

2. TECHNICAL SPECIFICATIONS

15.1. WIRING

ACCESSORIES SCOPE

Carry out wiring for lighting, small power, communication, music, computer, video, fire alarm and other facilities as required in conformity with all relevant rules, regulations, standards, specifications, codes of practice and site requirements including all supplies and works required to complete the installation in all respects.

The scope of Contractor's work will include but not being limited to the following:

- a. Completion of putting the ELV and Electrical conduits at required places before the concrete is poured for the RCC works.
- b. Clearing of the conduits after the de-shuttering works of the concreted Slabs and Beams
- c. Cutting the walls and putting conduits on the walls before the plastering of the walls.
- d. Fixing of Metal boxes for the fixing of Switches at a later stage.
- e. Carrying out wiring for all LT Installations till the Distribution Boards.
- f. Fixing of Fans, Light Fittings or any other LT related Fittings

CABLES & WIRES

For medium voltage cabling, 1100V grade heavy duty PVC armoured cables conforming to IS: 1554 (Part I) as amended and revised up to date shall be used. The work shall be carried out in accordance with section titled "Specifications for installation of cables"

Unless otherwise specified, single core, fine-stranded copper conductor, PVC insulated, unsheathed, 1100V grade wires manufactured according to relevant Indian Standard Specifications shall be used in conduit for point wiring for lighting and small power from distribution boards.

For wiring for three-phase loads, 1.1 kV grade XLPE/APVC cable shall be used except in cases where the wiring is to be concealed in walls/slabs. In case of concealed wiring only conduit wiring using single core PVC insulated wires shall be employed. For wiring from floor switchboards to MCB distribution boards, conduit wiring shall be used unless otherwise specified. Where the wiring from final sub switchboards to MCB distribution boards can be taken above false ceiling with only short vertical drop through concealed pipe embedded in wall to reach the MCB distribution board, armoured cables may be used for the wiring. In all other cases, single core wires in concealed conduit shall be used for wiring within the building.

The minimum permitted sizes of wires with copper conductors are as follows.

Primary light/fan point	:	1.5 Sq.mm, Class II
Secondary light/fan point	:	1.5 Sq.mm, Class II
5 Amps, SPN+E socket	:	1.5 Sq.mm, Class II
10/15 Amps, SPN+E socket	:	2.5 Sq.mm, Class II
20 Amps, SPN/TPN+E socket:		4.0 Sq.mm, Class II
Flexible cord for interconnection of appliance:		1.5 Sq.mm, Class II

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Circuit wiring : 1.5 Sq.mm, Class II

The wires shall be colour coded, red, blue and yellow wires shall be used for the phases, black for the neutral and green for covered earthing conductor.

The wiring shall be provided with proper identification facility. Circuit identification numbers shall be marked in the distribution boards and these numbers shall be displayed throughout the wiring of the circuits where identification is likely to become necessary by means such as ferrules, labels, etc.

The wires shall be installed in such a manner that they shall not get damaged due to contact with sharp/rough surfaces. The wires shall be easily accessible for replacement, if required. Approved wire pulling compound shall be used while drawing in wires through the conduits. All the wires to be installed in one conduit run shall be pulled together along with the continuous earth conductor.

All connections in wiring shall be made in adequate enclosures which shall comfortably accommodate the terminals and the wiring and in such a manner that these connections shall be easily accessible for inspection and testing. In the case of wiring above false ceiling or behind panels, such connections shall be accessible without disturbing the false ceiling / panels. In the case of wiring above false ceiling with recessed type lighting fixtures, the connections shall be made inside the lighting fixtures in such a manner that these can be easily accessed through the lighting fixture. No connection shall be made in the portion of the wiring above false ceiling or in areas which are similarly inaccessible.

Wherever wire connections are made, there shall be enough space to properly shape the conductors so that good segregation is available between wires of different voltages and no mechanical strain is imposed on the terminals. All crossing of wires, as far as possible, shall be avoided.

For conductors up to a size of 6 Sq.mm, self-insulated pressure type terminals with captive, self-locking screws shall be used. The terminals shall be finger-proof and shrouded against accidental contact.

For conductors above 6 sq.mm, the terminals shall be of bolted pressure type. No running joint shall be made anywhere in the wiring

Number of runs of wire in conduits shall not exceed those permitted by the relevant Indian Standard.

CONDUIT & ACCESSORIES

Medium gauge PVC conduits and accessories manufactured for electrical installations shall be used for concealed wiring. All the conduits and accessories shall comply with the relevant Indian Standard Specifications.

The minimum and maximum conduit diameters permitted are twenty (20) and forty (40) mm, respectively.

Conduit sizes shall be adequate for the number of runs as specified in the Indian Standards.

The entire conduit system, complete with all accessories, enclosures, inspection boxes and draw wires shall be installed before the commencement of wiring.

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Inspection boxes shall be provided at regular intervals not exceeding 12m along the conduit run to facilitate periodical inspection and also replacement/addition of wires. Number of right-angle bends between two inspection boxes shall not exceed two.

A run of copper continuous earthing conductor of required size shall be installed in every conduit pipe in the system and all non-current carrying metals parts of the wiring and fixtures shall be earthed using this wire.

All the conduit fixtures shall be of inspection type where these are accessible for inspection.

Rigid conduits shall not be installed across expansion joints in building. Expansion joints shall be crossed by using steel reinforced PVC flexible conduits. The length of the flexible conduit shall be kept to the minimum required.

Wires working at different voltage systems shall not be installed in the same conduit. In point wiring, wires of two different phases shall not be installed in the same conduit.

Surface conduits in plant rooms shall be heavy gauge G.I. and supported and clamped at intervals not exceeding 60mm. On either side of fittings such as bends, tees, junction boxes, enclosures, the conduit shall be provided with clamping at a distance not exceeding 200mm from the center of the fitting. Such clamping of conduits is to be provided both for recessed and surface-mounted conduits.

Surface mounted conduits shall be kept at least 6mm away from the surface by means of suitable spacers.

Where the conduits are to be concealed in concrete, the conduit layout drawings indicating the number and sizes of pipes, routes, location of junction boxes, outlets, etc. shall be prepared and submitted to Engineer sufficiently in advance for his scrutiny. Contractor shall carry out the installation of the piping system as per drawings approved by Engineer and as per his instructions.

After the conduit system is installed in position, Contractor shall get these inspected by Engineer and obtain his approval before the concrete is poured.

The conduits and all the fittings shall be firmly held in position by blocks and iron wires fastened to the reinforcement bars.

- a. The conduit system, exit points, outlets, etc. do not get dislodged from their routes and positions.
- b. The joints in the conduits system do not get opened and the entire system is closed to clogging by entry of concrete or other materials, and
- c. The conduit system or any of its parts do not get damaged.

Suitable number of draw wires shall be installed in all the conduits before the concrete is poured. The conduit system shall be installed above the bottom-most layer of reinforcement of the slab. Conduit running parallel to beams shall not be run above the beams.

For wiring under floor, only GI pipes/steel conduits shall be used. These pipes shall be painted with emulsion.

The chase in wall shall be neatly made and be of ample dimensions to permit the conduits

to be fixed in the manner desired. The conduits recessed in walls shall be fixed in position by means of suitable fasteners at intervals not exceeding 600 mm. Conduits installed in walls shall be at least 35mm behind the finished wall surface.

The open ends of the conduits shall be temporarily plugged using wooden or similar plugs till the wiring is installed. The open ends which are for future use shall be plugged using metallic plugs with square wrench hubs.

Where the conduit system is exposed to mechanical or other forms of damages, it shall be adequately protected against such damage.

A continuous earth wire of 14SWG copper conductor shall be run in every conduit. All lighting fixtures, socket outlets, etc. shall be earthed using this earthing wire.

While bending conduits, precaution emerges out of slabs or masonry, enough length of the pipe shall be available for fixing the required accessories or for extending the conduit. The conduit opening shall be neatly plugged in such a manner that it can be easily removed when required. The required amount of projection beyond finished surface shall be installed by contractor after carefully studying the details at the location concerned and in consultation with Engineer so that such conduit projections shall not interfere with Engineer's requirements.

Exposed conduits shall be installed to give a neat and well-arranged appearance. They shall be run either parallel or perpendicular to the building lines.

As far as possible, field-fabricated bends shall be used in the conduit system. This is particularly applicable to concealed wiring. Standard bends shall be used only where there is no space to accommodate a larger radius field-fabricated bend. No elbows shall be used.

Wiring shall be carried out in such a manner that the conduit directly enters the lighting fixtures so that the wiring is not exposed. Terminating the wiring near fixture at ceiling roses and taking exposed wiring from ceiling roses to fixtures will not be acceptable.

In such cases where conduits cannot support the fixtures, the fixtures shall be supported using adequate rigid structural supports. The conduit pipe leading to the fixture shall be clamped to this structural support at intervals not exceeding 600mm. The wires shall be bunched along with a GI bearer wire of adequate size in the vertical drops which exceed 1500mm in such a manner as to relieve the wiring of strain due to self-weight.

SWITCHES, SOCKETS & ACCESSORIES

Unless otherwise specified all switches, sockets and accessories shall be of non-metallic flush type. Components with BIS certification and Tariff Advisory Committee approval only shall be used samples shall be got approved by the Engineer before supply.

The locations of installation shall be as per the drawings subject to finalization at site in consultation with Engineer.

METAL CLAD SOCKET WITH SWITCHES

Metal clad sockets shall consist of individual switch-controlled sockets interlocked with the switches in the standard manner. The socket shall be provided with a spring-loaded cover which would automatically cover the socket when the plug is withdrawn. The switch interlock shall ensure that the plug cannot be inserted or withdrawn when the switch is in

closed position.

The metallic enclosure of the socket shall have integral earth terminals. The enclosure shall have facility for termination of suitable size of cable /conduit. There shall be enough space within the enclosure to properly shape the wires and make connections without undue strain to the wires and the terminals.

Non-metallic socket outlets shall be used only in areas other than plan areas. Every socket outlet shall be provided with a control switch. The 5A and 15A SPN+E sockets shall be of non-metallic flush type construction and shall be installed in metallic enclosures with non-metallic covers. Only sockets with safety shutters shall be used.

CEILING FANS

Every ceiling fan shall be provided with an individual switch control in addition to the regulator. The fan regulator should be electronic type. Cost of fan regulator is not to be included in point wiring. Space provision in the control enclosure for the regulator including its installation and connection, are, however, included in the scope of point wiring. Fan clamps of adequate size and strength shall be securely installed into the building structure for suspending the fans. The hook and outlet for the fan shall be provided in such a manner that the wiring will not be seen outside the top canopy.

LOCATION OF INSTALLATION

The locations and quantities of various outlets, controls, etc. shown in the tender drawings are only tentative. These are subject to change and the finalized locations and quantities as per which the work will have to be carried out may differ substantially from those shown in the tender drawings. Contractor shall make provision for such changes in his Tender since no extra payment will be made for any such change in the locations and/or quantities of the outlets, controls, etc.

The locations and quantities for each area shall be finalized as per the details furnished by Engineer and in consultation with them.

DRAWINGS

For each area of the buildings and premises, contractor shall in consultation with Engineer, prepare detailed layout drawings showing the locations and quantities of all the equipment outlets, controls, etc. These drawings shall be got approved in writing. Also, where possible and is required by Engineer, actual locations shall be marked in a suitable manner at the areas where the work is to be carried out and shown to Engineer. Engineer shall inspect these actual markings and approve the locations with or without instructions for modifications. Contractor shall then design the suitable wiring layout and carry out the works accordingly.

Pipe layout drawings showing the locations and sizes of accessories, outlets, etc. shall be prepared and furnished sufficiently early to Engineer in the case of pipes to be buried in concrete slabs, floors, etc. so that Engineer shall have ample time to scrutinize the drawings and issue necessary approval.

After completion of the work in each area, Contractor shall prepare and submit to Engineer as- installed drawings of the area giving complete details of the complete electrical

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installations and conduit system in the area with locations, routes, specifications and other relevant details of all the equipment, accessories, wiring, outlets, controls, etc. These drawings shall contain all the necessary information for maintenance and trouble-shooting of the installation.

POINT WIRING

A point is defined as a single or group of outlets (including connection up to the appliance) controlled by one switch. Every bell push will be treated as a bell push point.

Point wiring shall include the following:

- i. Wiring from the distribution board up to all the equipment such as lighting fixtures, fans, sockets, etc. via the switches, regulators, controls, junction boxes, terminal boxes, etc.
- ii. Required conduit piping system complete with all accessories, supports, inspection boxes, enclosures and 14SWG copper continuous earthing wire.
- iii. Required switches, socket outlets, bell pushes, indicating lamps, enclosures, cover plates, inspection boxes, ceiling roses, connectors and all other accessories and materials required to make the system from the distribution board to the equipment complete in all respects.
- iv. Fixing accessories such as saddles, brackets, racks, clamps, fasteners, raw plugs, fiber plug, etc. If the number of runs of conduit along any length is large enough to require the use of conduit trays/risers, the supply and erection of such trays/riser and tray/riser supports shall not be included in the scope of point wiring. The minimum width of tray/riser used shall be 150mm. Where this width cannot be fully utilized, Contractor shall have to make alternative arrangement for supporting the conduits at his own cost and this shall be included in the scope of wiring.
- v. Switches for fans and enclosure space for fan regulators.

Wiring shall be carried out using the looping back system. Both line and natural conductors can be looped back. No extra length wire will be provided for point wiring.

All connections in the wiring shall be made in accordance with the best of current practice so that loose connections or other problems will not arise during the working of the installations. No running joints shall be made in the wiring.

All connections shall be carried out only inside the enclosures specifically provided for the purpose, inside enclosures housing controls, or inside lighting fixtures. These connections shall be easily accessible for inspection.

The maximum number of lighting/fan points that can be wired in a circuit is limited to ten. The maximum total wattage of such points in a circuit shall not exceed 800 watts.

Wiring for 5A and 15A sockets shall be carried out in separate conduits. These shall not be carried in the conduits carrying lighting wiring. The maximum numbers of 5A and 15A sockets that shall be wired in a circuit are respectively four (4) and two (2)

The total load on any distribution board shall be, as far as possible, equally distributed over the three phases.

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Separate conduits shall be used for wiring emergency lighting system. In case wiring is done for supply from uninterruptible power supply. Such wiring and outlets shall be totally segregated from the normal supply system and suitably marked for identification.

Wiring and outlets for telephone, music, video, computers, public address system, etc. shall be totally segregated from the electrical system. These outlets shall be suitably marked for identification.

In the case of socket outlets, point wiring shall include the cost of complete wiring up to the socket outlet complete with supply and installation of socket with control switch in a suitable enclosure provided with approved cover plate and earthing of the socket using 14SWG bare copper wire. In the case of metal clad sockets, however the cost of socket and control switch unit shall not be included in the rate for point wiring of the socket.

In the case of bells, point wiring shall include wiring up to the bell or bell indicator board including the supply and installation of bell push in suitable enclosure with approved cover plate. The cost of the bell/bell indicator board shall not be included in point wiring for the bell push.

Unless otherwise specified, the enclosures shall be provided with covers of insulating materials. The materials used for the cover shall be of the quality, design and size as approved by Client. The covers shall be so fabricated and fixed that they give a neat and aesthetically high standard finish and also prevent ingress of dust, moisture, vermin, etc. into the enclosure. The components such as switches, regulators, sockets, etc. shall be neatly arranged on the covers. The arrangement of these components for different groupings shall be uniform throughout the installation. Marked switches shall be used for lights, fans, sockets, two-way control, bells, etc. The exteriors of the enclosures and covers shall match the interior décor to the requirements of Engineer.

CONDUIT SYSTEM

Contractor shall install the conduit system for the following as per the requirement of Client:

- a. P&T exchange and telephone.
- b. Internal communication system exchange and instruments.
- c. Public address system.
- d. Television and video system.
- e. Music system.
- f. Any other system which Client wishes to install

The supply and installation of the above piping system shall be carried out in accordance with the specifications for piping for lighting wiring. The system shall include all the required conduit accessories, draw wires, enclosures, junction boxes, outlets, etc.

EARTHING

Non-current carrying metal parts of all equipment, accessories, components and enclosures shall be effectively earthed by means of copper conductors of suitable size. The size of

copper earthing wire used after the mob distribution boards shall not be less than 14SWG

15.2. MCCB/MCB

15.3. TYPE POWER AND LIGHTING

DISTRIBUTION BOARDS.SCOPE

Contractor's scope is to handle, assemble, install, connect, test and commission the required MCB distribution boards complete with all residual current circuit breakers, miniature circuit breakers, bus and interconnection assemblies, terminals, covers, doors, locking arrangement, required supporting and fixing arrangement and other accessories in compliance with the relevant rules, regulations standards and codes of practice

The scope of Contractor's work will include but not be limited to the following:

- i. All transporting and handling of the equipment, accessories and materials from site store.
- ii. Inspection of the equipment, accessories and materials immediately on receipt and prompt action relating to any defect/damage/discrepancy/ shortage observed.
- iii. Assembly and installation of the equipment, accessories and materials at the location required and as per the manufacturer's instructions and in conformity with the relevant codes, rules and regulations.
- iv. All civil works as specified in "Conditions of Contract" including making of recesses of provision for fixing.
- v. Provision of supporting and fixing arrangements.
- vi. Any modifications/repairs/replacements which may be found necessary by the Engineer on completion of inspection/ tests and during the Defect Liability Period.
- vii. Commissioning of the installations.

MCB distribution boards for small power and lighting shall be manufactured, supplied and installed in accordance with the relevant standards, regulations and in compliance with the requirements of the project.

The fault level at the board shall be taken as 10kA unless otherwise specified.

ENCLOSURE

The enclosure shall be fabricated out of cold-rolled sheet steel having a minimum thickness of 1.6mm. The folded sections forming framework of the enclosure shall be of cold-rolled sheet of minimum thickness 2mm. The enclosure shall be powder-coated to required colour finish.

The enclosure shall be suitable for recessed-mounting with the front cover flush with the wall if not specified other-wise. The enclosure shall have a front collar to conceal the gap between the enclosure and the wall.

The enclosure shall have a front screwed cover with cut-outs for the incoming control and the miniature circuit breaker knobs. The unused cut-outs shall be effectively blocked. Identification label shall be provided over each MCB. In front of this screwed cover there shall be a hinged door which shall cover the entire front portion of the board. This door shall be fitted with captive screws having plastic moulded knobs. The door shall be effectively gasket 'ed to prevent entry of dust, water, insects and vermin. The front door shall be of steel or of acrylic materials and shall be lockable.

Facility shall be provided for the entry of required cables and conduits. The cables and conduits would be entering either at the top or bottom depending on site conditions. Suitable

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arrangements shall be provided on the board for both types of entry.

Detachable plates shall be provided for terminating the conduits. There shall be facility for entry of one 20mm conduit for every SPN way.

Separate compartment of adequate space shall be provided for accommodating the spare lengths of wires and cable cores so that these will not be inside the main components chamber.

All the doors and gaskets shall be effectively gasket to prevent entry of dust, water, insects, vermin, etc.

The enclosure shall be provided with two earthing terminals. In the case of recessed type boards, the earthing terminals shall be located inside the enclosure.

There shall be an engraved Bakelite/PVC identification label fixed on the hinged door of the board. A printed circuit list shall be pasted on the inside of the front hinged door. Danger board as per relevant standard shall be provided on the MCB distribution board.

The boards shall be of such design and finish to suit the aesthetics of the interior where they are installed. Boards with lesser depth shall be used where the wall thickness is not adequate for boards of regular depth

INTERNAL ARRANGEMENT

The distribution board shall be of vertical design. The bus bars and neutral bar shall be mounted vertically. The miniature circuit breakers shall be mounted horizontally on either side of the bus bar system, one below the other.

The interconnection between the bus bars and the incoming residual current circuit breakers shall be through insulated rigid conductors.

There shall be a separate neutral bar on each side of the bus bar system so that neutrals for the circuits from the miniature circuit breakers from one side can be taken from the neutral bar on the same side. The neutral bar shall have facility breaker in the board.

The bus bars shall be of tinned rectangular section copper bars. The interconnections shall also be of similar conductors. They shall be adequately supported to withstand the effects of prospective fault currents.

The arrangement of the bus bars shall be such that it should be possible to install single, two or three pole breakers at any location and interconnect them with the bus bars. The bus bar arrangement shall also facilities easy removal and addition of circuit breakers without disturbing the bus arrangement and the adjacent circuit breakers.

Adequate shrouding shall be provided to prevent accidental contact with live parts after removal of the front cover. There shall be efficient and simple means for phase and circuit identification.

Every miniature circuit distribution board for lighting shall be provided with a 30mA residual current circuit breaker for leakage protection and an MCB isolator for isolation. The number of poles in the incoming control shall be four and two for TPN and SPN distribution boards respectively. The incoming control shall be capable of breaking load current.

The enclosure shall contain a tinned copper earthing bar with one screwed terminal for each single- phase circuit that would emanate from the board.

The quantities, ratings and number of poles of the incoming and outgoing circuit breakers shall be as per the schedule of quantities and Rates.

The terminals shall be provided with screwed holes, plated bolts and spring washers. The

terminals shall be suitable to accept the conductor without any lug. The design of the terminal shall be such as to prevent swiveling of conductors

MINIATURE CIRCUIT BREAKERS

Miniature circuit breakers with current-time inverse delayed thermal trip for overload protection and instantaneous magnetic trip for short circuit protection shall be used. They shall be of trip-free construction. Miniature circuit breakers of suitable characteristics shall be used for different types of loads such as lighting, power and motors. The breaking capacity of the MCB shall be as per the requirements at location of installation subject to a minimum of 10kA. Single phase or three phases outgoing MCB controls shall be provided as required.

INSTALLATION

Irrespective of the locations shown in the drawings, the location of installation shall be got confirmed by Consultant/Client, before actual installation of the board.

The board shall be installed so that the top of the board is 1800mm above the finished floor. The MCB board shall be mounted on surface or recessed into wall as required and as per site conditions.

TESTING AND COMMISSIONING

The following pre-commissioning tests and checks shall be carried out:

- a. Visual inspection to confirm completeness and accuracy of assembly and installation as per the drawings and specifications.
- b. Proper functioning of all miniature circuit breakers and residual current circuit breakers.
- c. Correctness of wiring and connections.
- d. Rigidity of supports and tightness of connections.
- e. Insulation resistance measurements.
- f. Earth resistance of body.

All the tests and pre-commissioning procedures shall be carried out in the presence of Consultant/Client and all the results recorded and furnished.

15.4. CABLES

SCOPE

Laying, termination, testing and commissioning of Low voltage power cables of XLPE insulated, PVC sheathed, and PVC over sheathed Aluminium cables as shown in schematic diagrams and schedules.

The low-tension cable shall be Aluminium conductor, XLPE insulated, 1100 V grade power cable. The conductors shall be made from E.C. grade aluminium wires which are to be stranded and compacted. All sizes of conductors shall be of single or three core cables and shall be in circular shape. The construction of conductor and testing should comply to IS 8130-1984 as amended up to date. The XLPE insulation and the insulation shielding are all to be extruded by one process. For XLPE cables following routine tests are to be carried out on every length. Routine test certificates from factory shall be submitted along with the delivery of the cables.

- a. Conductor resistance test.
- b. Partial discharge test.
- c. High voltage test.

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d. Insulation resistance test.

LAYING

L.T. Cables shall be laid in outdoor trenches wherever called for. The depth of the trenches shall not be less than 750 mm, below the final ground level. The width of the trenches shall not be less than 350mm. However, where more than one cable is laid, a coaxial distance of not less than diameter of the cable shall be maintained between the cables. The trenches shall be cut square with vertical side walls and with uniform depth. Suitable shoring and propping may be done to avoid caving - in of trench walls. The floor of the trench shall be rammed level. Sand cushions of not less than 80mm shall be provided above and below the cable with a protective concrete slab on the top of the sand layer. The cable trench shall be back filled and compacted. L.T. Power cables shall be laid in cable trays, trenches etc.as shown in drawings and schedules, the cables shall be tied by means of purpose made cable ties/clamped at 50 cm intervals as required.

The cable drums shall be laid unrolled in the direction of the arrow for unrolling. Wherever cables are bent, the minimum bending radius shall not be less than 12 times the diameter of the cable. Cable shall be laid in Hume pipes, covered by concrete for mechanical protection, at all road crossings. After the cable has been properly stretched the same shall be lifted and placed over the sand cushioned cable trench. Again, the cable shall be covered with a sand layer of 80mm thick. Over this sand layer a layer of concrete slab shall be placed. The trenches shall then be back filled with earth and consolidated to suitable grade. Direction markers indicating the run of the cables shall be installed at every 25 meters intervals and marking must be done at all bends.

CABLE JOINTS

Cable jointing shall be done as per the instruction of the cable manufacturers. Cable jointing shall be carried out only by competent cable jointers. Cable shall be jointed using standard cable joint boxes. Cable shall be jointed as per colour coding or numbering of the cores and cable/cable joint manufacturer's recommendation.

The cable seal shall not be removed until all preparation for jointing is completed. Jointing the gland and armoured clamp shall establish good electrical contact between cable amour, lead sheath and body of the switch gear. The cable box and gland shall be bonded to the main earth bus with suitable size conductors.

LIST OF SPECIFICATIONS FOR ELECTRICAL INSTALLATION WORK

The following specifications will apply under all circumstances to the equipment to be supplied and installed against this contracts 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.

IS 613 : 2000 Copper Rods and Bars for Electrical Purposes - Specification

IS 1248 : Part 1 : Direct Acting Indicating Analogue Electrical Measuring
2003 Instruments and their Accessories - Specification - Part : 1
 Definitions and General Requirements

2003

IS 1248 : Part 2 :

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Direct Acting
Indicating Analogue

Electrical Measuring Instruments and their Accessories - Part 2 :
Special Requirements for Ammeters and Voltmeters

IS 1248 : Part 3 :
2003

Direct Acting Indicating Analogue Electrical Measuring
Instruments and their Accessories - Part 3 : Special
Requirements for Wattmeter and Varmeters

IS 1248 : Part 4 :
2003

Direct Acting Indicating Analogue Electrical Measuring
Instruments and Their Accessories - Part 4 : Special
Requirements for Frequency Meters

IS 1248 : Part 5 :
2003

Direct Acting Indicating Analogue Electrical Measuring
Instruments and Their Accessories - Part 5 : Special
Requirements for Phase Meters, Power Factor Meters and
Synchro scopes

IS 1248 : Part 6 : 2003 Direct Acting Indicating Analogue Electrical Measuring Instruments and their Accessories - Part 6 : Special Requirements for Ohmmeters (Impedance Meters) and Conductance Meters

IS 1248 : Part 7 : 2003 Direct Acting Indicating Analogue Electrical Measuring Instruments and their Accessories - Part 7 : Special Requirements for Multi- Function Instruments

IS 1248 : Part 8 : 2003 Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 8 : Special Requirements for Accessories

IS 1248 : Part 9 : 2003 Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 9 : Test Methods

IS 1271 : 1985 Thermal evaluation and classification of electrical insulation

IS 1646 : 1997 Code of practice for fire safety of buildings (general): Electrical installations

IS 1885 : Part 9 : 1992 Electro technical Vocabulary: Part 9 Electrical

relays IS 1897 : 1983 Copper strip for electrical purposes

IS 2419 : 1979 Dimensions for panel mounted indicating and recording electrical instruments

IS 2448 : Part 1 : 1963 Adhesive insulating tapes for electrical purposes: Part 1 Tapes with cotton textile substrates

IS 2464 : 1963 Built-up mica for electrical purposes

IS 3024 : 1997 Grain oriented electrical steel sheets and strips

IS 3231 : Part 1.2,3 : Sec 1 : 1986 Specification for Electrical Relays for Power System Protection Part 1 : General Requirements Section 1 : Contact Performance

IS 3480 : 1966	Flexible steel conduits for electrical wiring
IS 3837 : 1976	Accessories for rigid steel conduits for electrical wiring
IS 3842 : Part 12 : 1976	Application guide for electrical relays for ac systems: Part 12 Differential relays for transformers
IS 4483 : Part 1 : 1968	Preferred panel cutout dimensions for electrical relays: Part 1 Flushmounting IDMTL relays
IS 4648 : 1968	Guide for Electrical Layout in Residential Buildings
IS 5216 : Part I : 1982	Recommendations on Safety Procedures and Practices in Electrical Work - Part I : General
IS 9537 : Part 1 : 1980	Conduits for electrical installations: Part 1 General requirements
IS 9537 : Part 2 : 1981	Conduits for electrical installations: Part 2 Rigid steel conduits (superseding IS:1653)
IS 9537 : Part 3 : 1983	Conduits for electrical installations: Part 3 Rigid plain conduits of insulating materials (superseding IS:2509)
IS 9537 : Part 4 : 1983	Specification for Conduits for Electrical Installations - Part 4 : Pliable Self-recovering Conduits of Insulating Materials
IS 9537 : Part 5 : 2000	Conduits for Electrical Installations - Part 5 : Pliable Conduits of Insulating Material
IS 9537 : Part 6 : 2000	Conduits for Electrical Installations - Specification - Part 6 : Pliable Conduits of Metal or Composite Materials
IS 9537 : Part 8 : 2003	Conduits for Electrical Installations - Specification - Part 8 : Rigid Non-Threadable Conduits of Aluminium Alloy
IS 10381 : 1982	Terms (and their Hindi equivalents) commonly used for name plates and similar data of electrical power equipment
IS 11005 : 1984	Dust tight ignition proof enclosures of electrical equipment
IS 14927 : Part 1 : 2001	Cable Trunking and Ducting Systems for Electrical Installations : Part 1 General Requirements

IS 14927 : Part 2 : 2001

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Cable Trunking and
Ducting Systems for
Electrical Installations :
Part 2 Cable Trunking
and Ducting Systems
Intended for Mounting
on Walls or Ceiling

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IS 14930 : Part 1 : 2001 General Requirements	Conduit Systems for Electrical Installations - Part 1 :
IS 14930 : Part 2 : 2001 Particular Requirements -	Conduit Systems for Electrical Installations - Part 2 : Conduit Systems Buried Underground
SP 30 : 1985	Special Publication - National Electrical Code
IS 2516 - (L) PART I & II Section - I	LT air circuit breakers
IS 4064 (L)	Fuse switch units and switch fuse units
IS 2208 (L)	H R C fuse links
IS 2675 (L)	Distribution Boards
IS 2147	Enclosures for low voltage switch gears
IS 2418 (L)	Tabular Fluorescent lamps
IS 415 (L)	Tungsten filament lamps
IS 374 (L)	Ceiling fan
IS 1947 (L)	Flood light
IS 1771 (L)	Industrial light fittings
IS 3553 (L)	Water proof electrical fittings
IS 5133 (L)	Steel boxes for enclosure of electrical accessories
IS 2667 (L)	Fittings for rigid steel conduit:
IS 653 (L)	Mild steel conduit for Electrical wiring
IS 3837 (L)	Accessories for rigid steel conduit for electrical wiring
IS 4615 (L)	Switch socket outlets
IS 1293 (L)	Three pin plug & socket outlet
IS 3854 (L)	Switches for domestic and similar purposes
IS 2268 (L)	Call bell and buzzers

IS 3043 (L)	Earthing
IS 3072 (L)	Switch gear
IS 2309 (L)	Lighting protection
IS 7098 (L)	HT cable
IS 1886 (L)	Power transformer
IS 2705 (L)	Current Transformer
IS 2516 Part I & II / Sector I(L)	MCCB
IS 2959 (L)	Auxiliary contacts
IS 2834 (L)	Power factor correction
capacitors	IS 9357 (L) Part 1,2,3 & 4 PVC/ Metal
conduiting	
IS 2544 (L)	Bus bar support insulators
IS 375: 1963	Marking and arrangement for switchgears bus-bars, main connections and auxiliary wiring (revised) (superseded by IS: 5578 and IS: 11353)
IS 694: 1986	PVC insulated cables for working voltages up to and including 1100 V (third revision) (Amendment 1)
IS 722 (Part 1): 1986	AC electrical meters: Part 1 general requirements and tests (third revision)
IS 732: 1989	Code of practice for electrical wiring installations (third revision)
IS 1336: 1959	Recommendations for the colour of push buttons [superseded by IS: 6875 (Part 2)]
IS 1554 (Part 1): 1988	PVC insulated (heavy duty) electric cables: Part 1 for working voltages up to and including 1100 V (third revision) (Amendment 1)

IS 10118 (Part 1): 1982	Code of practice for selection installation and maintenance of switchgear and control gear: Part 1 General
IS 10118 (Part 2): 1982	Code of practice for selection installation and maintenance of switchgear and control gear: Part 2 Selection
IS 10118 (Part 3): 1982	Code of practice for selection installation and maintenance of switchgear and control gear: Part 3 Installation
IS 10118 (Part 4): 1982	Code of practice for selection installation and maintenance of switchgear and control gear: Part 4 Maintenance
IS 12021: 1987	Control transformers for switchgear and control gear for voltage not exceeding 1000 V ac (Amendment 1)
IS 12063: 1987	Classification of degrees of protection provided by enclosures of electrical equipment
IS 13234: 1992	Guide for short-circuit current calculations in three-phase systems (superseding IS 5728)
IS 13947 (Part 1):1993	Low voltage switchgear and control gear: Part 1 General rules (superseding IS 4237)
IS 13947 (Part 2):1993	Low voltage switchgear and control gear: Part 2 Circuit breakers [superseding IS 2516(Part 1 & 2/Sec 1): 1985] (Amendment 1)
IS 13947 (Part 3):1993	Low voltage switchgear and control gear: Part 3 Switches, disconnectors, switch disconnectors and fuse combination units [superseding IS 4064(Part 1 and 2)]
IS 13947 (Part 4/Sec1) : 1993	Low voltage switchgear and control gear: Part 4 Contractors and motor starters, Sec 1 Electromechanical contactors and motor starters [superseding IS 2959 & IS 8544(All parts)] (Amendment 1)
IS 13947 (Part 5/Sec1) : 1993	Low voltage switchgear and control gear: Part 5 Control circuit devices and switching elements, Sec 1 Electromechanical control circuit devices [superseding IS 6875(All Parts)] (Amendment 1)
IS 14415: 1997	Volt-ampere hour meters for restricted power factor

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range[superseding IS 722(Part 5) 1980]

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3. LIST OF APPROVED MAKES

SI No	Description	Approved Makes
1	LT panels	CPRI Approved Panels with approved make of switchgears and accessories
2	MCCB	L&T (D-Sine) / ABB (T-Max) / Schneider (Compact NSX) / Legrand (DPX CUBE)
3	MCB, RCBO, RCCB & ELCB	Legrand (DX Cube) / L&T (Exora) / Schneider (Acti-9 N)
4	ATS	ASCO (Schneider) / HPL / L&T / Socomec
5	Isolator / SFU / SDFU/ COS	L&T (FN) / Schneider (FUPACT NX Series) / ABB(OESA/OS) / Siemens (3KF)
6	Power / Aux Contactors	L&T (MO / MNX / MCX (4P) / ABB (A/AF Range) / Schneider (Tesys D / F)
7	Load Bank / SM DB	Havells / Legrand / L & T / ABB
8	VDB / DB	Legrand / Havells / L&T / ABB
9	LT Cables	Havells / RR Kabel / Polycab
10	PVC wires	Havells / RR Kabel / Polycab
11	PVC Conduit & Accessories	Balco / Supreme / Precision / Avon Plast / Konseal
12	Cable Gland & Crimping Sockets(Double compression)	Dowells / Jaison / Comet / Raychem / Denson / Gripwel
13	Current transformer	AE / L&T / Kappa
14	Potential Transformer	AE / Ashmore / Kappa
15	Indicating Meters	Socomec / L&T / Rishab / Elmeasure / Secure
16	Indicating Lamps - LED	L&T / Teknic / Schneider / Siemens / BCH
17	Multifunction Meters	Siemens/ Socomec / L&T / Elmeasure / Secure / Schneider
18	Energy Meters	Socomec / L&T / Elmeasure / Secure / Schneider
19	Single phase preventer	L & T / Siemens / ABB / Schneider
20	Digital Protective relay (Numerical relays)	L&T / Siemens / ABB / Alstom / Secure
21	Thermal Overload Relay	L & T / Siemens / ABB / Schneider

22	Timer	L & T / Siemens / ABB / Schneider
23	Modular Switches / Sockets	Legrand (Myrius) / Schneider (Livace) / Wipro (Nowa)
24	Industrial / Metal clad Sockets	Hensel / Legrand / L&T
25	Ceiling Roses / Angle Batten Holder	Precision / Anchor / Legrand / Indoasian / GM
26	Light Fixtures	Wipro / Havells / Philips
27	Ceiling Fan / Wall Fan / Exhaust Fan	Crompton / Usha / Havells / Almonard
28	Battery Charger	Keltron / Automatic Electric / Amararaja / Waves Electronics
29	Battery	Panasonic / Exide / Amaron
30	IP 66 / 67 Sockets	Hensel / SCAME / MENNEKES
31	Cable Management System	OBO Betterman / Legrand / Honeywell
32	Cable Tray	OBO Betterman / Profab / Legrand
33	Pop-Up Box	Legrand
34	Rubber Mat	ISI Approved