type fans regulators
(2)	IS 1169:1967	Electric pedestal type fans and regulators
(3)	IS 374:1979	Electric ceiling type fans (fourth revision)
(4)	IS 2997:1964	Air circulator type electric fans and regulators
(5)	IEC: 60665 (1981) IS 2312:1967	Propeller type ac ventilating fans
(6)	IS 3588:1987	Electric axial flow fans
(7)	IS 3963:1987	Roof Extractor units
(8)	IS 4283:1981	Hot Air Fans
(9)	IS 6272:1987	Industrial Cooling Fans (man Coolers)
(10)	IS 4894:1987	Centrifugal Fans
(12)	IS 12155:1987	General and safety Requirements for Fans and Regulators for Household and similarpurposes

Sl.No.	Standard	Title
1)	IS 4237:1982	General requirements for switchgear and control gear for voltages not exceeding 1000 volts ac or 1200 volts dc
2)	IS 6875 (Part 1): 1973	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages up to and including 1000Vac & 1200Vdc: Part1 General requirements [superseded by IS13947 (Part5/ Se ction1)]
3)	IS 6875 (Part 2): 1973	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages up to and including 1000Vac and 1200Vdc :Part2 Push- buttons and related control switches [Superseded by IS 13947 (Part 5/Section1)]
4)	IS 6875 (Part 3): 1980	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages up to and including 1000 V ac and 1200 V dc : Part 3 Rotary control switches [superseded by IS13947 (Part 5/ Section 1)]
5)	IS 10027:2000	Composite units of Air-Break switches andRewireable Type Fuses for voltages Not Exceeding650voltac-Specification (Second revision)
6)	IS 4064 (Part 1): 1978	Air-break switches, air break disconnectors, air-break switch disconnectors and fuse- combination units for voltages not exceeding1000 V ac or 1200 V dc: Part 1 General requirements (revised) [superseded by IS 13947 (Part 3): 1993]
7)	IS 2675:1983	Enclosed Distribution Fuse Boards and CutOuts for voltages Not Exceeding 1000 V A.C. or 1200 V D.C.
8)	IS 8828:1996	Electrical Accessories Circuit-breakers for over current protection for household and similar installations (second revision)
9)	IS 13032:1991	AC Miniature Circuit Breaker Boards forvoltage Not Exceeding 1000 Volt
10)	IS 12640 (Part 1): 2008	sidual Current operated Circuit Breakerwithout integral over rrent Protection for Household and similar uses (RCCBs) Part 1 neral Rules (Second Revision)
11)	IS 12640 (Part 2): 2008	Residual Current Operated Circuit-Breakerswith integral over current Protection for Household and similar Uses Part 2 General les (Second Revision)
12)	IS 2959:1985	ntactors for voltages not exceeding 1000V ac or 1200 V dc
13)	IS 12021:1987	Control transformers for switchgear forvoltages not exceeding 1000 Volt AC ecifications (first Revision)
14)	IS 5039:1983	stribution pillars for voltages not exceeding 1000 volts AC and 00 VDC

15)	IS 8623 (Part 1):1993/ IEC 60439-1 (1985)	Low voltage Switchgear and control gearassemblies: Part 1 Requirements for type-tested and partially type tested assemblies. uspended IS/IEC 61439-2:2011)
16)	IS 8623 (Part 2):1993/ IEC 60439-2 (1987)	Low voltage switchgear and control gear semblies: Part 2 Particular requirementsfor Busbar trunking stems (Busway)
17)	IS 8544 (Part 1): 1977	otor starters for voltages not exceeding 1000 V: Part Direction line starters [superseded by IS 13947 (Part 4/Section 1): 1993]
18)	IS 8544 (Part 2): 1977	otor starters for voltages not exceeding 1000 V : Part 2 Star-delta arters [superseded by IS 13947 (Part 4/ Section 1): 1993]
19)	IS 8544 (Part 3/ Sec 1): 1979	otor starters for voltages not exceeding1000 V : Part 3 Rheostatic otor starters, Section1 General requirements [superseded by IS 947 (Part4/Section 1):1993]
20)	IS 8544 (Part 4): 1979	otor starters for voltages not exceeding 1000 V: Part 4 Reduced ltage ac starters:two step auto-transformer starters [superseded IS 13947 (Part 4/Section 1): 1993]

Sl.No.	Standard	Title
1)	IS 694:1990/ IEC 60227- 1 to 5 (1979)	PVC Insulated cables for working voltagesup to and including 1100 V
2)	IS 694: 2010	Polyvinyl chloride insulated sheathed andunsheathed cables with rigid and flexibleconductor for ratedvoltages upto and including : Part 1 General requirements (fourth revision)
3)	IS 1554 (Part 1): 1988/IEC 60502 (1983)	PVC insulated (heavy duty) electric cables:Part For working voltages including 110 V
4)	IS 3961 (Part 1): 1967	Recommended current ratings for cables:Part 1 Paper insulated lead sheathed cables
5)	IS 4288:1988	PVC insulated (heavy duty) electric cables with solid aluminium conductors for voltages up to and including 1100 V (second revision) (withdrawn)
6)	IS 4289 (Part 1): 1984/ IEC 60245-5	Flexible cables for lifts and other flexibleconnections: Part 1 Elastomer insulated cables (first revision)
7)	IS 9537 (Part 1):1980/ IEC 60614-1 (1978)	Conduits for electrical installations: Part 1General Requirements
8)	IS 9537 (Part 2): 1981 documents 23and 23A (Central Office) 29 Draft	Conduits for electrical installations: Part 2Rigid steel conduits (superseding IS:1653)
9)	IS 3480:1966 B.S. 731 : Part-I : 1952 UL 1-1957	Flexible steel conduits for electrical wiring
10)	IS 3837:1976	Accessories for rigid steel conduits forelectrical wiring (first revision)
11)	IS 9537 (Part 4):1983 Documents 23A (Central Office) 23 and 23A (Central Office)	Conduits for electrical installations: Part 4Pliable self-recovering conduits of insulating materials
12)	IS 3419:1988 BS 4607 (Part-1) : 1984	Fittings for rigid non-metallic conduits(Second Revision)
13)	IS 2412:1975	Specification for Link clips for electricalwiring First Revision
14)	IS 371:1999	Ceiling roses –Specification Third Revision
15)	IS 4160:2005/ IEC60884-2-6 (1997)	Interlocking switch socket outlets – Specification

16)	IS 1293:2019/ IEC 60884-1 (2002)	Plugs and Socket-Outlets for Household andSimilar Purposes of Rated Voltage up to and Including 250 V and Rated Current up to andIncluding 16 A — Specification (Fourth Revision)

17)	IS B371:1999	iling roses Specification
18)	IS 4160 : 2005 IEC Publication 60884-2-6 (1997)	terlocking switch socket outlets – ecification First Revision
19)	IS 4649 : 1968	ecification for adaptors for flexible steelconduits
20)	IS 9537 (Part 3) : 1983 IEC Publication 614-2 (1980)	ecification for conduits for electrical installations Part 3 rigid ain conduits ofinsulating materials
21)	IS 9537 (Part 8) : 2003 IEC Publication 60614-2-7 (1995) 2018	nduits for electrical installation – Specification Part 8 rigid non-readbareconduits of aluminum alloy
22)	IS 10276 (Part 1) :1982 a) b) c) Electro technical Commission 238 (1975) Edisonscrew lamp holders. IEC P	ecification for Edison screw lamp holdersPart 1 requirements d tests
23)	IS 10276 (Part 2) :1982 IEC Publication 61 (1969)	ecification for Edison screw lamp holdersPart 2 standard data eets for lamp holdersand gauges
24)	IS 14763: 2022	nduit Systems for Cable ManagementOutside Diameters of nduits for Electrical Installations and reads for Conduits and Fitting
25)	IS 14768 (Part 2) :2003 IEC Publication 61035-24 (1993)	nduit fittings for electrical installations -Specification Part 2 etal conduit fittings
26)	IS 14927 (Part 1): 2001 ISO 9226	ble trunking and ducting systems for ectrical installations Part 1 generalrequirements
27)	IS 14927 (Part 2): 2001	ble Trunking and Ducting Systems for Electrical Installations Part Cable Trunkingand Ducting Systems Intended for Mounting Walls or Ceiling
28)	IS 14930 (Part 7): 2001	nduit Systems for Electrical Installations -Part 2 Particular equirements - Conduit Systems rred Underground
29)	IS 15368: 2003 EEC 61242 (1995)	ble reels for household and similarpurposes

30)	IS 15787: 2008 IEC Publication 60884-2-3	vitch - Socket - Outlets Non - InterlockType
31)	IS 16205 (Part 1): 2017 ice 61386-1	nduit systems for cable management PartI general requirements
32)	IS 16205 (Part 21): 2017	nduit Systems for Cable Management Part21 Particular equirements Rigid Conduit stems
33)	IS 16205 (Part 22): 2017	nduit Systems for Cable Management Part Particular Requirements - Pilable ConduitSystems
34)	IS 16205 (Part 23): 2017	nduit Systems for Cable Management Part23 Particular equirements Flexible Conduit stems
35)	IS 16205 (Part 24): 2017	nduit Systems for Cable Management part24 Particular equirements Conduit SystemsBuried nder Ground
36)	IS 16783: 2018	ble Cleats for Electrical Installations
37)	IS 17039: 2018 IEC 61316: 1999 IEC 61316: 1999	dustrial Cable Reels
38)	IS 17345 (Part 1): 2020 LEC 61534-1	wer Track System Part 1 GeneralRequirement
39)	IS 17345 (Part 21): 2020 IEC 61534-21	wer Track System Part 21 Particular equirements for Power Track SystemsIntended for Wall and iling Mounting
40)	IS/TEC 60309-1: 2002 IEC 60309-1 (1999) IEC 60309-1 (1999)	ugs socket - Outlets and couplers forindustrial purposes Part 1 neral requirements First evision
41)	IS/TEC 60320-2-2): 1998 IEC 60320-2-2:1998	pliance couplers for household andsimilar general purposes rt 2 Sec 2interconnection uplers for household and similarequipment
42)	IS/IEC 60320-2-3): 1998 IEC 60320-2-3:1998	pliance couplers for household and similar general purposes rt 2 - 3 appliancecouplers with a degree of protection higher an ipxo
43)	IS/IEC 60669-2-2): 2006 IEC 60669-2-2: 2008	vitches for Household and Similar FixedElectrical Installations rt 2 Particular Requirements Section 2 Electromagnetic mote-control switches RCS
44)	IS/IEC 60669-2- 1): 2008 60669-2-1	vitches for Household and Similar Fixed Electrical Installations rt 2 Particular Requirements Section 1 Electronic Switches

45)	IS/TEC 60884-2- 5): 1995 IEC 60884-2-5: 1995	Plugs and Socket-Outlets for Household andSimilar Purposes Part 2 Particular Requirements ection 5 Adaptors
46)	IS/IEC 60998-I: 2002	Connecting Devices for Low-Voltage Circuits for Household and Similar Purposes rt 1 General Requirements
47)	IS/IEC 61058 -1 :2000 IEC 61058 – 1: 2000	vitches for appliances Part 1 generalrequirements
48)	IS/IEC 61537: 2006 IEC 61537: 2006 IEC 61537: 2006	ble Management – Cable Tray System andCable Ladder System
49)	IS/IEC 62275: 2018	ble Management Systems – Cable ties forelectrical installations

Sl.No.	Standard	Title
1)	IS 418:2004/ IEC 60064 (1993)	Tungsten filament lamps for domestic andsimilar general lighting purposes
2)	IS 2418 (Part 1): 2018/ IEC 81 (1974)	Tubular fluorescent lamps for general lighting service: Part 1 Requirements and tests (Second revision)
3)	IS 9900 (Part 1): 1981 / IEC 188 (1974)	High pressure mercury vapour lamps: Part1 Requirements and test [Superseding IS 2183 and IS 7023]
4)	IS 9974 (Part 1): 1981/ IEC 662 (1980)	High pressure sodium vapour lamps : Part 1General requirements and tests
5)	IS 1258:2005/ IEC 61184 (1997)	Bayonet lamp holders Fourth Revision
6)	IS 3324:1982/ IEC Pub 400 (1972)	Holders for starters for tubular fluorescentlampsFirst Revision
7)	IS 2215:2006/ IEC 60155(1993)	Starters for fluorescent lamps
8)	IS 1534 (Part 1): 1977 / IEC 82 (1973)	Ballasts for fluorescent lamps: Part 1 Forswitch start circuits
9)	IS 1569:1976/ IEC 566	Capacitors for use in tubular fluorescenthigh-pressure mercury and low-pressuresodium vapour discharge lamp circuit
10)	IS 6616:1982/ IEC 262 (1969)	Ballasts for high pressure mercury vapourLamps

Sl.No.	Standard	Title
1)	IS 1913 (Part 1): 1978	General and safety requirements for luminaires: Part 1 Tubular fluorescent lamps
2)	*IS 10322 (Part 1) :1982 / IEC 598 - 1(1979)	Luminaires: Part 1 General requirements
3)	IS 10322 (Part 2): 1982 / IEC 598 - 1(1979)	Luminaires: Part 2 ConstructionalRequirements
4)	IS 10322 (Part 5/ Sec. 2):2012	Luminaires: Part 5 Particular requirements,Sec 2 Recessed luminaires (First Revision)
5)	IS 10322 (Part 5/ Sec. 3):2012/ IEC60598-2-3 (1979)	Luminaires: Part 5 Particular requirements, Sec 3 Luminaires for road and street lighting(First revision)
6)	IS 10322(Part 5/ Sec 4):1987/ IEC60598-2-4 (1979)	Luminaires: Part 5 Particular requirements,Section 4 Portable general purpose
7)	IS 10322(Part 5/ Sec 5):1987/ IEC60598-2-5	Luminaires: Part 5 Particular requirements,Section 5 Flood lights [superseding IS 1947]
8)	IS 3287:1965	Industrial lighting fittings with plasticreflectors
9)	IS 1777:1978	Industrial luminaires with metal reflectors
10)	IS 2206 (Part 1): 1984	Flameproof electric lighting fittings: Part 1Well-glass and bulkhead types
11)	IS 3528:1966	Waterproof electric lighting fittings
12)	IS 3553:1966	Watertight electric lighting fittings
13)	IS 8030:1976/ IEC162 (1972)	Luminaires for hospitals
14)	IS 7537:1974	Road traffic signals
15)	IS 9583:1981/ IEC 598-2-22 (1980)	Emergency lighting units

Sr. No.	Standard	Title
1)	IS 302 (Part 1):2008/ IEC 60335-1 (2006)	Safety of household and similar electricalappliances: Part 1 General requirements
2)	IS 2268:1994	Electric call bells and buzzers for indoor use
3)	IS 3412:1994	Electric water boilers

Sl. No.	Standard	Title
1)	IS 6236:2020/ IEC 60258(1968)	Direct recording electrical measuring Instruments and Their Accessories (First Revision)
2)	IS 1248(Part 1):2021/ IEC 600 51-1 (1997)	Direct acting indicating analogue electrical measuring instruments and their accessories:Part 1 Definitions and general requirements common to all parts Fifth Revision
3)	IS 1248(Part 2):2021/ IEC 600 51-2 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories:Part 2 Special requirements for ammeters and voltmeters
4)	IS 1248(Part 3):2021/ IEC 600 51-3 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories:Part3Special requirements for Watt meters and varmeters
5)	IS 1248(Part 4):2003/ IEC 600 51-4 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories:Part 4 Frequency meters
6)	IS 1248 (Part 5):2021/ IEC 600 51-5 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories:Part 5 Special requirements for Phase meters, power factor meters and synchroscope
7)	IS 722(Part 1): 1998	AC electricity meters : General requirementand tests
8)	IS 722 (Part 2): 1977	AC electricity meters: Part 2 Single-phasewhole-current watt-hour meters, Class 2
9)	IS 722 (Part 3): 1988	AC electricity meters: Part 3 Three-phase whole current and transformer operated andsingle-phase transformer operated watt-hourmeters, class 2 **Super seeded by :** IS 13010, IS 13779
10)	IS 722 (Part 5): 1980	AC electricity meters: Part 5 Volt-ampere hour meters for restricted power factor range,class 3.5 **Super seeded by :** IS 14415
11)	IS 722 (Part 7/Sec 1): 1987	AC electricity meters: Part 7 Volt-amperehour meters for full power factor range, Section 1 General requirements **Super seeded by :** IS 14372
12)	IS 722 (Part 8): 1972	AC electricity meters: Part 8 Single-phase 2-wire whole current watt-hour meter (class 1.0) **Super seeded by :** IS 13010, IS 13779
13)	IS 722 (Part 9): 1972	AC electricity meters: Part 9 Three-phase whole current and transformer operated watt-hour meters and single-phase two-wire transformer operated watt-hour meters (class 1.0) **Super seeded by :** IS 13010, IS 13779
14)	IS 8530: 1977 IEC 60211:1966	Maximum demand indicators (class 1)

15)	*IS 2992:1987	nsulation resistance testers, hand operated(magneto generator type)
16)	IS 3010 (Part 1) :1965 IEC Doc :23 (Secretariat) 58	Specification for appliance – connectors andappliance – nlets Non- Reversible Three-PinType Part-1 appliance- connectors
17)	IS 3010 (Part 2) :1965 IEC Doc :23 (Secretariat) 58	Specification for appliance – connectors andappliance – nlets Non- Reversible Three-PinType Part-2 appliance- nlets

Sl. No.	Standard	Title
1)	IS 2705 (Part 1): 1992/ IEC 60185 (1966)	Current transformers: General Requirements
2)	IS 2705 (Part 2): 1992/ IEC 60185 (1966)	Current transformers: Part 2 Measuringcurrent transformers **Superseeded by :** IS 16227 (Part 2) : 2016/IEC 61869-2 : 2012
3)	IS 2705 (Part 3): 1992/ IEC 60185 (1966)	Current transformers: Part 3 Protective current transformers
4)	IS 2705 (Part 4): 1992/ IEC 60185 (1966)	Current transformers: Part 4 Protectivecurrent transformers for special purpose applications
5)	IS 6949:1973	Summation current transformers

Sl. No.	Standard	Title
1)	IS 9224 (Part 1): 1979	Low voltage fuses: Part 1 General requirements [superseded by IS 13703 (Part1)]
2)	IS 9224 (Part 2): 1979	Low voltage fuses: Part 2 Supplementaryrequirements for fuses for industrial applications (superseding IS2208) [superseded by IS 13703 (part 2/Section1)]
3)	IS 2086:1993	Carriers and bases used in rewirable typeelectric fuses for voltages upto 650 V
4)	IS 9926:1981	Fuse wires used in rewirable type electricfuses up to 650 volts
5)	IS 8187:1976/ IEC 269-3 (1973)	D-type fuses **Superseded by :** IS/IEC 60269-3 : 2010

Sl. No.	Standard	Title
1)	IS 2551:1982	Danger notice plates
2)	IS 2448 (Part 1): 1963	Adhesive insulating tapes for electrical purposes: Part 1 Tapes with cotton textile substrates

Sl. No.	Standard	Title
1)	IS 1885 (Part 1): 1961	Electrotechnical vocabulary: Part 1 Fundamental Definitions
2)	IS 1885 (Part 9): 2019/ IEC60050 (446):1983	Electrotechnical Vocabulary: Part 9 Electrical relays (Third revision)
3)	IS 1885 (Part 11): 1966	Electrotechnical vocabulary: Part 11 Electrical Measurements **Superseeded by :** Completely Withdrawn
4)	IS 1885 (Part 16/ Sec1):1968	Electrotechnical vocabulary: Part 16 Lighting, Section 1 General aspects
5)	IS 1885 (Part 16/ Sec. 2):1968	Electrotechnical vocabulary: Part 16 Lighting, Section 2 General illumination, lighting fittings and lighting for traffic and signaling
6)	IS 1885 (Part 16/ Sec. 3):1967	Electrotechnical vocabulary: Part 16 Lighting, Section 3 Lamps and auxiliary apparatus
7)	IS 1885 (Part 17): 1979	Electrotechnical vocabulary: Part 17 Switchgear and control gear
8)	IS 1885 (Part 32):2019/IEC 60050 (461): 1984	Electrotechnical Vocabulary: Part 32 Electriccables (Second revision)

Sl. No.	Standard	Title
1)	IS 4770:1991	Rubber Gloves for electrical purposes
2)	IS 5424:1969	Rubber mats for electrical purpose (Superseded by IS 15652:2006)

Sl. No.	Standard	Title
1)	NEC 2023	National Electric Code, 2023

Insulators:		
(1)	Porcelain insulators for overhead power lines with a nominal voltage upto and including 1000V	1445-1977
(2)	Porcelain insulators for overhead power lines with a nominal voltage greater than 1000V	731-1971
(3)	Porcelain guy strain insulators	5300-1969
(4)	Characteristics of string insulator units	IS/IEC 60471 : 1977
(5)	Insulator fittings for overhead power lines with a nominal voltage upto and including 1000V	7935-1975
(6)	Insulator fittings for overhead power lines with a nominal voltage greater than 1000V	
(i)	General requirements and tests	2486(Part-1)-1993
(ii)	Dimensional requirements	2486(Part-2)-1989
(iii)	Looking devices	2486(Part-3)-1974
Codes of Practice:		
(1)	Design, installation and maintenance of overhead power lines	
(i)	Upto and including 11KV	5613-(Part-1 sections 1 and 2)-1985)
(ii)	Above 11KV and upto and including 220KV	5613(Part-2 sections1 and2)1985
(2)	Selection, handling and erection of concrete poles for overhead power and telecommunication lines	7321-1974
(3)	Installation and maintenance of power cables upto and including 33 KV rating	1255-1983
(4)	Lighting of public thorough-fares for main and secondary roads (Group A & B)	1944- (Part 1 & 2)1970
(6)	Code of practice for lighting of public thorough fares: Part 1 General principles Part 2 Lighting for traffic routes (Groups A1, A2, B1 and B2) (*first revision*)	1944 (Parts 1 and 2) : 19 0
(7)	Code of practice for lighting of public thoroughfares: Part 3 Lighting for Secondary roads which do not require lighting up to groupA standard(Group B)	1944 (Part 3) : 1981

(8)	Code of practice for lighting of public thoroughfares: Part 4 Lighting for residential andunclassified roads (Group C)	1944 (Part 4) : 1981
(9)	Code of practice for lighting of public thoroughfares: Part 5 Lighting of grade separated junctions, bridges, and elevated road (Group D)	1944 (Part 5) : 1981
(10)	Code of practice for lighting of publicthoroughfares: Part 6 Lighting for town and city centers and areas of civic importance (Group E)	1944 (Part 6) : 1981
(11)	Code of practice for lighting of publicthoroughfares: Part 8 Lighting in Tunnel	1944 (Part 8) : 1981
(11)	Code of practice for design, installation, and maintenance of overhead powerlines: Part 1 Lines up to and including 11 kV, Section 1 Design (*first revision*)	5613 (Part 1/Sec 1) : 1985
(12)	Code of practice for design, installation, and maintenance of overhead power lines Part 1 Lines up to and including 11 kV, Section 2 Installation, and maintenance (*first revision*)	5613 (Part 1/Sec 2) : 1985
(13)	Code of Practice for earthing	3043:2018
(14)	Code of Practice for electrical wiring Installation	IS 732 : 2019
(15)	Protection against lightning – Part 1: Generalprinciples	IS/IEC 62305-1 : 2010
(16)	Protection Against Lightning –. Part 2: RiskManagement.	IS/IEC 62305-2 : 2010
(17)	Protection against lightning – Part 3: Physicaldamage to structures and life hazard	IS/IEC 62305-3 : 2010
(18)	Energy Conservation Code of India 2017	ECBC : 2017
(19)	National Building Code of India 2016 (NBC 2016)	SP7 : 2016
(20)	National Lighting Code of India 2010	SP : 72
(21)	Code of practice for selection, handling and erection of concrete poles for overhead power and telecommunication lines	7321: 1974

Safety standards:		
(1)	Guide for safety procedures and practices inelectrical works:	
(i)	General	216(Part-1)-1982
(ii)	Life saving techniques	216(Part-2)-1982
(2)	Excavation work	764-1992
(3)	Rubber gloves for electrical purposes	770-1991
(4)	Fire safety of industrial buildings: Generatingand Distributing stations	034 :1993
(5)	Warning symbol for dangerous voltages	923 : 1978
(6)	Classification of insulating liquids	3503 : 2013
(9)	Safety of machinery — Electrical equipment of machines: Part 1 General requirements (*first revision*)	S 16504 (Part 1) : 019/IEC 60204-1 : 016
	Safety of machinery — Electrical equipment of machines – Part 11 Requirements for equipmentfor voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV	IS 16504 (Part 11) : 2020/IEC 6020411 : 2020
	Specification for unused natural esters fortransformer and similar electrical equipment	16659 : 2017
General:		
(1)	Dimensions for hot rolled steel beam, columnchannel, and angle sections	808-2021
(2)	Galvanized stay strand	2141-2000
(3)	Galvanized steel barbed wire for fencing	278-2009
(4)	Cast iron manhole covers and frames:	1726 (Part ii)-1994
(5)	Luminaires for road and street lighting	10322(Part-5/2012)
(6)	Voltage bands for electrical installations including preferred voltage and frequency	12360-1988
(7)	Luminaires: Part 1 General Requirements	10322 (Part 1) : 2014
(8)	Residual current operated circuit breakers forhousehold and similar purposes	12640 (Part 1) : 2016
(9)	Residual current operated circuit breakers withintegral over current protection (RCBOs)	12640 (Part 2) : 2016

(10)	Information technology equipment — Safety —Part 1 General requirements (*second revision*)	(Part1):13252 60950-1 :2010 IEC 2005
(11)	Effects of current on human beings andlivestock: Part 1 General aspects	IS/IEC 60479-1 : 2018
(12)	Low - voltage surge protective devices — Part 11 Surge protective devices connected to low — Voltage power systems — Requirements and test methods	16463 (Part 11) : 2016
(13)	Low - voltage surge protective devices — Part 12 Surge protective devices connected to low — Voltage power distribution systems — Selectionand application principles	16463 (Part 12) : 2017
Electro-technical vocabulary		
1)	Overhead transmission and distribution of electrical energy	1885(Part-30)1971
2)	Cables, conductors and accessories for electricity supply (Second Revision)	1885(Part-32)2019
3)	Insulators	1885(Part-54)2021
4)	Electrotechnical vocabulary — Part 16 Lighting — Section 1 General aspects	1885 (Part 16/Sec 1 :1968/IEC 60050-45 : 1958
5)	Electrotechnical vocabulary — Part 16 Lighting - Section 2 General illumination, lightingfittings and lighting for traffic and signalling	1885 (Part 16/Sec 2): 1968/IEC 60050-45 : 1958
6)	Electrotechnical vocabulary — Part 16 Lighting - Section 3 Lamps and auxiliaryapparatus	1885 (Part 16/Sec 3):1967/IEC 60050-54
7)	Electrotechnical vocabulary -Part 17 Switchgear and control gear (*first revision*)	1885 (Part 17) : 1979/IEC 60050-441 : 1974
8)	Electrotechnical vocabulary — Part 27 Power electronics (*third revision)*	1885 (Part 27) : 2008/IEC 60050-551 : 1998
9)	Electrotechnical vocabulary — Part 28Instrument transformers (*first revision*)	1885 (Part 28) : 1993/IEC60050-321 : 1986

10)	Electrotechnical vocabulary — Part 38 Power transformers and reactors (*second revision*)	1885 (Part 38) : 1993/ IEC 60050421 : 1990
11)	Electrotechnical vocabulary — Part 69 Generation, transmission and distribution of electricity — Generation	1885 (Part 69) : 1993/ IEC 60050602 : 1993
12)	Electrotechnical vocabulary: Part 70 Generation, transmission and Distribution of Electricity- Operation	1885 (Part 70) : 1993/ IEC 60050604 : 1987
13)	Electrotechnical vocabulary — Part 71 Generation, transmission and distribution of electricity — Substations	1885 (Part 71) : 1993/ IEC 60050605 : 1983
14)	Electrotechnical vocabulary — Part 77 Overhead lines	1885 (Part 77) : 1993/ IEC 60050466 : 1990
15)	Electrotechnical vocabulary — Part 78 Generation, transmission and distribution of electricity — General	1885 (Part 78) : 1993/IEC 60050-601 : 1985
16)	Electrotechnical vocabulary — Part 79 Generation, transmission and distribution of electricity — Power system planning and management	1885 (Part 79) : 1993/IEC 60050-603 : 1986
17)	Electrotechnical vocabulary — Part 80 Generalterms on measurements in electricity	1885 (Part 80) : 1994/IEC 60050-301 : 1983
18)	Electrotechnical vocabulary — Part 81Electrical measuring instruments	1885 (Part 81) : 1993/IEC 60050-302 : 1983
19)	Voltage bands for electrical installationsincluding preferred voltages and frequency	12360 : 1988
20)	Distribution system supply voltage quality	17036 : 2018

Lighting Arrester		
(1)	Application guide for non-linear resistor type surge arresters for a.c. system	4004-1985

(2)	Lighting arresters for a.c. systems: Non-linear.Resistor type lighting arresters	3070(Part-1)-1985

LIGHTING/ SOLAR PHOTOVOLTAIC		
(1)	Halogen free flame retardant HFFR cables forworking voltages up to and including 1100 Volts — Specification	17048 : 2018
(2)	Specification for Thermosetting Insulated Fire Survival Cables for Fixed Installation having Low Emission of Smoke and Corrosive Gases when Affected by Fire for Working Voltages upto and including 1100V	17505 (Part 1) : 2021
(3)	Code of practice for selection, installation andmaintenance of transformers: Part 2 Installation	10028 (Part 2) : 1981
(4)	Testing, evaluation, installation and maintenance of a.c. electricity meters — Code of practice	15707 : 2006
(5)	Low-Voltage Switchgear and ControlgearAssemblies – Part 1 General Rules	IS/IEC 61439-1 : 2011
(6)	Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1500 V d.c.	IS/IEC61557 series : 2019
(7)	Automatic power factor correction (APFC) panels for voltage rating up to and including1000 V	16636 : 2017
(8)	Distribution system supply voltage quality	17036 : 2018
(9)	Low-voltage electrical installations — Energy efficiency	16996 : 2018
(10)	Low voltage fuses	IS/IEC 60269 (all parts) : 2016
(11)	Electrical accessories — Circuit-breakers for overcurrent protection for household and similarinstallations	IS/IEC 60898 (all parts) : 2015
(12)	Degrees of protection provided by enclosures forelectrical equipment against external mechanical impacts (IK code)	IS 17050 : 2018/ IEC 62262 : 2002
(13)	Requirements for low-voltage special electrical installations or locations — Solar photovoltaic (PV) power supply systems	61997 : 2018
(14)	Crystalline silicon terrestrial PV module designqualification and type approval	14286 : 2010/ IEC 61215 : 2005

(15)	Thin film (a-Si, CiGS and CdTe) terrestrial PV module design qualification and type approval	16077 : 2013/ IEC 61646 : 2008

(16)	Concentrator photovoltaic (CPV) modules andassemblies design qualification and type approval	1228 : 2019/ IEC 62108 : 2016
(17)	PV modules safety qualification: Part 1 Requirements for construction	IS/IEC 61730-1 : 2016
(18)	PV modules safety qualification: Part 2 Requirements for testing	IS/IEC 61730 (Part 2) : 2016
(19)	PV modules salt mist corrosion testing	IS/IEC61701 : 2011
(20)	PV module performance testing and energy rating: Part 1 Irradiance and temperatureperformance measurements and power rating	16170 (Part 1) : 2014/ IEC 61853-1 : 2011
(21)	PV modules Test methods for the detection ofpotential-induced degradation (PID): Part 1 Crystalline silicon PV modules	17210 (Part 1) : 2019/ IEC 62804-1 :2015
(22)	PV module ammonia (NH3) corrosion testing	16664 : 2018/ IEC 62716 : 2013
(23)	Safety of power converters for use in photovoltaic power systems: Part 2 Particular requirements for inverters	16221 (Part 2) : 2015
(24)	Photovoltaic system-power conditioners — Procedure for Measuring efficiency	IS/IEC61683 : 1999
(25)	Test procedure of islanding prevention measuresfor utility connected PV inverters	16169 : 2019
(26)	Balance-of-system components for photovoltaic systems — Design qualification naturalenvironments	16229 : 2015/ IEC 62093 : 2005
(27)	Secondary cells and batteries for solar PV application-general requirements and methods oftest	16270 : 2014
(28)	Cross linked polyethylene insulated thermoplastics sheathed cables: Part 3 For working voltages from 66 kV up to and including 220 kV	7098 (Part 3) : 1993
(29)	Electric cables for photovoltaic systems for ratedvoltage 1 500 V d.c.	17293 : 2020
(30)	Recommended current ratings for cables: Part 5PVC insulated light duty cables	3961 (Part 5) : 1968

(31)	Recommended current ratings for cables: Part 6Crosslinked polyethylene insulated PVC sheathed cables	3961 (Part 6) : 2016

(32)	Recommended current ratings for cables: Part 7 Crosslinked polyethylene insulated thermoplasticsheathed cables	3961 (Part 7) : 2017
(33)	High-voltage switchgear and controlgear: Part 1Common specifications	IS/IEC 62271-1 : 2007
(34)	High-voltage switchgear and controlgear: Part100 Alternating — Current circuit — Breakers	IS/IEC 62271-100 : 2008
(35)	High-voltage switchgear and controlgear: Part 102 Alternating current disconnectors and earthing switches	IS/IEC 62271-102 : 2018
(36)	High-voltage switchgear and controlgear: Part 105 Alternating current switch — Fuse combinations for rated voltages above 1 kV up to and including 52 kV (*first revision*)	IS/IEC 62271-105 : 2012
(37)	High-voltage switchgear and controlgear: Part 200 a.c. Metal-enclosed switchgear and controlgear for rated voltages above 1 kV up to and including 52 kV (*first revision*)	IS/IEC 62271-200 : 2011
(38)	High-voltage switchgear and controlgear: Part 202 High-voltage/low — Voltage prefabricated substation	IS/IEC 62271-202 : 2014
(39)	Degrees of protection provided by enclosures (IPcode)	IS/IEC60529 : 2001
(40)	Measuring relays and protection equipment —Product safety requirements (First Revision)	IEC 60255-27 : 2013
(41)	Connectors for d.c. application in photovoltaicsystems, safety requirements and tests	16781 : 2018/ IEC 62852 : 2014
(42)	Low-voltage switchgear and control gear: Part 1General rules	IS/IEC60947-1 (Part 1) : 2007
(43)	Low-voltage switchgear and control gear: Part 3 Switches disconnectors switch disconnectors and fuse-combination units (*first revision*)	IS/IEC60947-3 (part 2) : 2012
(44)	Power transformers: Part 1 General	2026 (Part 1) : 2011
(45)	Power transformers: Part 2 Temperature rise	2026 (Part 2) : 2010
(46)	Power transformers: Part 3 Insulation levels, dielectric tests and external clearances in air	2026 (Part 3) : 2018/ IEC 60076-3 : 2013
(47)	Power transformers: Part 5 Ability to withstandshort-circuit	2026 (Part 5) : 2011

(48)	Power transformers: Part 10 Determination ofsound levels resp	2026 (Part 10) : 2009/ IEC 6007610 : 2001
(49)	Static direct connected smart watt-hour meter Class 1 and 2 specifications (with import and export/net energy measurements)	16444 : 2015
(50)	Guide for general description of PV power generating systems	14153 : 1994
(51)	Photovoltaic PV arrays design requirements	IS/IEC62548 : 2016
(52)	Grid connected photovoltaic systems —Minimum requirements for system documentation, commissioning testsand inspection	16960 (Part 1) : 2018/ IEC 62446-1 : 2016
(53)	PV systems performance monitoring; guidelinesfor measurement, data exchange and analysis (all parts)	IS/IEC 61724 : 2017
(54)	Standalone PV systems design qualification	16230 : 2017/ IEC 62124:2004
(55)	Protection against lightning (*all parts*)	IS/IEC 62305 (*all parts*)