

**TECHNICAL SPECIFICATION
FOR ELECTRICALS**

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TECHNICAL SPECIFICATIONS FOR ELECTRICAL INSTALLATION WORK

The following specifications will apply under all circumstances to the equipment to be supplied and installed against this contract and it is to be ensured that the contractor shall obtain for himself at his own expense and on his own responsibility all the information which may be necessary for the purpose of submitting the tender and for entering into a contract keeping in view the specifications of installation and inspection of site etc.

1.0 INDIAN STANDARD SPECIFICATIONS

The following Indian Standard Specifications amended as on date will apply to the equipment and the contract.

a)	L.T. Air circuit breakers	:	IS 2516 - 1965 Part I Section I
b)	Switch fuse units on cubicle switchboards	:	IS 4047 - 1967
c)	Switchgear bus bars	:	IS 375 - 1963
d)	H.R.C. fuse links	:	IS 2208 - 1962
e)	Distribution fuse boards	:	IS 2675 - 1966
f)	Enclosures for low voltage switchgear	:	IS 2147 - 1962
g)	P.V.C. Cables	:	IS 1554 - 1964
h)	Steel boxes for enclosure of electrical accessories	:	IS 5133 – 1964 Part I
i)	Fittings for rigid steel conduits	:	IS 2667 - 1964
j)	Rigid steel conduits for electrical wiring	:	IS 1653 - 1964
k)	Accessories for rigid steel conduits for electrical wiring	:	IS 3837 – 1966
l)	Switch socket outlets	:	IS 4615 – 1968
m)	Three pin plug and socket outlets	:	IS 1293 – 1967
n)	Switches for domestic and similar purpose	:	IS 3854 – 1966
o)	PVC wires	:	IS 694 – 1964 Part II
p)	Call bell and buzzers	:	IS 2268 – 1966
q)	Earthing	:	IS 3034 – 1966
r)	Electrical wiring installation	:	IS 732 – 1963
s)	Switchgear	:	IS 3072 – 1965
t)	Lightening protection Indian Electricity Rule 1956 amended as on date.	:	IS 2309 – 1969

2.0 CONCEALED / SURFACE CONDUIT WORKS

2.1 PVC Conduits specification & size

- 2.1.1 These shall be of 1.5mm thick P.V.C. rigid Conduit. The conduit shall be protected from rust by one coat of black enamel paint applied inside and outside in its manufactured form.
- 2.1.2 Conduit bends shall of 1.5mm thick P.V.C. rigid Conduit. As far as possible, the conduit system shall be so laid out that is will alleviate the use of tees, elbows and sharp bends. Bending of conduit with large radius while lying at site to minimize use of readymade bends shall be adopted as far as possible.
- 2.1.3 The conduit shall be of ample section area to facilitate the drawing of P.V.C. wires / cables. In no case shall the total cross section of wires/cables measured overall, be more than half the inside area of the conduits. Refer Table provided at Clause No. 13, Page IV- 48 for maximum no. of wires that can pulled in various sizes of conduits.

MINIMUM CONDUIT DIA (O.D.) FOR ELECTRICAL WIRING – 25 MM

MINIMUM CONDUIT DIA (O.D.) FOR TELEPHONE WIRING – 19 MM

2.2 Laying of Conduits

- 2.2.1 Conduits shall be laid before casting in the upper portion of a slab/in PCC if below flooring or otherwise, as may be instructed in accordance with approved drawings, so as to conceal the entire run of conduits and ceiling outlet boxes. Conduits shall be so laid that they are interconnected. This is required to facilitate pulling of wires from different routes in case of any of the portion of conduit / junction box / outlet box is blocked during slab casting. Vertical drops shall be cut in masonry work by the contractor to sufficient depth to allow full thickness of plaster over conduits. The width of the chases will be made to accommodate the required number of conduits. The chases will be filled with cement, coarse sand mortar (1:4) and properly cured by watering by the contractor. This filing of chases shall be done by electrical contractor prior to building contractor during finishing plaster on walls.
- 2.2.2 When the conduit is to be embedded in a concrete member it shall be adequately tied to the reinforcement to prevent displacement during casting / vibrating of concrete. Tying wire to be supplied by the contractor.
- 2.2.3 Cutting of chases in any RCC member / finished floor / already finished wall surface is not allowed unless prior approval of Site Engineer is taken in site instruction book. If chases is cut in an already finished surface, the contractor shall fill the chases and finish it to match the existing finish including painting at his cost to Site Engineer's satisfaction.
- 2.2.4 Contractor shall not cut any steel reinforcement bars or steel structure to fix the conduits. Puncturing of wooden / steel shuttering for RCC slab/beams/ column etc. for conduit work is also not allowed, unless Site Engineer permits inside instruction book under special condition.
- 2.2.5 Run of conduit pipe through expansion joints in RCC members should be avoided as far as possible and if unavoidable, flexible conduit pipe should be used with ceiling outlet box on both sides of expansion joint.
- 2.2.6 Conduit on surface of walls / RCC members shall be avoided as far as possible and if unavoidable prior approval of Site Engineer on sample saddles, clamps, screws and a minimum 5 M conduit laid on surface shall be taken, to achieve best possible workmanship. Distance between 2

consecutive clamps for fixing conduit on surface shall not exceed 800 mm. No wooden gutties for fixing saddles / clamps shall be used. Roll plug/ steel fastener with hard setting / sealing compound shall be used.

In case of stone masonry, necessary conduits with M.S.boxes should be placed as the masonry is in progress, since after completing masonry; it is very difficult to cut chases in walls. Special location of cement concrete shaft is also recommended to conceal conduit in stone masonry and the same shall be provided by the SHREE SOMNATH TRUST.

- 2.2.7 In ground floor conducting below the flooring should be avoided. Wherever it is unavoidable GI 'A' class pipe shall be used with prior approval of Site Engineer.

2.3 Ceiling / Wall outlet boxes for lights / fans

- 2.3.1 Outlet boxes shall be of 16 gauge steel plates with 3 mm thick Hylem sheet covers for all the light points & Hylem sheet for the fan paints and so installed as to maintain continuity throughout. These shall be protected at the time of lying by filling with jute/earth/cotton etc. so that no cement mortar finds its way inside during concreting or plastering etc. Typical sketches for such outlet boxes are attached.
- 2.3.2 For fixing lighting fixtures /brackets, outlet boxes, complete with check nut for holding conduits shall be used. For lighting fixture suitable for 20 Watts fluorescent tubes / incandescent lamps /discharge lamps, only one outlet box is required. For fixing lighting fixture suitable for 40 Watts fluorescent lamps, two numbers outlet boxes should be provided at a distance of 300 mm away from the centre in the longitudinal direction of the fixture, so that the use of gutties / rawl plugs etc. may be avoided, as well as wiring from outlet box to the light fitting is completely concealed. If the light fitting is to be installed in RCC beam, and due to heavy reinforcement at the bottom of beam it is not possible to provide outlet boxes, simple conduit should be provided. These details have been shown in the attached sketch no. SK-16 and these should always be followed.
- 2.3.3 For fixing ceiling fans, circular outlet boxes, made of 16 G Sheets steel, 100 mm diameter, complete with 12 mm dia Mild Steel rod 500 mm long, with loop in the box & hylam sheet cover 125 mm dia at bottom shall be used. See sketch no.SK -17 for the details of this special outlet box and fan fixing detail.

2.4 Draw Out junction Boxes

Steel draw out boxes of ample dimensions shall be provided at convenient points on walls/ceiling to facilitate pulling of long runs of cables/wires. These shall be completely concealed with hylam sheet covers, flush with plaster work. These draw out boxes should be five sided. The location of these boxes is to be decided prior to fixing, as per site requirement and following shall be treated as general guide-lines for deciding the location of these.

- a) These shall be provided at a place where these are not in direct view. Recommended place is 400/450mm below ceiling, if conduits are running vertically.
- b) Junction box in the offset of bottom of R.C.C. beam and vertical wall shall not be provided
- c) If junction boxes are coming side by side for two or more conduits, one common M.S. box of proper size can be used to act as junction box.
- d) If junction box is to be provided in ceiling, its position should be so located that it is in line with other light/fan points.
- e) Junction boxes shall never be used for splitting one conduit into two or more. Junction box for such function is avoidable and for this, number of conduits to be connected to one switch board shall be calculated correctly as per drawing before laying conduits in ceiling.

- f) Locating junction boxes on outer surface of exterior walls of building shall be avoided as these are in direct view and are also exposed to weather.
- g) Junction boxes shall never be closed permanently by plaster. Removable covering of Hylam Sheet shall be provided for conduit boxes acting as junction boxes and for M.S. junction boxes removable hylam (white colour) plate shall be provided. This cover to be painted with wall colour.
- h) Junction boxes in important areas shall be avoided and can be located in toilets/corridors/service shafts & stores etc.

2.5 Switch Boxes

Steel boxes of required sizes, shall be provided to house speed regulators of fans, switches for lights, fans, plug sockets etc. as per requirement of drawings. These should be so designed that accessories on hylam sheet could be mounted with tapped holes and brass machine screws, leaving ample space at the back and on the sides for accommodating wires and checknuts are conduit entries. These shall be attached to conduits by means of checknuts on walls of the boxes through which the conduits are entering. These shall be completely concealed leaving edges flush with finished wall surfaces. 3 mm thick Hylam cover should be fixed to these which boxes by means of brass chrome plated machine screws. Utmost care shall be taken by contractor to ensure that all switch boxes are in line and level.

In side each switch box, one bolt shall be welded to receive earthing wire. Typical sketches for these switchboxes are shown in the attached sketch No.SK-19.

UNLESS OTHERWISE SPECIFIED IN EXECUTION DRAWINGS, THE HEIGHT OF SWITCH BOXES, OUTLET BOXES FOR LIGHTS IN WALLS, POWER PLUGS ETC. FROM FINISH FLOOR LEVEL SHALL BE SHOWN IN SKETCH NO.20.

2.6 Cleaning and Protection of Conduit System.

The entire conduit system including outlet boxes, junction boxes and switchboxes shall be thoroughly cleaned after completion of erection and tested for non blockage by air/sound or steel wire prior to finishing of building and before drawing in of cables/wires. To safe guard conduit system against filling up with the plaster/cement slurry/ water etc. all the outlet and switch boxes will have to be provided with temporary jute/cotton filling covers and plugs etc. withing tendered cost which shall be replaced later on by hylem sheet cover after wiring as required.

2.7 Painting

All conduit, accessories and boxes etc. should be their original paint in good finish prior to erection & if due to long storage in open, painting has been damaged/worn-out, fresh coat of paint should be applied. In addition to this, conduit should be painted at such places where the pipe has been damaged due to vice or wrench grip. Wherever threads have been cut in conduits at site, red-oxide primer as well as synthetic enamel paint should be applied before erection.

3.0 WIRING (POWER)

3.1 Specification of wires

All wires shall have been manufactured in accordance with the latest I.S Specification (I.S 694-1964 Part II). All wires shall be PVC insulated, Copper conductor, of 650 volt grade. Cross section of the conductor shall be as per the specification mentioned in schedule of quantities.

MINIMUM CROSS SECTION OF CONDUCTOR FOR ELECTRICAL WIRING-2.5 MM SUARE.

For single phase wiring, colour of live conductor's insulation shall be Red/Yellow/Blue (only one of these colours for one building) and Black for neutral Earthing is to be done by green PVC insulated copper conductor. For three phases wiring colour of live conductor's insulation shall be Red/Yellow/Blue, as per relevant phase and black for neutral. However, if due to unavoidable circumstances, these colour codes cannot be used by contractor, prior approval of the Site Engineer shall be taken and correct colour PVC tape should be put in distribution board/outlet boxes/switch boxes etc. wherever these wires are to be inspected. Earth wire shall always be of Copper conductor PVC insulated & colour of insulation shall be Green.

Whenever wires are being terminated in Distribution Board/Switch Box Plug Points/Outlet Box etc., a minimum of 200 mm long extra wire should be provided in the form of a loop for future maintenance use.

3.2 Point wiring

3.2.1 For lights, fans, call belts & 5A plug points.

- (a) Fixing of conduit, conduit accessories, drawout boxes, outlet boxes and switch boxes etc. In concealed/surface system.
- (b) Looping system shall be adopted from terminal to terminal throughout including supply and drawing of required numbers and size of wires (2.5 Sq.mm) without stripping off the insulation in between.
- (c) All flush type switches and accessories will be used on 3 mm thick hylem sheet in M.S.switch box.
- (d) The point will commence from the switch box and would end up to outlet box.
- (e) POINT WIRING AND CIRCUIT WIRING IN SAME CONDUIT IS NOT ALLOWED AND THESE SHOULD BE DRAW IN INDEPENDENT CONDUITS.
- (f) The ceiling fan point shall be complete with special outlet box as specified in 2.3.3. Including fixing and connection of regulator. Supply and fixing of 5A switch for each ceiling fan is included in scope of the contractor even if electronic regulator is being used. Switch box for ceiling fan shall be suitable for resistance/chock type regulator even if electronic type regulator is being used.
- (g) For exhaust fans, ceiling rose near exhaust fan to be provided.
- (h) In any switch box, not more than four (4) regulators for ceiling fans should be provided unless approved in writing by the Site Engineer.
- (i) Joining of wires by taping inside the switch box to be avoided by utilizing neutral pin of 5/15/20 A socket or of suitable capacity connector.
- (j) Fan regulator in switch box should be earthed. Earthing of light fittings/call bells/fans not required. 5 Amp. Convenience plug points 3rd pin to be earthed with 2.5 sq.mm green PVC insulated copper wire.

3.2.2. For 15 A Power Plug Points.

- (a) Fixing of conduit, conduit accessories, draw out boxes, switch boxes etc. in concealed/surface system.
- (b) In one circuit, there shall not be more than 2 nos.15 A power plug points and circuit shall be 2x4 Sq.mm Copper conductor wires.
- (c) One no. flush type plug socket outlet and switch shall be fixed for each power point on 3mm thick hylem sheet cover. Plug socket can be standard type or of universal type (one common 15 A switch for 15/5A sockets) as advised by Site Engineer/shown in drawing. If not mentioned in the drawing, it shall be universal type.
- (d) The point would commence from the distribution board and will end up to the switch box. Looping of circuit would be done to second 1.5 A power point from first 15 A power point.
- (e) Each circuit would have its own 2.5 Sq.mm green PVC insulated copper wire from distribution board to switch box and would be connected to third pin of socket outlet.
- (f) Electric load for each 15 A power point would be considered as 1000 Watts.

3.2.2 For 20 A Power Plug Point.

- (a) Fixing of conduit, conduit accessories, draw out boxes and switch box etc. in concealed/surface system.
- (b) In one circuit, there shall be only one power point and circuit shall be 2 x 4 Sq.mm Copper conductor wire, complete with 4 sq.mm green PVC insulated copper wire.
- (c) One no M.C.B. 20 A, single phase shall be fixed for each power point on 3 mm thick hylem sheet cover in such a way that only knob is outside M. S. switch box should also have one no.20A three pin metallic type socket outlet complete with metallic plug top.
- (d) The point would commence from the distribution board and will end up to the switch box.
- (e) Electric load for each 20 A power point would be considered as 1500 watts.

3.3. Group Wiring (for industrial lighting)

- (a) Specifications for this would be applicable if either or more lights of total 200 Watts or more lighting load are controlled by one M.C.B.
- (b) Lights would be controlled by M.C.B of rating and wire size, as specified in schedule of quantities. However, it shall not be less than 10 A and 4.0 Sq.mm respectively. Light points controlled by one M.C.B would be in parallel.
- (c) M.C.B. for these lights would be installed in a suitable M.S. box with hylem sheet cover. Total electric load to be controlled from this "Group Lighting Board" would not exceed 3000 W or 6 groups of lights.
- (d) "Group Lights" point would commence from group lighting switch board in surface/concealed conduit system, necessary wiring and up to the last light of the group.

- (e) Group light points having fluorescent lamps light fittings with total wattage up to 500 W or less should be covered under the item 81.18 to 81.21. For discharge lamp type light fittings in total wattage more than 150 but less than 750 watts should be covered under the item No.81.15 to 81.17 of library of schedule of quantities. However if wattage of each point is above 500 W, each fitting may be controlled by independent MCB under item no. 81.17 of library of schedule of quantities.

3.3 **Circuit/Sub Mains Wiring**

3.4.1 **Circuit wiring with PVC insulated wires.**

Specification for this item covers, PVC insulated wires from distribution boards to light switch board or to Group lighting switch board in surface/concealed conduit system. This shall also cover wiring between two light switch boards or between two group lighting switch boards. This shall be carried out as follows.

- (a) Fixing of conduit, conduit accessories, draw out boxes etc. in concealed/surface system.
- (b) Drawing of wires of sizes as specified in schedule of quantities. For each circuit independent conduit to be used.
- (c) Each circuit shall have a parallel independent running earthing of green PVC insulated copper wire of sizes as specified in schedule of quantities. For single phase (2 wires) circuit one earthing wire and for 3 phase (4 wires) circuit, 2 earthing wires shall be drawn.
- (d) For the purpose of determining the load per circuit the following electric rating of points shall be assumed.

Light points (4' Fluorescent lamp)	80 Watts
Light points (incandescent lamp)	80 Watts
Light points (Compact Flu. lamp)	20 Watts
Light points (Discharge lamps)	As per the load of the fitting.
Call bell point	10 Watts
Convenience plug point 5A	100 Watts
Fan points	60 Watts
Exhaust fan points	300 Watts or as specified

Type and size of circuit shall be specified in the drawings. However, if this is not specified the same may be worked out based on following guidelines.

1. For office building workers' amenity, staff quarters etc. the load per circuit may not exceed 1000 W and hence circuit of 2.5 SQMM may be used.
2. For industrial building load per circuit can be more than 1000 W. Size of circuit may be.

For load up to 1500	:	4 SQMM Circuit
For load from 1500-2000 W	:	6 SQMM Circuit
For load more than 2000 W	:	10 SQMM Circuit

For industrial Building depending upon the load 3 phase circuits of 4 & 6 SQMM can also be used.

3.4.2 **Sub-Main Wiring with PVC insulated wires/cables.**

Specification for this item covers, PVC insulated wires/cables from main distribution board to distribution board or from one distribution board to other distribution board in surface/concealed conduit system. This shall be carried out as specified in 3:4:1.

3.4.3 **Sub Main Wiring with PVC insulated PVC sheathed armoured cables**

Same as 3.4.1. above except that PVC insulated, PVC outer & inner sheath, armoured Al. conductor cables shall be used instead of PVC insulated wire/cable. These cables shall be supplied & laid as specified in 4.0 of tender' technical specification.

4.0 **POWER CABLE WORK**

4.1 **Specification of Cables.**

Heavy duty, PVC insulated, PVC outer and inner sheath, armoured. Al. conductor, cables suitable for 1100 Volts. A.C. , as per IS 1554 (Part-I-1964) of sizes as specified in schedule of quantities.

4.2 **General Precautions for handling of cables.**

4.2.1 Before laying cables, these shall be tested for physical damage, continuity, absence of cross phasing, insulation to earth and between conductors. Insulation resistance tests shall be carried out with 500/1000 Volt. Megger.

4.2.2 The cables shall be supplied to site wound on wooden drum as far as possible. For smaller length and sizes, cable in properly coiled form can be accepted. The cables shall be laid by mounting the drum of the cable on drum carriage. Where the carriage is not available, the drum shall be mounted on a properly supported axle, and the cable laid out from the top of the drum. In no case the cable will be rolled on, as it produces kinks, which may damage the conductor.

4.2.3 Sharp bending and kinking of cables shall be avoided. The bending radius for PVC insulated and sheath armoured cable shall not be less than 10 D where 'D' is overall dia of the cable.

4.2.4 While drawing cables through G.I. pipes and conduits, RCC pipe, ensure that size of pipe is such that, after drawing cables 40% area is free. After drawing cable, the end of GI pipes/conduits shall be sealed with cotton/bituminous compound. After drawing cables through RCC pipes, the ends shall be sealed with lean mortar of brick bat.

4.2.5 Electric power cables and telephone wires/cables shall not be laid in same trench, G.I./conduit/R.C.C. pipe. Minimum distance of 400 mm between power and telephone wire/cable shall maintained.

4.2.6 Armoured cables shall never be concealed in walls/floor/roads without G.I. pipes, conduit or R.C.C. pipes.

4.3 **Laying of Cables (Underground System)**

4.3.1 Cables shall be so laid in ground that these will not interfere with other underground structures. All water pipes, sewage lines or other structure which become exposed by excavation shall be properly supported and protected from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded, diverted as directed by the Site Engineer.

4.3.2 Cables shall be laid at a minimum depth of 750 mm from existing ground level Excavation will generally be in ordinary alluvial soil. The width of the trench shall be sufficient for lying of required number of cables.

4.3.3 Sand bedding 75 mm thick shall be made below and above the cables. A layer of bricks (full size) shall be laid over the cable, above sand bedding to cover cable completely. More than one cable

can be laid in the same trench by providing sand between two cables. See sketch no SK-26 attached. However, the relative location of cables in trench shall be maintained till termination. The surface of the ground after back filling the earth shall be made good so as to conform in all respects to the surrounded ground and to the entire satisfaction to Site Engineer.

- 4.3.4 Joints in the cable throughout its length of lying shall be avoided as far as possible and if unavoidable, prior approval of site engineer shall be taken. If allowed proper straight through epoxy joint shall be made including preparing necessary bedding without any additional cost.
- 4.3.5 A minimum loop of 3 M shall be provided on both ends of the cable, or after every 150 M of un-jointed length of cable, and on both ends of straight through cable joint. This additional length shall be used for fresh termination in future. Cable for this loop shall be paid for supply and laying. THE LOOP SHALL BE KEPT IN "S" FORM AND LOOPS OF DIFFERENT CABLES SHOULD NOT OVERLAP.
- 4.3.6 For all under ground cables, route markers should be used.**

Separate cable route marker should be for L.T. H.T. and Telephone cables.
Standard specification of cable markers is as follows.

Galvanized cast iron plate with marking (LT/HT/Telephone cable) dia 150 mm with 600 mm long GI class 'B' 20 mm pipe riveted/bolted with this plate.

Route markers should be grouted in ground with 1:2:4 cement concrete pedestal size 230x230x300 mm.

Cable markers should be installed at an interval not exceeding 50 M along the straight routes of cables at a distance of 0.5M away from centre of cable with the arrow marked on the cable markers plate indicating the location of cable. Cable markers should also be used to identify change in direction of cable route and for location of every joint in underground cable. The typical sketch of a cable marker is shown in Sketch no. SK-27 attached.

- 4.3.7 R.C.C. hume pipe for crossing road in cable laying shall be provided by SHRE SOMNATH TRUST. Similarly masonry/concrete trench inside building if required shall be provided by SHREE SOMNATH TRUST. However 'A' class G.I. pipes/conduits for laying cables in walls in walls/floors/concrete block etc. near cable ends/if required shall be provided by contractor without any extra cost. Sealing of G.I. pipes/conduits R.C.C. hume pipe, trenches etc. also shall be done by electrical contractor without any extra cost.

Laying of cables (in air)

If major length (more than 75%) of cable is an air above ground it would be considered laid in air whereas if major portion (more than 75%) is in the ground and part length is in air, it would be considered as underground system.

Cables in air shall be laid in GI 'A' class pipes or on cable trays, as specified in schedule of quantities. Clamping of cables directly on wall surface shall not be allowed. Suitable Copper clamps with Copper cast saddles it be provided if G.I. pipes is laid on wall surface. For fixing cables on cable trays, Al. strip clamp of minimum 2 mm thickness shall be used. Providing and fixing of M.S. supports for cable tray would be done by electrical contractor without any extra cost.

Clause no. 4.3.4, 4.3.5, 4.3.7 of underground cable system shall be applicable to cable in air system also.

4.5 **Termination & Jointing of Cables.**

On both ends of cables suitable size brass chrome plated (CP) heavy duty, double compression type cable glands shall be used before it enters terminal box/main L.T. panel/distribution board/sub distribution board/joint box/cable box etc. Armour of cable shall be connected to earth point.

All the cores of PVC cables, 4 Sqmm or more conductor size shall be connected at the ends with the help of appropriate size and type of socket/lugs. These sockets shall be tinned copper or Al. alloy, and these shall be fitted on conductor by crimping process with appropriate crimping tool. Following is the recommended procedure for crimped joint and the same shall be followed.

Strip off the insulation of the cable and with every precaution, not to sever or damage any strand. All insulations to be removed from the stripped portion of the conductor and ends of the insulation should be clean and square.

The cable should be kept clean as far as possible before assembling it with the terminal/socket. For preventing the ingress of moisture and possibility of re-oxidation after crimping of the Copper conductors, the socket should be fired with corrosion inhibiting compound. This compound should also be applied over the stripped portion of the conductor and the palm surface of socket.

Correct size and type of socket/ferrule/lug should be selected depending on size of conductor, and type of connection to be made.

Make the crimped joint by suitable crimping tool.

If after crimping the conductor in socket/lug, same portion of the conductor remains without insulation the same should be covered sufficiently with PVC tape.

5.0 **TELEPHONE AND TELEVISION WIRING**

5.1 **Point Wiring for Telephone System**

- (a) The point wiring shall be carried out with telephones wires/cables. 2 pair un-armoured PVC insulated and sheath 0.61 mm dia annealed tinned copper conductor (IS 2532-1965) in suitable size conduit (one pair always remaining spare for one point).

MINIMUM DIA OF CONDUIT FOR TELEPHONE WIRING –19 MM

If more than one telephone point has to be provided at one point, multi core, un-armoured telephone cable shall be used (pairs required are equal to 2 x no. of points) in suitable size conduit.

- (b) The point shall commence from the main telephone tag box/sub box and would terminate at outlet box of point. Connection at both ends included in point wiring.
- (c) Fixing of conduit, conduit accessories, draw out boxes and outlet box etc. in concealed/surface system. General specification of conduit for electrical wiring (2.0 concealed/surface conduit works) shall be applicable for telephone wiring conduit system also.
- (d) Each telephone point shall have 1 no. flush type 2 pin, telephone socket, outlet fixed on 3 mm thick, and hylem sheet in M.S. outlet box (size 100 x 100 mm). More than one telephone socket outlet (maximum 3 nos.) can be fixed on one outlet box, provided these points are at one place and multi pair (more than 2 pair) telephone cable has been drawn to this point from tag box.
- (e) Joint in telephone wiring (between main tag box/sub tag box and outlet box of point) shall not be allowed and the contractor should bear wastage of wire if resulted due to this special requirement

of telephone system No. looping in telephone system is allowed unless specially shown in the drawing of instructed by site engineer in the drawing/instruction book.

- (f) Telephone and intercom wiring can be drawing in the same conduit, provided after drawing wires, 50% of conduit cross sectional area is free. However independent PVC insulated telephone wire of suitable pairs shall be used for telephone and intercom.
- (g) To identify each pair of multipair telephone wire/cable, PVC indication numbers shall be put on both end of pair just before termination.

5.2 **Point Wiring (Intercom telephone)**

- (a) The point wiring shall be carried out with telephone wires/cable of suitable pairs (as specified in schedule of quantities) unarmoured, PVC insulated and sheath, 0.61 mm dia annealed tinned copper conductor, in suitable size conduit.

MINIMUM DIA OF CONDUIT FOR INTERCOM TELEPHONE WIRING 25 MM.

- (b) The point shall commence from the main junction box of intercom system and would terminate at outlet box of point with 2.0 m loose. intercom cable after outlet box. Connection at both ends of cable shall be carried out by employer.
- (c) General specification for concealed/surface conduit system of telephone system (clause no.5.1 (c) & (d) shall be applicable for this system also.
- (d) Joint in intercom telephone cable (between main junction box and outlet box of point) shall not be allowed and the contractor should bear the wastage of cable if resulted due to this special requirement of intercom system. It joint is unavoidable due to long distance (more than 90 m) permission of site engineer in site instruction book shall be taken.

5.3 **Telephone Cable Work (Underground System)**

- (a) The cable shall be suitable for telephone system of suitable pairs (as specified in schedule of quantities), steel armoured, PVC insulated and seath,.0.61 mm dia annealed tinned copper conductor (IS:2532:1965). All telephone cables for underground laying shall be jelly filled type.
- (b) Specification for laying of telephone cable in underground system shall be same as for electrical system (clause no. 4.2, 4.3, 4.4 and 4.5 and the same shall be followed.

5.4 **Telephone Tag Boxes**

These shall be of KRONE type using insulation displacement technique in which there is no stripping of soldering of wire, of M.S. steel 14 G with connector suitable for telephone connection. It shall have hinged M.S. sheet cover.

5.5 **Telephone point wiring**

- (a) ONLY PVC CONDUIT MINIMUM 25 MM DIA SHALL BE USED FOR ALL TV WIRING.
- (b) Co-axial TV cable of single stand tinned copper conductor of diameter of 0.80 mm, complete with metallic shield. Cable should have single loss less than 6 db per 100 mtrs. for band 1 UHF.
- (c) One number each TV wall outlet in PVC box should be fixed at terrace and at receiving end.

- (d) In each 25 mm dia PVC conduit max.2 nos. co-axial cables should be drawn. There should be the least possible number of bends in the PVC conduit system.
- (e) The samples of TV cable & wall outlet should be got approved before installing.

EARTHING & LIGHTING PROTECTION SYSTEM

6.1 Earth Pit

- (a) Plate or pipe type earth electrode with earth pit shall be provided for this work unless otherwise advised by site engineer due to typical site condition. Earthing electrode and pit shall be as per IS :3043-1966 (code of practice for Earthing). For ready reference, sketches for pipes and plate type earth electrode earthing pit have been shown in the attached sketch no.SK-25. All earth electrodes shall preferably be driven to a sufficient depth to reach permanent moist soil.

PRIOR APPROVAL OF SITE ENGINEER SHALL BE TAKEN FOR SELECTING TYPE OF EARTH ELECTRODE (PIPE OR PLATE)

- (b) Earth pit centre shall be at a minimum distance of 2 M from nearest building, unless otherwise advised. The minimum 3 M distance shall be maintained between centers of 2 earth pits.

6.2 Earth Bus, Earthing Lead & Earth Wire/Strip

- (a) All single phase distribution board shall be provided with one earth point from earthing system whereas for 3 phase distribution board/LT panels etc .would have 2 earth point from 2 independent earthing systems.
- (b) Bare round/flat sections of galvanized Iron or PVC insulated copper conductor wire of size as specified in schedule of quantities shall be used for taking out earthing from earth electrode for making earthing bus or for connecting to LT panels/distribution board etc.
- (c) Heavy duty PVC insulated PVC outer and inner sheath armoured copper conductor cable suitable for 1100 Volts as per IS-1554 (PART-1 :1964) of sizes in specified in schedule of quantities shall be used from earth electrode to concealed distribution board shall be laid underground. Specification 4.2, 4.3, 4.4 & 4.5 of handling and lying of power cable shall be applicable for this cable also.

6.3 Lightning Protection System

For lightning protective system IS:2309-1963” Code of practice for the protection of building & alide structures against lightning “ shall be followed.

6.3.0 Lightning Arrestor/Air-Terminal

It should be of copper 50 mm dia (minimum) globe with at least 3 nos. pointed probes at top, 1000 mm long-stem of minimum 25 mm dia and base palate with fixing arrangements. Roof conductor/down conductor/GI strip as specified in schedule of quantities shall be fixed to base plate of this lightning arrestor. Lightning arrestor shall be fixed on highest point of the tallest building of the project. Numbers and building on which it has to be installed shall be shown in the drawings.

6.3.1 Roof conductor

These shall be used as per drawings (if required) to interconnect the various lightning arrestor of one building near the top, to extend zone of protection. These shall be of GI strip of size 25x4mm as specified in schedule of quantities and shall be fastened securely to the building surface by means of GI saddles, maximum 1 m apart with GI nails/screws.

6.3.2 Down Conductors

These shall be used for connecting the lightning arrestors/roof conductors to earth electrode of earth pit. Structures with a base area of up to 90 sq.mm may if the height of the lightning arrestor gives sufficient protection be equipped with one down conductor only. These shall be GI strip size 37x6 mm fastened securely to the building surface by means of GI saddles maximum 1 m apart with GI nails/screws. Each down/conductor shall have its own independent earth pit.

6.3.4 General

The lightning protective system shall have a few joints as possible and they shall be mechanically and electrically effective. In general joints for strips shall be tinned soldered and at least double riveted. Bolted joints shall only be used on test points or on bonds to existing metals. Each down conductor shall be provided with a testing joint in a position convenient for testing but increasable for interference.

All other metal objects such as water tanks, iron staircase/railings, water or gas pipes on top of inside or by the side of a building should be at least 2 m away from the lightning roof conductor/down conductor system. If this is not possible they should be provided with a separate down conductor and earth pit.

Structures with explosive or inflammable contents shall not have any spire flat-staff or other salient point which can impire the efficiency of air termination/lighting arrestor. No. out door radio aerials or overhead line poles may be located within a distance of 15 m from the structure.

1. EARTHING SYSTEM USED FOR LIGHTING PROTECTION MUST BE INDEPENDENT OF THE EQUIPMENT/DISTRIBUTION EARTHING SYSTEM.

2. EARTHING SYSTEM FOR TELEPHONE SYSTEM SHALL NOT BE MIXED WITH EQUIPMENT/DISTRIBUTION OR LIGHTING EARTHING.

7.0 SUPPLY & INSTALLATION OF LIGHTING FIXTURES/FANS.

7.1 Technical specifications of lighting fixtures/fans.

Lighting fixtures, fans and exhaust fans are not to be supplied by the contractor and hence the detail specification of these are not being given here.

Installation of Lighting Fixtures.

7.2.1 Scope of work under this item shall start from light point, with a 5A bakelite connector, 2 core 2.5 Sq.mm PVC insulated wires from this connector to the connector inside the lighting fixtures, connections, fixing of lighting fixture complete with all accessories, lamps on wall/roof/steel truss etc. testing the lighting fixture and commissioning. If wire length of light point is enough to reach connector of light fitting, connector in light point can be deleted.

7.2.2 If lighting fixtures are being supplied by SHREE SOMNATH TRUST./Client, the contractor would take delivery of these from site store, test the same before installation and if found defective, the defect would be brought to the notice of site engineer. Repair of wiring/circuit of the

fitting shall be carried out by contractor without any additional cost. However, if any component of the lighting fixture is defective / damaged, the same would be located and brought to the notice of site engineer, who would arrange repair / procurement of the same. However, labour for replacement of the damaged / defective component of lighting fixture shall be done by contractor without any additional cost.

- 7.2.3 Contractor shall clarify from site engineer for type of installation (direct on ceiling /hanging) of lighting fixture, if not specifically mentioned on drawings. Length of the suspension rods shall also be decided in consultation with site engineer.

7.3 Installation of Ceiling Fans

- 7.3.1 Scope of work under this item shall start from fan point with a 5A bakelite connector, 2 core 2.5 Sqmm PVC insulated wires from this connector to the connector fan, connections, fixing of fan (complete with all accessories) to the fan hook of fan point, testing the fan with regulator and commissioning.

- 7.3.2 If ceiling fans are being supplied by SHREE SOMNATH TRUST, the contractor would take delivery of these from site store, assemble the same, test before installation and if found defective, the defect would be brought to the notice of site engineer. If any component of fan is defective/damaged, the same shall be located and brought to the notice of site engineer, who would arrange repair/procurement of the same. However, labour for replacement of the damaged/defective component of fan shall be done by contractor without any additional cost.

- 7.3.3 Extension / replacement of hanging rod of fans shall be carried out only if advised by site engineer on drawing/site instruction book. Only GI pipe ('B' class) shall be used for ceiling fan hanging. Screwed joint within the length of fan hanging rod is not allowed and shall never be adopted. Fan hanging rod should be preferably of one piece and if not possible, welded joint can be allowed.

- 7.4 Installation of wall fans

Specification same as 7.3 except that has to be fixed on wall with screws/ bolts grouting instead of on fan hooks.

7.5 Installation of Exhaust fans

- 7.5.1 Scope of work under this item shall start from exhaust fan wire from ceiling rose to connector of exhaust fan, connections, fixing of exhaust fan in existing opening, complete with accessories and louvers on walls with hold-fasts, testing the exhaust fans and commissioning.

- 7.5.2 Same as 7.3.2 (read exhaust fan instead of ceiling fans).

- 7.5.3 If instructed by Site Engineer, Electrical contractor shall make opening in wall for exhaust fan including repair and finishing of opening. Charges of this work shall be paid separately as per schedule of quantities.

7.6 Special Notes

- 7.6.1 Location of lighting fixtures/fan shall be shown on the working drawings and the same shall be followed. However, if due to site conditions the location can not be adhered to, the same shall be brought out to the notice of site engineer for advice.

- 7.6.2 Maintenance and custody of light fixture/fans after installation / commissioning would be with contractor till that building / area is completed and handed over to SHREE SOMNATH TRUST. Site Engineer in satisfactory working order.

8.0 STREET LIGHTING

Street Light Poles Specification

These shall be of steel tubular type with suitable arrangement at the top of the pole for fixing the lighting fixture. Poles shall be fabricated out of MS medium class pipes ERW type, in stepped sections as specified in the attached drawing of street light poles. For reducing the section of pole's pipe for stepped design, SWAGING process only shall be used. Poles will have one mast / two mast readily equidistant / three mast readily equidistant as specified in schedule of quantities for fixing one / two / three lighting fixtures. Each pole would have one MS water tight box fabricated out of 14 SWG sheet steel complete with a six way heavy duty 30 Amp. Power connector, four way heavy duty 30 Amp neutral connector, 10 A SP MCB etc. as shown in the attached drawing of street light poles.

The pole shall be painted with two coats of anti-corrosive Zinc chromate red-oxide primer before dispatch to site and two coats of enamel / Al. paint of approved make and shade after installation.

The earthing of each street light pole shall be carried out with PVC insulated black colour 10 Sq.mm Aluminium conductor cable, connected to perforated 38 mm NB GI 'B' class pipe 2.5 M long, driven in earth (150 mm dia pit filled with charcoal & salt). The pipe should have removable plug at top.

Bracket for street light fittings on buildings – Specification

The brackets shall be made of 38 mm NB MS class 'B' pipe, approx. 1.8 M long, bend at the center at an angle of 10 degree from horizontal, with necessary holding brackets, holdfasts etc. with special reducer at end to accommodate type of street light fittings to be fixed. Bracket shall have two coats of anti-corrosion Zinc chromate red-oxide primer before dispatch to site and 2 coats of approved make and shade of enamel paint at site after installation. Each bracket to be provided with suitable MS flat clamps for fixing. Each bracket shall also be provided with one MS water tight switch box, complete with a connector, neutral link, 10 A SP MCB etc. similar to box being provided for street light poles. See attached drawing of street light poles.

Installation of poles

Installation of poles shall be done as per attached drawing of street light poles. The depth of pole to be buried in ground shall be 1/5th of total pole length unless otherwise specified in pole drawing. Special care shall be taken in erecting poles so that these are not strained or damaged during erection and are firmly stayed till the foundation are secured. The pole shall be grouted inside ground pit (cross section 600 x 600 mm) with cement concrete 1:2:4. Before the placement of pole in the pit. 100 mm thick 600 x 600 mm, 1:2:4 cement concrete bed shall be prepared and only after its drying, poles shall be put in pit. Before placement of concrete around pole in the pit, necessary GI class A pipes (not less than 38 mm dia NB) shall be placed for facilitating drawing of cables and earthing wire. Separate pipes shall be provided for incoming and each outgoing cables. The cement concrete shall be protected from premature drying by curing for atleast seven days after pouring. All concrete surface from 150 MM below ground level to top shall be finished smooth with cement mortar 1:4. Nothing extra shall be paid for these GI pipes which are there to facilitate pulling of armoured cables & earthing wire, as cost of these are included in laying of cables.

Installation of street light fixtures

This includes fixing of street light fitting complete with accessories and lamps at the end of the pole / bracket, connecting it with 3x2.5 Sq.mm Copper conductor, PVC insulated, flexible cable from water tight MS switch box, testing & commissioning. One core of cable shall be connected

with earthing point of light fitting at one end & earthing point of MS switch box at the other end. If the pole has more than one light fitting, each fitting should have independent flexible cable from MS switch box to fitting.

While fixing street light fitting on bracket (8.2 above), supplying and fixing of necessary MS conduit between MS switch box and fitting is also included in contractor's scope without any extra cost.

Installation of post top lantern

For entrance gate

This includes providing & fixing 76 mm NB GI class 'B' pipe of 0.5 M long and 25 mm dia GI 'B' class pipe with bend at lower end for pulling wire in brick / RCC column, including MS water tight switch box (specification same as that of street light pole) and installation of post top lantern complete with all accessories and lamp, connecting it with 3 x 2.5 Sqmm copper conductor, PVC insulated flexible cable, testing & commissioning. Painting of the exposed portion of the pipe with two coats of approved make & shade of enamel paint is also included. One conductor of flexible cable shall be used for earthing.

For open ground

This includes providing and fixing 76 mm dia GI class 'B' pipe of total length 4 M (including 1 M in ground to be grouted with 450 x 450 x 1000 mm cement concrete 1:2:4) and water tight switch box (specification same as that of street light poles) installation of post top lantern complete with all accessories and lamp connecting it with 3 x 2.5 sq.mm copper conductor, PVC insulated flexible cable, testing and commissioning. Painting of exposed pipe length with 2 coats of approved make & shade of enamel paint is also included. One conductor of flexible cable shall be used for earthing.

Flood Lighting on Tower

Flood Light Tower Specification

Flood lighting tower shall be either of steel tubular or Ms angle type with suitable arrangement at the top of the tower for fixing the lighting fixtures. Tower shall be fabricated out of MS medium class pipes ERW type or with MS angles / flats etc. as specified in the attached drawing. Each tower would have one MS water tight switch box fabricated out of 14 SWG thick sheet steel complete with a heavy duty 30 A, 6 way power connector, 6 way heavy duty 30 A connector for neutral, required number of 10 A MCB (one MCB for one light fitting) etc. as shown in the attached drawing of flood light tower. The control gear box of each light fitting, received with the fittings, shall be installed on the working platform at the top of tower. MS switch box and light fittings on tower shall be connected by three-core, copper conductor PVC insulated unarmoured cable in conduit pipe as shown in the attached drawing of tower. The tower shall be painted with two coats of anti-corrosive zinc chromate red-oxide primer before dispatch to site and two coats of Aluminium paint after installation. The earthing of tower shall be carried out with PVC insulated 10 Sq.mm Aluminium conductor PVC insulated black wire, connected to perforated 38 mm GI 'B' class pipe as shown on flood light pole drawing, driven in earth near tower (150 mm dia pit filled with charcoal and salt).

Installation of flood light poles

Installation of flood light poles shall be done by the contractor on concrete pedestal which shall be made ready SHREE SOMNATH TRUST as per the drawing. However necessary GI pipes (minimum 38 mm NB) shall be provided by electrical contractor to put in the concrete pedestal to

facilitate pulling of power cable & earthing wire. Nothing extra shall be paid for providing these GI pipes, as cost of the same is including in laying & connecting of cables / wires.

Installation of flood lights on tower

This includes of street light fitting complete with accessories and lamps on the bracket, connecting it with 3 x 4 Sq.mm copper conductor, PVC insulated unarmoured cable in a MS conduit from water tight MS switch box through control gear box, testing and commissioning. One conductor of cable shall be connected with earthing point of light fitting at one end and earthing point of MS switch box at the other end . If the pile has more than one light fitting, each fitting should have 3 x 4 sq.mm copper conductor, independent cable from MS box to fitting.

Flood Lighting of Spray Pond

Control panel

This shall consist of water tight panel with switch gear, contractor relay, timer etc. to achieve switching on, 6 sets (each set having 3 nos. lights) of different colours, in a fixed sequence. Necessary protection device and locking arrangement shall be there in the panel and it shall be completed with all internal copper wiring ready for use.

Installation of flood lights

Flood lights would be installed in concrete pockets of spray pond, all pockets to be inter-connected with 'A' class GI pipe (25mm dia) and one pocket nearest to control panel to be linked with it, by GI 'A' class pipe (25 mm dia). All wiring to each flood light to be with 3 x 2.5 Sqmm Aluminium conductor PVC insulated flexible cable. Approx. dia of spray pond is 10 M. Testing of flood lights, control panel and commissioning the same.

Flood Lighting on building top

This includes supplying and installation of MS switch box (specification same as that of street light pole) approximately 1 M above ground, laying of 25 mm conduit up to fitting on top of building, installation of flood light with grouting of clamps etc. if required, connecting with 3 x 2.5 Sqmm copper conductor PVC insulated cable, testing and commissioning of flood lights.

General notes for street & flood lighting

For supplying and laying of cable, clause no 4.1, 4.2, 4.3 & 4.5 of technical specification (wiring) shall be applicable.

If employer supplies street light fixtures, flood lights and post top lanterns, clause on 7.2.2 of technical specification shall be applicable.

For street light poles along reads, nearest finished road level shall be taken as round level and for street light poles and flood light poles along compound wall / away from roads, existing ground / finished round shall be taken as ground level.

Distance of 1.5 M shall be maintained between center of pole and center of curb of road. For compound wall poles, distance between compound wall and poles shall be 5 M.

A loop of 1.5 M of cable shall be provided near each street light pole for all incoming and outgoing cables.

9.0 SWITCH BOARDS AND DISTRIBUTION BOARDS

9.1 Cubicle type electrical switch boards

9.1.1 General

It shall be of cubicle type (having individual cubical for each incoming and outgoing feeder), totally enclosed, dust and vermin proof, floor mounted, fabricated out of 14 G mild steel of commercial quality.

The height of switch to be so designed that no operating switch is at more than 1800 mm and less than 400 mm from finished floor level. Door closing shall be by quick openable thumb screws. Mechanical inter locking to be there for doors of cubicles having incoming / outgoing feeder such that door can be opened only if feeder is OFF.

9.1.2 Painting

All the M.S. parts shall be full surface including decreasing, picking, phosphatising etc. and anti rust primer coating, following by two coats of spray paint of approved shade. Half liter paint shall be supplied along with panel for touch up wherever necessary.

9.1.3 Gaskets

All joints between different sections and the switch board shall be provided with synthetic rubber gaskets so as to make the complete board completely dust proof.

9.1.4 Bus Bars

The bus bar shall be made of high conductivity Aluminium alloy, PVC sleeved, air insulated and of adequate size, current density to be considered as 0.8 Amp/sq.mm for operation on 3 phase, 4 wire, 440 V, 50 Hz. AC supply system, as per IS 345-1963 with amendment till date. The bus bars shall be supported and separated by strong hylem sheet at close intervals to prevent bus bar sag and to effectively with-stand electro magnetic stresses in the event of a short circuit. Minimum clearance to be working at system voltage up to 600 V shall be as follows:

Phase to earth	-	20 mm
Phase to phase	-	25 mm

Backelite partition plates shall be provided between the feeder boxes and the bus bar chambers, in order to avoid, falling down of any nuts/bolts into the bus bar chambers while carrying out maintenance of the feeder components.

MINIMUM SIZE OF MAIN BUS BAR OF CUBICAL TYPE MAIN SWITCH BOARD TO BE -40X6 MM.

9.1.5 Components of switch boards

The panel shall be provided with switches, fuses, MCB, MCCB, meters and struments etc. of size, capacity as specified in schedule of quantities. Only approved make, as selected by contractor in annexure III can be used for manufacture of switch board.

Heavy and normal duty switch fuse units

Heavy duty switch fuse unit to be incorporated in the switch boards shall comply fully with the requirements of IS:4047 and all other switch fuse units shall be of the double break type, suitable for load break duty with quick make and quick break action shall be capable of making and breaking 300% of the rated current. The units shall be suitable for accommodating HRC cartridge fuse links. All switch contacts shall be silver plated. The door of the unit shall be interlocked with the operating mechanism so as to prevent opening of the door when the switch is in 'ON' position and also to prevent closing of the switch with the door not properly secured. However by releasing interlock, switch shall be able to operate in any door position. The interior arrangement of the switch shall be such that all live metal is shrouded. The moving contacts shall be mounted on their own operating shaft so that they can be removed as a complete sub-assembly to facilitate inspection and maintenance. The terminal connections of the unit shall be capable of taking the appropriate sizes of cables with Aluminium conductors. For heavy duty switch fuse units, the connections to the units from the bus bars and cables shall be terminated in pressure bolted joints inside the switch contacts, enabling readily removal of individual switch fuse unit from the front of the Board, if required. All normal duty switch fuse units shall have an external earthing terminal to enable the enclosure to be earthed.

HRC cartridge fuse links

The high rupturing capacity cartridge fuse links to be used in the switch fuse units, distribution boards etc. shall comply fully with the requirement of IS:2205. The fuse links shall have a certified rupturing capacity of not less than 35 MVA at 440 volts.

Miniature circuit breakers (MCB)

These shall be suitable for 230/415 V, 50 Hz. AC supply and current rating as specified in schedule of quantities. These shall be of short circuit current of 3 KA minimum at 230 V. AC, long mechanical and electrical operation life, with over load tripping through accurately calibrated thermal bimetal strips and short circuit tripping through magnetic coil. Complete MCB should be housed in heat resistant moulding. Over current tripping should result in switching off all poles automatically even if tripping only takes place in one pole. Miniature circuit breakers shall conform to BS-3871 (Part I) and IS:8828-1978.

Moulded case circuit breakers.

The MCCBs shall be of triple pole construction arranged for simultaneous three pole manual closing or opening and automatic instantaneous tripping on short circuits. Closing mechanism shall be quick make, quick break and trip-free type. 'ON'. 'OFF' and 'Trip' indications shall be provided on the front cover with door interlocking facility. All feeders having MCCB shall be provided with neutral link complete with isolating link.

The MCCBs shall be rated for continuous maximum duty as specified. The rating of the MCCBs shall be as per the feeder details.

Rated breaking capacities shall be as under:

MCCBs up to 200 Amps	10 KA
250 to 800 Amps	35 KA

HRC fuses should be provided for MCCBs below 250 Amps rating to make their rupturing capacity minimum 35 KA.

The control voltage shall be 240 V AC.

Measuring instruments

These shall be of squares pattern having approximate dimensions 96 mm x 96 mm, flush mounting type. Necessary auxiliary instruments like CTs, VTs etc. are also included in the scope of supply.

All AC meters shall be of moving iron type having class 1.0 accuracy. Ammeters for motor feeders shall have a non-linear compressed scale at the end to indicate starting current.

Voltmeter shall be suitable for direct line connection. Voltmeters shall be connected through fuses only.

Energy meters shall be suitable to measure unbalanced / balanced loads of 3 phase 3/4 wire system.

Ammeters provided for switch fuse units shall be with rotary selector switches and those for motors shall be without selector switches.

All voltmeters shall be provided with selector switches.

Ammeters for 20 Amps and above shall be CT operated.

Current Transformers (CTs)

CTs shall be cast iron insulated type. Primary and secondary terminals shall be marked indelibly. CTs preferably be mounted on stationery parts. CT rating and ratios shall be as per feeder ratings. These shall be capable of withstanding momentary short circuit and symmetrical short circuit current for 1 second. Neutral side of CTs shall be earthed. Protection CTs shall have low reactance, accuracy class "SP" and accuracy limit factor greater than "10" Instrument CTs shall be of accuracy class "1.0" and accuracy limit factor less than "5.0".

Earth leakage circuit breakers (ELCB)

These current operated ELCB's shall be suitable for 2/4 poles 230/415 V, 50 Hz. AC supply, current and sensitivity rating to be as specified in schedule of quantities. These shall be able to withstand short circuit current of 3 KA minimum at 230 V.AC and have long operational life. This shall incorporate highly sensitive relay to trip the circuit in case of earth leakage. This shall have the facility to trip the circuit during interruption in the earth connection or loss of supply neutral. Over current tripping should result in switching off all poles automatically even if tripping takes place in one pole. Earth leakage circuit breakers shall conform to BS-4293 protection (ELCB + MCB combination) of appropriate size may also be used instead of separate ELCB and MCB.

9.1.6 Connections

Connections to the bus bars shall be made by drilling holes. However, no holes shall be left in the bus bars. The bolts & nuts used for connections to bus bars shall be of Aluminium alloy or tinned forged brass. For tapping of connections from bus bars suitable size PVC insulated copper conductor wire (minimum size 4.0 sq.mm) shall be used with suitable size and type of crimped lugs/cable sockets. For connection of feeder above 63 Amps, only Al. alloy links bus bar link with PVC tapes shall be used. Suitable size cable boxes shall be provided for incoming /outgoing cable of sizes more than 95 sq.mm. For all outgoing cables, cable trays of suitable sizes in sides and tops, as required for proper cable connections/laying inside the panel, shall be provided. Switch board shall be suitable of Copper conductor PVC insulated incoming and outgoing cables. Removing gland plates shall be provided for cable entries.

9.1.7 Earthing

Two independent earthing points shall be provided outside the panel near bottom and these shall be inter-connected with GI earthing bus bars of minimum size 40x6 mm. All earthing points inside the distribution board shall be interconnected to these earthing points with suitable size copper conductor PVC insulated wire.

9.1.8 Name plates

Switch board / distribution board shall be provided with danger plate and name plates for all incoming and outgoing feeders. These name plate shall be of PVC (black colour base & white letters engraved) screwed to panel. PVC identification ferrule numbers shall be used for all internal wiring.

9.1.9 Approvals

The drawing showing general arrangement and detailed wiring diagram for the switch board shall be submitted to employer for approval, prior to manufacture and switch board shall be got inspected, prior to dispatch to project site. The complete switch board and its component shall conform to Indian Electricity Rules & relevant I.S.S. Approval if required from Electrical Inspector shall be obtained by contractor and changes if desired by Electrical Inspector, shall be carried out.

9.2 Electrical Distribution Boards

9.2.1 General

These shall be wall mounted, surface / flush type, indoor type enclosure, hinged front cover, dust and vermin proof fabricated out of 14 G mild steel sheet of commercial quality. All Components such as switches, MCB etc. to be so mounted inside the distribution boards, that only operating handles / knobs are visible outside the front hinged door. Detachable cable/conduit entry plates with required 25 mm dia knockouts shall be provided on top and bottom of D.B.

If distribution board is concealed and receiving incoming power from bottom of board by Armoured cable through GI pipes, height of DB shall increased suitably, so that 3 mm thick gland plate can be fixed as shown in the attached sketch no. .

9.2.2 Painting

Same as clause 9.1.2 of cubicle switch boards.

9.2.3 Gaskets

Same as clause 9.2.3 of cubicle switch boards.

9.2.4 Bus bars

Same as clause 9.1.4 of cubicle switch board except that the minimum size bus bars shall be 25 x 6 mm Al. or 19x6 mm Copper.

9.2.5 Component of Distribution board

Same as clause no. 9.1.5 if cubicle switch board.

9.2.6 Connections

All interconnections shall be done by suitable size minimum 4.0 sq.mm. Copper conductor PVC insulated wires with suitable size and type of crimped type plug. Arrangement shall be there for directly mounting of MCB on bus bars. The bolts and nuts used for connections to bus bars shall be of Al. alloy or tinned forged brass. Enough space shall be provided inside the distribution board to accommodate loop of surplus incoming and outgoing wires. For all line conductor PVC colour of wire would be Red, Yellow, Blue & that of neutral to be Black. For accommodating neutral wires of all incoming and outgoing circuits, suitable size connector or neutral bus shall be provided inside the distribution board.

9.2.7 Earthing

Two independent earthing points shall be provided the distribution board in case of 3 phase and one earthing point incase of single phase system. An earthing bus of copper shall be provided inside the D.B.

9.2.8 Name plates

Same as clause no. 9.1.8 of cubicle switch boards.

9.2.9 Approval

Same as clause no. 9.1.8 of cubicle switch boards except that same approval of only one typical distribution board may be taken from employer.

9.2.10 Components of distribution boards

Same as clause no. 9.1.5 of cubicle switch boards.

10.0 COMPLETION TESTS

After supply and installation of complete project or a particular building / area, following tests shall be carried out by the contractor before switching on the power to installation and the results shall be recorded and submitted to the site engineer. If results are not satisfactory as per the standard set herewith, the contractor shall identify the defects short coming and shall rectify shall rectify the same. Nothing extra shall be paid for carrying out these tests and contractor has to arrange all necessary instruments.

10.1 Insulation resistance to earth

This to be measured with all fuse links in place, all switches on, all lamps and appliances in position by applying a voltage not less than twice the working voltage (subject to a limit of 500 V). Insulation resistance of the whole or any part of the installation to earth must not be less than 50 Mega ohms divided by the number of outlets (points and switch positions) except that it need not exceed 1 Mega ohm for t he whole installation.

10.2 Insulation resistance between conductors

Test to made between all the conductor connected to one pole or phase conductor of the supply and all the conductors connected to the middle wire or neutral or the other pole or phase conductors of the supply. For this test, all lamps shall be removed and all switches put on. The result of the test must be 50 Mega ohms divided by the number of outlets (point and switch positions) but need not exceed one Mega ohm for the whole installation.

10.3 Polarity of single pole switches

Test shall be made to verify that all non-linked single pole switches are on phase conductor (Live) and not on the neutral or earthed conductor. This can be done by connecting test lamps between two terminals of switch and earth. If the lamp lights up when switch is ON & either terminal is touched the switch is correctly installed.

10.4 Resistance of metal conduits / sheaths (Earth continuity test)

In case of cables encased in metal whether conduit or metallic sheathing, the total resistance of the conduit or sheathing from the earthing point any other position in the completed installation shall not exceed 2 ohms. This can be carried out by the circuit shown in Annexure VII. One end of the lead is connected to the ECC at its connection with the electrode and the other to the farthest point of the ECC. First, current through the circuit is measured with the resistance of 2 ohms short circuited by the link. Next, current is measured through the two ohms resistance by disconnecting the two leads from the ECC and joining them together. If current is more in the first case, the resistance of ECC is less than two ohms.

11.0 MODE OF MEASUREMENT

11.1 WIRING (PART 1) TRADE CODE 81

Item	Mode of Measurement
01	Each light point shall be measured as one no.
02	Two light point shall be measured as one no.
03	Three light points shall be measured as one no.
04	One light with 2 switches shall be measured as 1 no.
05	One fan point shall be measured as one no.
06	One exhaust/bracket fan shall be measured as one no.
07	One buzzer point shall be measured as one no.
08	One buzzer extension shall be measured as one no.
09	One isolated 5 A power point shall be measured as one no.
10	One 5 A power point in lighting switch board shall be measured as one no.
11	One 15 A power point shall be measured as one no.
12	One 15 A power point shall be measured as one no.
13	One 20 A power point shall be measured as one no.
14	One aviation light point shall be measured as 1 no.
15	One light controlled by one MCB shall be measured as one no.
16	Group of 2 lights controlled by one MCB shall be measured as one no.
17	Group of 3 lights controlled by one MCB shall be measured as one no.
18	Group of 4 lights controlled by one MCB shall be measured as one no.
19	Group of 2 lights controlled by one MCB shall be measured as one no.
20	Group of 3 lights controlled by one MCB shall be measured as one no.
21	Group of 4 lights controlled by one MCB shall be measured as one no.
22	Group of 5 lights controlled by one MCB shall be measured as one no.
23 to 28	Length of single run of PVC insulated wire (Not total of 3 or 5 wires but one length) used to be measured in meter. (This will be more than conduit length as loose/loop wire inside distribution board/lighting switch box also to be measured and paid for). Measurement to be restricted up to one point after decimal.

29 to 34	Length of PVC insulated and sheath cable to be measured in M (Portion of cable without outer insulation and armoring inside the main panel/distribution board also to be measured and paid. All loops inside the panel/distribution board also to be measured and paid). Measurement to be restricted up to one point after decimal.
35 to 41	Length of PVC insulated and sheath cable to be measured in M (Portion of cable without outer insulation and armoring inside the main panel/distribution board also to be measured and paid. All loops inside the board/in ground or trench also to be measured and paid). Measurement to be restricted up to one point after decimal.
41 to 67	Same as above and addition no reduction in rates or quantity to be effected for drawing cable through hume pipe/ trench/ GI pipe etc. provide by employer.
68 to 70	Length of cable tray used to be measured in Meter. Measurement to be restricted up to one point after decimal.
71	Length of conduit laid shall be measured in meters. Measurement to be restricted up to one point after decimal.
72 to 75	Length of GI pipe shall be measured in meters. Measurement to be restricted up to one point after decimal.
76	One 15 A power point with switch & socket place separately shall be measured as one no.
77 to 82	Length of single run of wire shall be measured in meters. Measurement shall be restricted up to one point after decimal.
83	Length of GI pipe including bends shall be measured in meter. Measurement to be restricted to one point after decimal.

NOTE: FOR ITEM NO. 35 TO 67, ONE CABLE SHALL BE MEASURED UNDER ONE ITEM ONLY THOUGH IT MIGHT HAVE BEEN LAID UNDER TWO ITEMS FOR DIFFERENCE PORTION OF IT'S LENGTH. ITEM AS PER WHICH MORE LENGTH HAS BEEN LAID SHALL BE APPLICABLE FOR COMPLETE LENGTH.

Item No.	Mode of Measurement
01 to 09	Each lighting fixture shall be measured as one no.
10 to 12	Each fan shall be measured as one no.
13	Each exhaust fan shall be measured as one no.
14	Each buzzer/bell/musical bell shall be measured as one no.
15	Each aviation light (consisting of two bulbs) shall be measured as one no.
16	Each opening of exhaust fan shall be measured as one no.
17	Each clamp shall be measured as one no.

11.4 EARTHING AND LIGHTING PROTECTION (PART-IV) TRADE CODE 84

Item Code	Mode of Measurement
01	Each plate type earthing pit shall be measured as one no.
02 to 07	Total length as laid of continuity conductor shall be measured in meter. Overlaps shall not be measured. Measurement shall be restricted to 1 st point after decimal.
08	Each lighting arrestor shall be measured as one no.
09	Total length as laid of roof conductor shall be measured in meter. Overlaps shall not be measured. Measurement shall be restricted to meter.
10	Each earthing pit shall be measured as one no.
11	Length of PVC insulated cable to be measured in Meters. (Portion of cable without outer insulation and armoring inside the distribution board/junction box/ cable joint/ switch box also to be measured and paid. All loops inside the board/switch box also to be measured. No deduction in quantity or rate to be effected for more than one cable laid in same trench). No deduction in quantity or rate to be effected for cable laid in hume pipe/GI piper / trench etc. provided by employer. Measurement to be restricted up to one point after decimal.
12	Same as above

11.5 TELEPHONE/INTENRCOM SYSTEM (PART-V) TRADE CODE 85

Item Code	Mode of Measurement
01	Each telephone point shall be as one no.
02	Length of wire/cable laid shall be measured in Meter, loose wire provided in junction box/tag box/outlet box shall be measured and paid. Measurement to be restricted up to one point after decimal.
03	Each extension to telephone point shall be measured as one no.
04 TO 12	Length of cable laid shall be measured in meter length of cable without outer insulation and armoring inside tag box/junction box/ outlet box etc. shall also be measured and paid. Loop of cable provided shall also be measured. No deduction in quantity or rate shall be done for laying more than one cable in same trench. No deduction in measurement or rate shall be made for cable drawn through hume pipe / trench / GI pipe etc. provided by employer Measurement to be restricted up to one point after decimal.
13 to 14	Length of conduit laid shall be measured in meters. Measurement to be restricted up to one point after decimal.
15	Telephone point wiring with 4 pair cable shall be measured as one no.
16 to 19	Each block shall be measured as one no.
20	Each TV point with wall outlet at one end shall be measured as one no.

11.6 DISTRIBUTION SYSTEM (PART-V) TRADE CODE 86

Each switch board/ distribution board complete with switch gear for incoming and outgoing feeder shall be measured as one set.

11.7 GENERAL

The following guidelines to be followed for recording part payment of various items, if rather than secured advance, Engineer In charge agrees to recommend part rate for incomplete work.

11.7.1 Part 1 (Wiring)

(a) Point wiring & circuit wiring, wire sub main etc. – Supply & laying of conduct ceiling only (25%)

Supplying & laying of conduit in ceiling/walls & switch boxes i.e. point ready without wiring(25%)

Item ready with wiring 7 switches but without testing/commissioning (30%)

(b) Cable Laying – Supply of cable only (80%)

11.7.2 Part II (Installation of Fixtures)

No part rate to be recommended.

11.7.4 Part IV (Earthing & Laying Protection)

No part rates, only secured advance can be paid.

11.7.5 Part V (Telephone System)

(a) Point Wiring

Supplying & laying of conduit in ceiling only (25%)

Supplying & laying of conduit in ceiling/walls & switch boxes i.e. point ready without wiring (25%)

Item ready with wiring & switches but without testing / commissioning (30%)

(b) Cable Laying

Supply of cables only (80%)

11.7.6 Part VI (Distribution System)

Supply of Panel /DB (85%)

APPROVED MAKES OF ITEM FOR ELECTRICAL TENDER

Sr.No.	Item Description	Approved make	Make selected by 1 st preference	Contractor preference 2 nd
1	PVC insulated flexible, copper conductor	FINOLEX, RR Kabel, Polycab, L & T		
2	PVC insulated armoured, Al. conductor power cables	FINOLEX, Polycab, Avocab		
3	Flush types, modular switches, sockets outlet and accessories	ROMA , L & T, Siemens, ABB, Salzer		
4	Switch fuse units with HRC fuses (for Distribution Boards) (TPN & DP)	L&T, SIEMENS, Legrand, C & S		
5	Miniature Circuit Breakers (MCB)	L&T, SIEMENS, Legrand, Schneider, ABB		
6	Earth Leakage Circuit Breakers (ELCB)	L&T, SIEMENS, Legrand, Schneider, ABB		
7	Moulded Case circuit Breaker	L&T, SIEMENS, Legrand, Schneider, ABB		
8	Measuring Instruments	MECO, AUTOMATIC ELECTRIC, I.M.P.		
9	Current Transformers	MECO, AUTOMATIC ELECTRIC, I.M.P.		
10	Energy meters	G.E.C., UNIVERSAL, HAVEL, SIMCO		
11	Telephone wires & Cables	DELTON, RR Kabel, FINOLEX		
12	Industrial type Metallic plug sockets	L&T, SIEMENS, Legrand		
13	Cable Glands	DOWEL, HMI, 3-D		
14	Cable Lugs	DOWEL, HMI, 3-D		
15	Rigid PVC conduits	PRECISION, Vraj, Havells.		
16	Data Cable/ Network items	D- link, DG Link, Molex		
17	Electrical Fittings	Philips, Crompton, Wipro, Havells		
18	Ceiling/ Ex. / Wall Fan (Power Saver Type)	Crompton, Havells, Usha, Orient		
19	LED type Fitting	Philips, Crompton, Wipro, Havells, VIN		
20	Electric Geyser	Usha, Crompton, Re cold, Havells		

Note:

For All items samples should be got approved from SHREE SOMNATH TRUST & Architect / Consultant.

1. Tender should quote rates of various items considering supply / use of FIRST PREFERENCE MAKE OF MATERIAL SELECTED by them. Second preference make material would be accepted by SHREE SOMNATH TRUST, if satisfied that 1st preference make material can not be supplied/ used by contractor due to any specific reasons. However the final decision for accepting 2nd preference make or accepting only 1st preference makes would be of SHREE SOMNATH TRUST.

MAXIMUM CAPACITY OF CONDUITS FOR THE DRAWING IN OF 650 VOLTS GRADE PVC AL. WIRES.

Nominal Cross Sectional area Sq.mm	Size of Conduit (mm)											
	19		25.4		31.8		38		51		63.5	
	S	B	S	B	S	B	S	B	S	B	S	B
2.5	5	4	8	6	12	10	-	-	-	-	-	-
4.0	3	2	6	4	8	7	-	-	-	-	-	-
6.0	2	1	5	3	8	5	-	-	-	-	-	-
10.0	2	-	4	3	6	5	-	-	-	-	-	-
16.0	-	-	2	-	3	2	5	4	-	-	-	-
25.0	-	-	-	-	2	1	4	3	6	4	8	6
35.0	-	-	-	-	-	-	3	2	5	4	7	5
40.0	-	-	-	-	-	-	2	2	5	4	7	5
50.0	-	-	-	-	-	-	2	1	4	2	5	4

NOTE : This table shows the maximum capacity of conduit for the simultaneous drawing in the cables. The table applies to 650 volts grade wire/cables. The columns headed S apply to runs of conduit which have distance not exceeding 4.25 m between draw-in-boxes and which do not deflect from the straight by an angle of more than 15 deg. The columns headed B apply to runs of conduit which deflect from the straight by an angle of more than 15 deg.

STANDARD SKETCHES

S.No.	DESCRIPTION	PAGE NO.
	Fixing Details for Fluorescent Light Fittings (Sketch No. 16)	IV-29
	Outlet Box & Installation Details for Ceiling Fans (Sketch No. 17)	IV-30
	Details of MS Outlet Box for Installation of Fittings on Slab (Sketch No 18 A)	IV-31
	Details of MS Outlet Box for Installation of Fittings on Wall (Sketch No.18 B)	IV-32
	Details of MS Box for Switchboards (Sketch No. 19)	IV-33
	Installation Tips for Lighting switch boards (Sketch No. 20)	IV-34
	Termination of Armoured Cable in Concealed DB (Sketch No 24)	IV-35
8.	Earthing Pit Detail (Sketch No. 25)	IV-36
	Laying of Cables (Sketch No. 26)	IV-37
10.	Rout Maker for Underground Cables & Ckt. Diagram for Earth Continuation Test (Sketch No. 27)	IV-38
11.	Street Lighting (Sketch No. 21)	IV-39