




**AMARKANTAK- CHIMNEY PACKAGE
ELECTRICAL SPECIFICATION**


CLAUSE NO.	<p align="center">TECHNICAL REQUIREMENTS</p> 
1.00.00	GENERAL REQUIREMENTS
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% shall be considered. The equipment shall operate in a highly polluted environment. However, for equipment in air-conditioned areas, design ambient temperature shall be 35 deg.C, if 2x100% air conditioning system is provided.
1.02.00	All equipment's shall be suitable for rated frequency of 50Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and International Codes & Standards, especially the Indian Statutory Regulations.
1.05.00	<p>The auxiliary AC voltage supply arrangement shall have, 415V systems. It shall be designed to limit voltage variations as given below under worst operating condition:</p> <p>b) 415 V/240 V +/- 10%</p> <p>c) 220V/48V DC -15% to +10%</p> <p align="center">FAULT LEVEL 415V - 50 KA RMS FOR 1 SECOND</p>


SUB-SECTION-B – 14


ELECTRICAL WORKS FOR CHIMNEY

CLAUSE NO.	<p style="text-align: center;">CHIMNEY ELECTRICAL WORKS</p> 		
	<p>CHIMNEY ELECTRICAL WORKS</p> <p>1.00.00 GENERAL REQUIREMENTS</p> <p>1.01.00 This chapter has to be read in conjunction with sub-section B-0 "General electrical specification" of Technical specification Section- VI, Part-B and Sub-Section-IIB Electrical system/Equipment of Technical Specifications Section-VI, Part-A.</p> <p>1.02.00 For specification requirement of electrical equipment and accessories such as DB, cable, cabling, lighting, earthing, lightning protection etc., contractor shall refer relevant chapters of this Technical specification in addition to following clauses mentioned in this document.</p> <p>1.03.00 The equipment shall be suitable for installation and render trouble free & continuous operation at higher ambient temperature and rigorous weather conditions prevailing at chimney. Ambient temperature for design of all equipment shall be considered as 55 degrees C.</p> <p>1.04.00 The electrical equipment/installations shall comply with the requirements of the following Rules/ Regulations as amended up to date:</p> <ul style="list-style-type: none"> i) The Indian Electricity Rules/Acts. ii) National Electrical codes and Indian standards. iii) International Civil Aviation organisation Regulations. iv) National Airport Authority/DARA Regulations. <p>1.05.00 Main distribution board & emergency distribution board shall be located at chimney base. Main DB shall be 415V, 3ph 4 wire and Emergency DB shall be 415 volt, 3 phase, 3 wire. Emergency DB will receive one feeder from Emergency power supply feeder and one feeder from main distribution board. Contractor shall provide auto-change over supply to healthy source on failure of any source. In case any power supply other than 415 V, 3 phase indicated above is required, the transformation for same shall be included in the Contractor's scope of work.</p> <p>1.06.00 Elevator Board shall be of metal enclosed, single front, indoor, floor mounted, free standing, fixed type conforming to IS 13947-PART-I. The Elevator board & Power panels shall be of floor/wall mounted type. The equipment shall be supplied fully assembled and wired, complete with base frame and anchoring arrangement, gland plates, internal wiring, terminal blocks and suitable for termination of external power and control cables. Overall height of Board shall not exceed 2450 mm. All board frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness not less than 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness not less than 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plates thickness shall be 3.0 mm (minimum) for hot/cold-rolled sheet steel and 4.0 mm (minimum) for non-magnetic material. All panels shall be dust and vermin proof.</p> <p>1.06.01 The Board shall be divided into distinct vertical sections, each comprising of :</p> <ul style="list-style-type: none"> i) A completely enclosed busbar compartment for running horizontal and vertical busbars. 		
	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B</p>	<p>SUB-SECTION-B-14 ELECTRICAL WORKS FOR CHIMNEY</p>	<p>PAGE 1 OF 5</p>

CLAUSE NO.	<p style="text-align: center;">CHIMNEY ELECTRICAL WORKS</p> 												
<p>1.06.02</p> <p>2.00.00</p> <p>2.01.00</p> <p>2.02.00</p> <p>2.03.00</p> <p>2.04.00</p> <p>2.05.00</p> <p>3.00.00</p> <p>3.01.00</p> <p>3.02.00</p>	<p>ii) Completely enclosed switchgear compartment(s) one for each circuit of outgoing feeder.</p> <p>iii) A cable alley for power and control cables of 250 mm width. Cable alley shall have no exposed live parts and shall have no communication with busbar compartment. Cable terminations in cable alley shall be designed to meet Form IVb Type & (as per IEC 60439) for safety.</p> <p>The front of the compartment shall be provided with hinged single leaf door with locking facility.</p> <p>Boards shall be provided with phase & neutral busbars along entire length of board. The minimum air clearance between live parts shall be 25mm for busbars and 10mm elsewhere both for phase to phase and phase to earth. Wherever such clearance is not available, the live parts shall be fully insulated/shrouded. However, for busbars minimum 25mm air clearance shall be maintained irrespective of insulated/shrouded busbars are provided.</p> <p>Lighting System</p> <p>The lighting system shall provide adequate illumination at various platforms, stairways, landing and other areas of the chimney.</p> <p>The following average illumination levels shall be achieved and guaranteed by the contractor after considering maintenance factor of not more than 0.6 :</p> <table border="0" data-bbox="397 1018 1193 1165"> <tr> <td>a)</td> <td>On equipment</td> <td>150 Lux</td> </tr> <tr> <td>b)</td> <td>General platform area</td> <td>70 Lux</td> </tr> <tr> <td>c)</td> <td>Stairways and landings</td> <td>100 Lux [minimum one (1) light fixture at each landing].</td> </tr> </table> <p>Power supply for normal lighting system shall be obtained through main distribution board. 80% lighting at various platforms and 50% lighting in staircases shall be fed from normal A.C. source. 20% lighting at various platforms and 50% lighting on staircases shall be fed from emergency distribution board.</p> <p>3 Pin Receptacles designed for IP:55 degree of protection shall be provided at every platform level, rated for 20A, 240 V,AC. The Receptacles shall be complete with 20A, 240V, AC switch and 3 pin plug.</p> <p>Heavy duty welding Receptacle rated for 415V, AC, 63A shall be provided at each internal platform level.</p> <p>Aviation obstruction lighting system</p> <p>Aviation obstruction lighting system shall conform to the requirements of the latest applicable rules of International civil aviation organization (ICAO) and NAA/DARA regulations.</p> <p>The aviation obstruction lighting system shall be of high intensity type.</p>	a)	On equipment	150 Lux	b)	General platform area	70 Lux	c)	Stairways and landings	100 Lux [minimum one (1) light fixture at each landing].	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION – VI, PART-B</p>	<p style="text-align: center;">SUB-SECTION-B-14 ELECTRICAL WORKS FOR CHIMNEY</p>	<p style="text-align: center;">PAGE 2 OF 5</p>
a)	On equipment	150 Lux											
b)	General platform area	70 Lux											
c)	Stairways and landings	100 Lux [minimum one (1) light fixture at each landing].											

CLAUSE NO.	CHIMNEY ELECTRICAL WORKS 										
3.03.00	Photo electric controller shall be housed in rugged weather tight, IP 65 enclosure. LED's shall be provided to indicate the operation status of the unit.										
3.04.00	System controller shall be suitable for operation at specified ambient temperature and shall be wall mounted type. The enclosure shall have IP:55 degree of protection.										
3.05.00	Aviation obstruction light unit shall provide easy access to lamp and components.										
3.06.00	Four nos. of obstruction lights shall be installed at each specified elevation. The system controller is proposed to be located at 1.2 metre elevation and photo electric controller at about 40 metre elevation. Necessary cables for wiring between photocell & system controller and between system controller & obstacle lights shall be provided. Typical aviation obstruction lighting system arrangement is shown in the enclosed tender drawing.										
3.07.00	Each item shall be preassembled, routine tested optically and electrically before shipment.										
3.08.00	Bidder shall furnish the complete routine test report of the fixtures, controllers, photocells etc. Testing of aviation lights as per ICAO regulations to be carried out and routine test report to be submitted.										
3.09.00	<p>High intensity obstacle lights shall meet the following requirements.</p> <p>(a) It shall be flashing white light. The effective intensity of obstacle light shall be variable and dependent on background luminance as follows.</p> <table border="0" data-bbox="483 982 1170 1136"> <thead> <tr> <th style="text-align: left;">Background luminance</th> <th style="text-align: left;">Effective Intensity</th> </tr> </thead> <tbody> <tr> <td>(i) Above 500 cd/m²</td> <td>200000 cd ± 25% cd</td> </tr> <tr> <td>(ii) 50 to 500 cd/m²</td> <td>20000 ± 25% cd</td> </tr> <tr> <td>(iii) Less than 50 cd/m²</td> <td>4000 ± 25% cd</td> </tr> </tbody> </table> <p>(b) The obstacle lights shall flash simultaneously at a rate between 40 to 60 per minute.</p> <p>(c) The system shall also provide automatic sensing and display of system status and aviation lamp failure detection.</p>			Background luminance	Effective Intensity	(i) Above 500 cd/m ²	200000 cd ± 25% cd	(ii) 50 to 500 cd/m ²	20000 ± 25% cd	(iii) Less than 50 cd/m ²	4000 ± 25% cd
Background luminance	Effective Intensity										
(i) Above 500 cd/m ²	200000 cd ± 25% cd										
(ii) 50 to 500 cd/m ²	20000 ± 25% cd										
(iii) Less than 50 cd/m ²	4000 ± 25% cd										
3.10.00	The distance between lighting elevations shall not be more than 105 Metre and lowest lighting elevation shall not be less than 70 metre.										
3.11.00	The light unit shall have adjustable bracket with level indicator to ensure accurate vertical placement of the light flash.										
3.12.00	Temporary obstruction lighting shall be provided during construction. Obstruction lights shall be provided on the uppermost part of the chimney, or the surrounding scaffolding. As construction progresses each completed level shall be provided with temporary lighting. Temporary obstruction lights shall have four fixtures located in a horizontal plane on the chimney structure to ensure unobstructed visibility of at least one obstruction light from aircraft at any normal angle of approach. Power for operation of the temporary obstruction lights shall be obtained from the construction power system. Supply circuit for these lights shall be furnished, installed and maintained by the Contractor. Temporary obstruction lights shall be operated from sunset to sunrise during each day of the contract period until such time as the Engineer issues instructions in writing to discontinue.										
		TECHNICAL SPECIFICATION SECTION – VI, PART-B	SUB-SECTION-B-14 ELECTRICAL WORKS FOR CHIMNEY	PAGE 3 OF 5							

CLAUSE NO.	<p style="text-align: center;">CHIMNEY ELECTRICAL WORKS</p> 		
4.00.00	Earthing		
4.01.00	<p>Earth grid system for chimney shall consist of horizontal conductors and vertical conductors. Horizontal conductor shall be of 40mm dia mild steel rod buried at a depth of 1 metre all around the chimney. Vertical rods shall be of 40 mm dia, 3 metre long mild steel driven deep in to the ground and also connecting to horizontal conductor at 20 metre interval. The chimney earth grid system shall be interconnected with main plant earth grid at minimum 2 points, through bolted removable link and earth pits.</p>		
4.02.00	<p>Metallic enclosures of all electrical equipments shall be earthed by two separate and distinct connections to earth grid system. The earth connections shall consist of galvanised steel strip/rod/wire, sized adequately to carry the earth fault current of the system. Two nos. main earthing conductor shall be run inside all along chimney height. Electrical equipments at every platform shall be earthed with this conductor. Cable armour shall be bonded to earthing system at both ends of the circuit. The earthing conductors and accessories located at top 12m level shall have lead cover of minimum 2mm thickness. The accessories like nuts, bolts, dash fasteners, round clamps, washers etc. to be used for top 12m level shall be made of stainless steel.</p>		
4.03.00	<p>Steel structures, metallic pipes etc. shall also be connected to earthing system. Connections between earthing conductor and equipments shall be of bolted type only. Earthing conductors along their run on walls shall be supported by cleating at 1 metre interval. Clamps and hardwares shall be of compatible material.</p> <p>Minimum size of earthing conductor shall not be less than 14 SWG G.S wire. Earthing conductor shall also be run along with cable ways / each conduit run.</p>		
4.04.00	<p>The contractor shall provide and maintain a temporary earthing system until permanent earthing system is installed.</p>		
5.00.00	Lightning Protection System		
5.01.00	<p>Lightning protection system shall conform to IEC:60203. It shall comprise vertical air termination, horizontal air termination, down conductor, test links, earth connections and earth electrodes.</p>		
5.02.00	<p>Vertical air termination shall extend 3 metre above the top of the chimney. For each flue duct, 3 nos. vertical air terminations shall be provided. Vertical air termination shall be of 20mm dia copper rod with lead cover of 2 mm thickness.</p>		
5.03.00	<p>Horizontal air terminations(coronal bond) shall be of minimum 50x6 mm galvanised steel strips provided at following levels.</p> <ul style="list-style-type: none"> a) Top level of each flue b) Roof top level around outer concrete shell c) Mid height around concrete shell 		
5.04.00	<p>Horizontal air terminations and vertical air terminations shall be inter connected by down conductors. No. of down conductors shall be minimum 4, equally spaced around and on exterior surface of concrete shell. Down conductors shall be of minimum 50x6 mm galvanised steel strip. Down conductors shall additionally be connected to vertical reinforcement</p>		
	TECHNICAL SPECIFICATION SECTION – VI, PART-B	SUB-SECTION-B-14 ELECTRICAL WORKS FOR CHIMNEY	PAGE 4 OF 5

CLAUSE NO.	<p style="text-align: center;">CHIMNEY ELECTRICAL WORKS</p> 		
	<p>rods at top and bottom of chimney at minimum four locations. Suitable precaution shall be taken at these joint connections to prevent any galvanic action. Reinforcement bars shall be made electrically continuous throughout their height.</p>		
5.05.00	<p>Each down conductor shall be provided with a test link at 1 metre above ground level. Each test link shall be enclosed in a galvanised sheet steel enclosure.</p>		
5.06.00	<p>Below the test link, direct connection with 40 mm dia mild steel rod shall be made to the earth grid system. Adequate no. of vertical electrodes of 40mm dia mild steel shall be provided to obtain required earth resistance.</p>		
5.07.00	<p>Down conductors shall not be connected to other earthing conductors above ground level. To avoid side flashing, metallic structures like hand rails, stairs etc.in the vicinity of down conductor shall be bonded to lightning protection system.</p>		
5.08.00	<p>Air terminations, down conductors, coronal band and accessories located at top 12 m level shall have lead cover of 2mm thickness. Suitable bimetallic washers shall be used while connecting conductors of different materials.</p> <p>The accessories like nuts, bolts, dash fasteners, round clamps, washers etc., to be used for top 12 metre level shall be made of stainless steel.</p>		
5.09.00	<p>Down conductors and horizontal air terminations shall be cleated to concrete structure at 750 mm interval.</p>		
5.10.00	<p>The contractor shall provide and maintain a temporary lightning protection system until permanent lightning protection system is installed.</p>		
6.00.00	<p>Communication system</p>		
6.01.00	<p>Contractor shall provide telephone cable installed in independent G.I. conduits and wired up to junction boxes with telephone socket at 0.0 M and at every internal platform for connection of telephone handset.</p>		
6.02.00	<p>Telephone cables shall be of minimum 0.6 mm dia annealed high conductivity electro copper conductor, PVC insulated, twisted, PVC tape wrapped, screened, rip corded, PVC sheathed, conforming to relevant ITD (Indian Telephones Department) specifications.</p>		
7.00.00	<p>TESTS</p>		
7.01.00	<p>All equipment to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all type tests as listed below:</p> <p>(A) Distribution boards/panels-Degree of protection tests (B) Aviation lights: (1) Intensity Test (2) Degree of protection test (3) Dust Ingress test</p>		
	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION – VI, PART-B</p>	<p style="text-align: center;">SUB-SECTION-B-14 ELECTRICAL WORKS FOR CHIMNEY</p>	<p style="text-align: center;">PAGE 5 OF 5</p>



SUB-SECTION - IIB

ELECTRICAL SYSTEM / EQUIPMENTS

TECHNICAL SPECIFICATION
SECTION-VI, PART-A
BID DOC NO.: CW-CM-11233-C-O-M-001

SCOPE OF SUPPLY AND SERVICES



1.00.00

SCOPE

The Bidder scope shall include design, engineering, manufacture, type testing, inspection & shop testing at supplier's works, packing, forwarding to site including customs clearance/ port clearance (if required), receipt and unloading, in plant transportation, handling and storage (preservation & conservation of equipment) at site, erection including associated civil and structural works, testing and commissioning of the Electrical equipment/ system and works as indicated for chimney package.

TERMINAL POINT(S):

1. 2 no. supply feeder of 415V, 3 phase, 4 wire from Main panel; & 1 no. emergency feeder of 415V, 3 phase, 3 wire from DG - Emergency board shall be supplied by BHEL. Any other voltage level (AC/DC) required will be derived by vendor. Further distribution of power shall be in vendor's scope.
2. BHEL shall provide 4 nos. riser pigtails along with below ground earthing, around the periphery of the chimney. Supply & Interconnection of earthing/ Lightning protection material, shall be in vendor's scope.

Note: Supply & E&C of 'structural steel' for supporting cabling material shall be in 'Vendor's scope'.

SCOPE OF SUPPLY AND SERVICES



1.05.02

LV SWITCHGEARS AND LV BUSDUCTS

The scope of work includes the following for feeding all the LV Loads of Chimney.

The major LT Switchgear shall include the following:

415 Volt AC Distribution Boards

MLDB/WLDB with Lighting/Welding Transformers (2 no's of MCCB both at Primary and Secondary End of Transformer shall be provided)

Spares (MCCB Modules less than 100 A and MPCB Modules):

AC/DC distribution boards, etc. shall have at least twenty per cent (20%) or minimum two (whichever is higher) fully equipped MCCB/MPCB modules of each rating as spares which shall be uniformly distributed over different vertical sections.

Spares (MCCB modules—100A and higher/Starter/DAE-OG/DM Modules): In addition, AC distribution boards shall have as spares at least twenty per cent (20%) of starter modules/MCCB/DAE-OG/DM modules or at least one module (whichever is higher) of each rating range of the selection table, equipped for the rating of the largest auxiliary fed from that range.

1.08.00**Cabling**

The scope of the contractor for all areas including building and equipment covered under this package including interplant areas are:-

- (a.) Supply and installation of Laying of _____, LT power and control cables.
- (b.) Supply and installation of Cable trays, fittings, and their accessories, along with support system.
- (c.) Supply and installation of Cable glands and lugs.
- (d.) Supply and installation of Straight-through jointing kits for, _____, LT power and control cables.
- (f.) Supply and installation of Welding receptacles.
- (h.) Supply and installation of Junction boxes.
- (j.) Supply and installation of Miscellaneous items like M.S. sections etc. as required

SCOPE OF SUPPLY AND SERVICES



(o.) Complete cable erection includes supply and erection of all the accessories such as rigid/ flexible conduits, fittings, junction boxes, tying materials, cable tags, and markers, support structures, cable trays, cable termination, junction boxes etc. shall be under the scope of contractor.

1.09.00

CABLES:

1.09.03

LT Power and Control Cables

Supply of LT Power and Control cables along with interplant control and protection cabling, necessary termination, lugs & glands as required for all systems covered under this package :

1.10.00

Earthing and Lightning Protection

Below and above ground earthing mat/Grounding and lightning protection for the complete buildings, switchyard and equipment's in the Contractor's scope.

SCOPE OF SUPPLY AND SERVICES



1.11.00

All earthing in isolated BOP areas shall be provided with treated earth pits as per latest Indian Standard and IEEE guidelines.

Station Lighting

Bidder's scope includes the following:

Design and Supply of Station lighting system for the plant, buildings, and equipment under Bidder's area.

Lighting fixtures complete with lamps & accessories, LED lighting fixture complete with driver circuit & accessories Lighting Panels, Receptacles, Switch boxes, Conduits, Lighting Wires ~~Ceiling fans, Wall mounted fans with regulators~~, lighting poles, ~~Lighting masts~~, Earth wires and rods, Junction boxes, Battery operated automatic self-contained lighting fixture as required.

Scope shall also cover all interior and exterior lighting such as area lighting, aviation obstruction lighting, street lighting, security lighting etc.

LED type lighting fixtures shall be provided for all area

Contractor shall prepare complete lighting layout drawings of all the areas under this contract.

Mandatory spare parts and maintenance equipment as required.



1.20.00

PAINTING FOR ELECTRICAL EQUIPMENT

Unless explicitly stated in relevant chapters of the specification, the painting of all electrical equipment shall be as follows:

The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However, in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be acceptable for finish coat. In case procedure is not indicated, Epoxy based paint with suitable additives shall be used. Paint shade for various Equipment shall be as follows

Sl no.	Item Description	Procedure	Paint Shade
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SCOPE OF SUPPLY AND SERVICES



9. ~~MV~~ and LT
Switchgear,

- a) Front and Rear
- b) Extreme ends
- c) AC and DC MCCB Box
- d) Local Push Button Stations
- e) Lighting and Welding trf

RAL 9002
RAL 5012
RAL 9002
RAL 9002
RAL 9002

SCOPE OF SUPPLY AND SERVICES



1.21.00

TYPE TEST

Contractor shall meet the requirements of type tests on electrical equipment as stipulated in relevant chapters of technical specifications.

1. The Contactor shall carry out the type tests as listed in the specifications of respective equipment. The Contactor shall indicate the charges for each of these type tests (which are not under report category) separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the Employer's engineer.
2. The type tests shall be carried out in presence of the Employer's or his Consultant's representative, for which minimum 07 days notice shall be given by the Contactor. The Contactor shall obtain the Employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
3. In case the Contactor has conducted such specified type test(s) within period as per Table-A below as on the date of bid opening, he may submit during detailed engineering the type test reports to the Employer for waive of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either

SCOPE OF SUPPLY AND SERVICES



conducted at an independent laboratory or should have been witnessed by a client. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the Contactor.

4. Further the Contactor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within period as per Table -A below from the date of bid opening. Such type tests shall be under "Report category" These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the Contactor is not able to submit report of the type test(s) conducted within period as per Table -A below from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.

SCOPE OF SUPPLY AND SERVICES



Table-A

S.No.	Equipment	Type test report validity (in years)
5.	MV Switchgear, LV Switchgear, Busducts and Numerical relay	10
9.	HT , LT Power and Control Cables	10
10.	Cable tray support	10
11.	Lighting: LED and Other equipment	10

SUB-SECTION-B – 08

LT & CONTROL CABLES



LT Power Cables & Control Cables

This chapter has to be read in conjunction with sub-section B-0 "General electrical specification" of Technical specification Section- VI, Part-B and Sub-Section-IIB Electrical system/Equipment of Technical Specifications Section-VI, Part-A".


1.00.00


CODES AND STANDARDS

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS: codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes :

IS:7098 (Part -II)	Specification for Cross linked polyethylene insulated PVC sheathed cables. Part-II: For working voltages from 3.3 KV upto and including 33 KV.
IS : 3975	Low Carbon Galvanized steel wires, formed wires and tapes for armouring of cables.
IS:4905	Methods for random sampling.
IS : 5831	PVC insulation and sheath of electrical cables.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D - 2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Tests on gases evolved during combustion of electric cables.
IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961 IEC- 332	Recommended current ratings for cables Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).
IS:7098 (Part -I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.


CLAUSE NO.	TECHNICAL REQUIREMENTS																							
<p>2.00.00</p> <p>2.01.00</p> <p>2.02.00</p> <p>2.03.00</p> <p>2.04.00</p> <p>2.05.00</p> <p>2.06.00</p> <p>2.06.01</p> <p>2.06.02</p> <p>2.06.03</p>	<p>TECHNICAL REQUIREMENTS</p> <p>All cables (HT Power, LT power and control cables) shall be Armoured type irrespective of anything contrary mentioned elsewhere in the specification.</p> <p>All cables including EPR cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.</p> <p>Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be multi stranded.</p> <p>XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C. PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.</p> <p>The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmored cables, shall have distinct extruded PVC inner sheath of black color as per IS: 5831.</p> <p>For single core Armoured cables, armoring shall be of aluminum wires. For multicore Armoured cables armoring shall be of galvanized steel as follows : -</p> <table border="1" data-bbox="399 863 1401 1453"> <thead> <tr> <th colspan="2" data-bbox="399 863 883 947">Calculated nominal diameter of cable under armour</th> <th data-bbox="883 863 1401 947">Size and Type of armour</th> </tr> </thead> <tbody> <tr> <td data-bbox="399 947 490 1014">i)</td> <td data-bbox="490 947 883 1014">Upto 13 mm</td> <td data-bbox="883 947 1401 1014">1.4mm dia GS wire</td> </tr> <tr> <td data-bbox="399 1014 490 1108">ii)</td> <td data-bbox="490 1014 883 1108">Above 13 & upto 25mm</td> <td data-bbox="883 1014 1401 1108">0.8 mm thick GS formed wire / 1.6 mm dia GS wire</td> </tr> <tr> <td data-bbox="399 1108 490 1203">iii)</td> <td data-bbox="490 1108 883 1203">Above 25 & upto 40 mm</td> <td data-bbox="883 1108 1401 1203">0.8mm thick GS formed wire / 2.0mm dia GS wire</td> </tr> <tr> <td data-bbox="399 1203 490 1297">iv)</td> <td data-bbox="490 1203 883 1297">Above 40 & upto 55mm</td> <td data-bbox="883 1203 1401 1297">1.4 mm thick GS formed wire/2.5mm dia GS wire</td> </tr> <tr> <td data-bbox="399 1297 490 1392">v)</td> <td data-bbox="490 1297 883 1392">Above 55 & upto 70mm</td> <td data-bbox="883 1297 1401 1392">1.4 mm thick GS formed wire/3.15mm dia GS wire</td> </tr> <tr> <td data-bbox="399 1392 490 1453">vi)</td> <td data-bbox="490 1392 883 1453">Above 70mm</td> <td data-bbox="883 1392 1401 1453">1.4 mm thick GS formed wire / 4.0 mm dia GS wire</td> </tr> </tbody> </table> <p>The aluminum used for armoring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm-sq.mm/mtr at 20 deg.C. The types and sizes of aluminum armoring shall be same as mentioned for galvanized steel at 2.05.00 above.</p> <p>The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armoring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface of G.S. wire/ formed wire.</p> <p>Distinct extruded PVC inner sheath of black color as per IS:5831 shall be provided for the cables as follows:</p>			Calculated nominal diameter of cable under armour		Size and Type of armour	i)	Upto 13 mm	1.4mm dia GS wire	ii)	Above 13 & upto 25mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire	iii)	Above 25 & upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire	iv)	Above 40 & upto 55mm	1.4 mm thick GS formed wire/2.5mm dia GS wire	v)	Above 55 & upto 70mm	1.4 mm thick GS formed wire/3.15mm dia GS wire	vi)	Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire
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	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUB-SECTION-B-08 HT, LT AND CONTROL CABLES	PAGE 2 OF 7																					

CLAUSE NO.	TECHNICAL REQUIREMENTS 			
2.07.00 2.08.00 2.09.00 2.010.00 2.011.00 2.012.00 2.013.00 2.014.00 2.015.00 3.00.00 3.00.01 3.00.02	<p>a) For all multicore cables.</p> <p>b) For single core Armoured cables, where armouring is not being used as metallic screen.</p> <p>Outer sheath shall be of PVC black in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.</p> <p>a) Oxygen index of min. 29 (Test method as per IS 10810 Part-58)</p> <p>b) Acid gas emission of max. 20% as per IEC-754 (Part-I)</p> <p>c) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTM-D-2843.</p> <p>Allowable tolerances on the overall diameter of the cables shall be ± 2 mm maximum over the declared value in the technical data sheets.</p> <p>Cable lengths shall be considered in such a way that straight through cable joints is avoided.</p> <p>Multi core cables are allowed for sizes upto 300 sq.mm. only. All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated. However for cable sizes upto 120 sq.mm. both XLPE insulated (having conductor temperature of 90° C) or HR PVC insulated (having conductor temperature of 85° C) LT power cables are acceptable. For LT cables, Same cable sizes to be used for same type & rating of motor i.e if there are three drives for one application, all three-drive motor should be provided with same cables sizes. However due to layout constraints no of runs of same size cable may be increased.</p> <p>Cores of the cables shall be identified by coloring of insulation. Following color scheme shall be adopted:</p> <ol style="list-style-type: none"> i. 1 core - Red, Black, Yellow or Blue ii. 2 core - Red & Black iii. 3 core - Red, Yellow & Blue iv. 4 core - Red, Yellow, Blue and Black <p>For reduced neutral conductors, the core shall be black.</p> <p>In plant repairs to the cables shall not be accepted. Pimples, fisheye, blow holes etc. are not acceptable.</p> <p>The cross-sectional area of the metallic screen strip/tape/wires shall be considered in sizing calculations.</p> <p>The eccentricity of the core shall not exceed 10% and ovality not to exceed 2%.</p> <p>CABLE SELECTION & SIZING</p> <p>Cables shall be sized based on the following considerations:</p> <ol style="list-style-type: none"> a) Rated current of the equipment b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage c) Short circuit withstand capability <p>Derating Factors</p>	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUB-SECTION-B-08 HT, LT AND CONTROL CABLES	PAGE 3 OF 7

CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 
4.00.00	<p>Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:</p> <ul style="list-style-type: none"> a) Variation in ambient temperature for cables laid in air b) Grouping of cables c) Variation in ground temperature and soil resistivity for buried cables. <p>The bidder shall furnish detailed cable selection/sizing criteria for Employer's approval.</p> <p>CONSTRUCTIONAL FEATURES</p>


4.00.04	<p>1.1 KV Grade Power Cables</p> <ul style="list-style-type: none"> (a) 1.1 KV grade XLPE power cables shall have compacted aluminum conductor, XLPE insulated, PVC inner-sheathed (as applicable), Armoured-PVC outer-sheathed conforming to IS: 7098. (Part-I). (b) 1.1KV grade HR PVC power cables shall have aluminum conductor (compacted type for sizes above 10 sq.mm), HR PVC Insulated, PVC inner sheathed (as applicable) Armoured, PVC outer-sheathed conforming to IS:1554 (Part-I). (c) 1.1 KV grade Trailing cables shall have tinned copper (class 5) conductor, insulated with heat resistant elastomeric compound based on Ethylene Propylene Rubber(EPR) suitable 		
	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUB-SECTION-B-08 HT, LT AND CONTROL CABLES	PAGE 4 OF 7

CLAUSE NO.	TECHNICAL REQUIREMENTS																	
4.00.05	<p>for withstanding 90 deg.C continuous conductor temperature and 250deg C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968.</p> <p>CABLE DRUMS</p> <p>a) Cables shall be supplied in steel drums of heavy construction. The drum shall be designed on the basis of weight, diameter, bending radius and length of cable. The surface of the drum and the outer most cable layer shall be covered with waterproof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection.</p> <p>b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stenciled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.</p>																	
5.00.00	<p>d) The standard drum length of LT power cable with a maximum tolerance of +/- 5% may be decided by the bidder subject to condition that there shall not be any joint in cable, where application length of cable is up to & including 1000 meter for single core cable excluding 630 sq.m size, and 750 meter for multicore cable & single core 630 sq.m.</p> <p>e) The standard drum length for Control cables with a maximum tolerance of +/- 5% may be decided by the bidder subject to condition that there shall not be any joint in cable, where application length of cable is up to & including 1000 meter.</p> <p>f) One drum length of each cable size can be of non-standard length (not less than 250 meter) so as to match the ordered quantity subject to condition that there shall not be any joint in cable.</p>																	
5.01.00	<p>TYPE, ROUTINE AND ACCEPTANCE TESTS</p>																	
5.01.00	<p>Type Tests</p> <p>The reports for the following type tests shall be submitted for one size each of LT XLPE, LT PVC Power and control cables. The following type tests shall be carried out on one size each of 19/33 KV & 11/11 KV, 3.3/3.3 KV HT Cables. Size shall be decided by the employer during detailed engineering</p> <table border="1" data-bbox="399 1577 1401 1801"> <thead> <tr> <th>S. No</th> <th>Type Test</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td colspan="3">Conductor</td> </tr> <tr> <td>1.</td> <td>Resistance test</td> <td>For Armour Wires / Formed Wires</td> </tr> <tr> <td>2.</td> <td>Measurement of Dimensions</td> <td></td> </tr> <tr> <td>3.</td> <td>Tensile Test</td> <td></td> </tr> </tbody> </table>			S. No	Type Test	Remarks	Conductor			1.	Resistance test	For Armour Wires / Formed Wires	2.	Measurement of Dimensions		3.	Tensile Test	
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	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUB-SECTION-B-08 HT, LT AND CONTROL CABLES	PAGE 5 OF 7															

CLAUSE NO.	TECHNICAL REQUIREMENTS		 MPPGCL
	S. No	Type Test	Remarks
	4.	Elongation test	
	5.	Torsion test	For round wires only
	6.	Wrapping test	
	7.	Resistance test	
	8(a)	Mass & uniformity of Zinc Coating tests	For GS wires/formed wires only.
	8(b)	Adhesion test	For GS wires/formed wires only
		For XLPE insulation & PVC Sheath	
	9.	Test for thickness	
	10.	Tensile strength and elongation test before ageing and after ageing	
	11.	Ageing in air oven	
	12.	Loss of mass test	For PVC outer sheath only.
	13.	Hot deformation test	For PVC outer sheath only.
	14.	Heat shock test	For PVC outer sheath only
	15.	Shrinkage test	
	16.	Thermal stability test	For PVC outer sheath only
	17.	Hot set test	For XLPE insulation only
	18.	Water absorption test	For XLPE insulation only
	19.	Oxygen index test	For PVC outer sheath only
	20.	Smoke density test	For PVC outer sheath only
	21.	Acid gas generation test	For PVC outer sheath only
	22.	Flammability test as per IEC-332 Part-3 (Category -B)	For completed cable only

SUB-SECTION-B – 10


CABLING EARTHING AND LIGHTNING PROTECTION

CLAUSE NO.	TECHNICAL REQUIREMENTS			 MPPGCL
2.00.00	DESIGN AND CONSTRUCTIONAL FEATURE			

2.01.10	Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.		
	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION	PAGE 2 OF 21



<p>3.00.00</p> <p>3.01.00</p> <p>3.01.02</p> <p>3.01.03</p> <p>3.01.04</p> <p>3.01.05</p> <p>3.02.00</p> <p>3.02.01</p> <p>3.02.02</p>	<p>EQUIPMENT DESCRIPTION</p> <p>Cable trays shall be ladder/perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.</p> <p>Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per Clause No. 3.13.00 of this chapter.</p> <p>Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm.</p> <p>Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanized as per Clause No. 3.13.00 of this chapter. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm.</p> <p>The tolerance for cable tray and accessories shall be as per IS 2102 (Part-1). Tolerance Class: - Coarse</p> <p>Support System for Cable Trays</p> <p>Cable tray support system shall be pre-fabricated out of single sheet as per enclosed tender drawings.</p> <p>Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder:</p> <ol style="list-style-type: none"> a) Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc. b) The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares fittings and accessories shall be prefabricated factory galvanized. c) The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvansied surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied.
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CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 
3.02.03	<p>d) All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drilling and other machining operation.</p> <p>e) The typical arrangement of flexible support system is shown in the enclosed drawings and described briefly below: The main support channel and cantilever arms shall be fabricated out of 2.5 thick rolled steel sheet conforming to IS 1079.</p> <p>f) Cantilever arms of 320 mm, 620mm and 750 mm in length are required, and shall be as shown in the enclosed drawing. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position.</p> <p>g) Support system shall be able to withstand <ul style="list-style-type: none"> • weight of the cable trays • weight of the cables (75 Kg/Metre run of each cable tray) • Concentrated load of 75 Kg between every support span • Factor of safety of minimum 1.5 shall be considered </p> <p>The size of structural steel members or thickness of sheet steel of main support channel and cantilever arms and other accessories as indicated above or in the enclosed drawings are indicative only. Nevertheless, the support system shall be designed by the bidder to fully meet the requirements of type tests as specified. In case the system fails in the tests, the components design modification shall be done by the Bidder without any additional cost to the Employer. The bidder shall submit the detailed drawings of the system offered by him alongwith the bid.</p>
3.02.04	<p>Four legged structure shall be provided wherever there is change in elevation and change in direction</p>

3.03.00	Pipes, Fittings & Accessories			
3.03.01	Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria.			
<table border="1" style="width: 100%; text-align: center;"> <tr> <td data-bbox="625 1843 987 1959"> TECHNICAL SPECIFICATIONS SECTION-VI, PART-B </td> <td data-bbox="987 1843 1276 1959"> SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION </td> <td data-bbox="1276 1843 1421 1959"> PAGE 4 OF 21 </td> </tr> </table>		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION	PAGE 4 OF 21
TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION	PAGE 4 OF 21		



3.04.00
3.04.01

Junction Boxes

Junction box shall be made of Fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. The box shall be provided with the terminal blocks, mounting bracket and screws etc. The cable entry shall be through galvanized steel conduits of suitable diameter. The JB shall have suitable for installing glands of suitable size on the bottom of the box. The JB shall be suitable for surface mounting on ceiling/structures. The JB shall be of grey color RAL 7035. All the metal parts shall be corrosion protected. Junction box surface should be such that it is free from crazings, blisterings, wrinkling, colour blots/striations. There should not be any mending or repair of surface. JB's will be provided with captive screws so that screws don't fall off when cover is opened. JB's mounting brackets should be of powder coated MS. Type test reports for the following tests shall be furnished:

- a) Impact resistance for impact energy of 2 Joules (IK07) as per BS EN50102
- b) Thermal ageing at 70deg C for 96 hours as per IEC60068-2-2Bb
- c) Class of protection shall be IP 55
- d) HV test

3.04.02


Terminal blocks shall be 1100V grade, of suitable current rating, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side the required cables/wire size. All internal wiring shall be of cu. Conductor PVC wire.


CLAUSE NO.	TECHNICAL REQUIREMENTS	
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3.06.00	<p>Cable glands</p> <p>Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.</p>
3,07.00	<p>Cable lugs/ferrules</p>
3.07.01	<p>Cable lugs/ferrules shall be solderless crimping type suitable for power and control cables as per the DIN 46239. Aluminium solderless crimping lugs/ ferrules shall be used for Aluminium cables and Copper lugs/ferrules shall be used for Copper cables. Bimetallic washers or bimetallic type lugs shall be used for bimetallic connections.</p> <p>Crimping tool for crimping (from 1.5sqmm cable to 630sqmm cables) above mentioned lugs shall be of Hexagonal Type crimp profile, with suitable die of crimp match code.</p> <p>Characteristics of crimping tool:</p> <ol style="list-style-type: none"> 1) To should generate enough pressure to pass pull out test as per IEC 61238-1. Relevant type test to be produced for the sizes specified in the tender. 2) Tool die shall be replaceable for assorted sizes and crimp code to be mentioned on both part the die 3) Tool should be compliant of testing according to IEC, UL and GS standards <p>Tool shall have features such as</p> <ul style="list-style-type: none"> • Auto retraction system • Manual retraction stop • Feedback signals for improper pressure • Better battery capacity and with status display • Flexible and rotating head for easy crimping

3.09.00	<p>Cable Clamps & Ties</p>
3.09.01	<p>The cable clamps/ties required to clamp multicore cables shall be of SS-316 material, 12mm wide, polyster coated ladder lock type. The clamps/ties shall have self locking arrangement &</p>

	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION	PAGE 6 OF 21
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CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 		
<p>3.10.00</p> <p>3.10.01</p>	<p>shall have sufficient strength. The cable clamps/ties shall be supplied in finished individual pieces of suitable length to meet the site requirements.</p> <p>Receptacles</p> <p>Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped gavanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break, AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polyimide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with RCCB/RCD of 30mA sensitivity having facility for manual testing/checking of operation of RCCB/RCD.</p>		
<p>3.12.00</p> <p>3.12.01</p> <p>3.12.02</p>	<p>Galvanising</p> <p>Galvanising of steel components and accessories shall conform to IS:2629 , IS4759 & IS:2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots.</p> <p>The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS:1367 . The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified.</p>		
<p>3.13.00</p> <p>3.13.01</p>	<p>Welding</p> <p>The welding shall be carried out in accordance with IS:9595. All welding procedures and welders qualification shall also be followed strictly in line with IS:9595.</p>		
<p>4.00.00</p> <p>4.01.00</p> <p>4.01.01</p> <p>4.01.02</p>	<p>INSTALLATION</p> <p>Cable tray and Support System Installation</p> <p>Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.</p> <p>Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray</p>		
	<p style="text-align: center;">TECHNICAL SPECIFICATIONS SECTION-VI, PART-B</p>	<p style="text-align: center;">SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION</p>	<p style="text-align: center;">PAGE 7 OF 21</p>


CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 												
	<p>installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the support system along with tray, spacing etc in line with tray loadings/drawings.</p>												
4.01.03	<p>The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated</p>												
4.01.04	<p>The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer. Make of anchor fasteners subject to QA approval and the same shall be finalized at pre-award stage.</p>												
4.01.05	<p>All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/stenciled with identification numbers at every floor.</p>												
4.01.06	<p>In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.</p>												
4.01.07	<p>In fire prone areas, like Boiler, TG, fuel oil area and any other strategic location etc, fire retardant paint to be applied after installation cables.</p>												
4.02.00	<p>Conduits/Pipes/Ducts Installation</p>												
4.02.01	<p>The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall / cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.</p>												
4.02.02	<p>GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.</p>												
4.02.03	<p>Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material</p>												
4.02.04	<p>Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise</p> <table border="1" data-bbox="381 1543 836 1690"> <thead> <tr> <th>Conduit /pipe size (dia).</th> <th>Spacing</th> </tr> </thead> <tbody> <tr> <td>Upto 40 mm</td> <td>1 M</td> </tr> <tr> <td>50 mm</td> <td>2.0 M</td> </tr> <tr> <td>65-85 mm</td> <td>2.5 M</td> </tr> <tr> <td>100 mm and above</td> <td>3.0 M</td> </tr> </tbody> </table>			Conduit /pipe size (dia).	Spacing	Upto 40 mm	1 M	50 mm	2.0 M	65-85 mm	2.5 M	100 mm and above	3.0 M
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4.02.05	<p>For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth.</p>												
	<p style="text-align: center;">TECHNICAL SPECIFICATIONS SECTION-VI, PART-B</p>	<p style="text-align: center;">SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION</p>	<p style="text-align: center;">PAGE 8 OF 21</p>										

CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 
4.03.00	Junction Boxes Installation
4.03.01	Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.
4.04.00	Cable Installation
4.04.01	Cable installation shall be carried out as per IS:1255 and other applicable standards.
4.04.02	<p>For Cable unloading, pulling etc following guidelines shall be followed in general:</p> <ol style="list-style-type: none"> a. Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture. b. While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged, the same shall be repaired or changed to the satisfaction of Project Manager.
4.04.03	Cables shall be laid on cable trays strictly in line with cable schedule
4.04.04	<p>Power and control cables shall be laid on separate tiers inline with the approved guidelines/drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on top most tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every one metre. All multicore cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/support with cable clamps/ties with self locking arrangement. For horizontal trays arrangements, multicore power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multicore power cables and control cables shall be secured at every one meter. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by cable clamps/ties with self locking arrangement at every five meter interval and at every bend.</p> <p>Fibre Optical cable shall be laid in trenches/trays or as decided by Employer</p>




4.04.15	Minimum number of spare cores required to be left for interconnection in control cables shall be as follows:	
	No. of cores in cable	No. of spare cores
	2C,3C	1
	5C	1
	7C-10C	2
	14C and above	3


CLAUSE NO.	TECHNICAL REQUIREMENTS 		
4.04.17	<p>Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags. The cable tag requirements mentioned above shall prevail over Tag requirements mentioned elsewhere in this document for HT power, LT power & control cables.</p>		
4.04.18	<p>While crossing the floors, unarmoured cables shall be protected in conduits upto a height of 500 mm from floor level if not laid in tray.</p>		
4.05.00	<p>Cable Terminations & Connections</p>		
4.05.01	<p>The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/or as directed by Project Manager. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site</p>		
4.05.02	<p>Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Project Manager.</p>		
4.05.03	<p>The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.</p>		
4.05.04	<p>Control cable cores entering control panel/switchgear/MCC/miscellaneous panels shall be neatly bunched, clamped and tied with self locking type nylon cable ties with de interlocking facility to keep them in position.</p>		
4.05.05	<p>All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, ---etc along with cable numbers and coiled up after end sealing.</p>		
4.05.06	<p>All cable terminations shall be appropriately tightened to ensure secure and reliable connections.</p>		
5.00.00	<p>EARTHING SYSTEM</p>		
5.01.00	<p>Earthing system shall be in strict accordance with IS:3043 and Indian Electricity Rules/Acts. The earthing system shall be designed for a life expectancy of at least forty (40) years, for a system fault current of 63 kA for 1.0 sec. The minimum rate of corrosion of steel for selection of earthing conductor shall be 0.12mm per year.</p>		
Earthing system	<p>network/earthmat shall be interconnected mesh of mild steel rods buried in ground in the plant. All areas under contractor scope of supply shall be interconnected together by minimum two</p>		
	<p>TECHNICAL SPECIFICATIONS SECTION-VI, PART-B</p>	<p>SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION</p>	<p>PAGE 11 OF 21</p>


CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 																																						
	<p>parallel conductors. The Contractor shall furnish the detailed design and calculations for Employer's approval. Contractor shall obtain all necessary statutory approvals for the system. All the columns shall be earthed by nearby risers and earthmat grid spacing shall be maximum 15 mts. Minimum two nos of risers shall be provided for each equipment in SG area. Separate dedicated riser shall be provided for C&I earthing purpose and also for Lightning down conductor connection purpose. Sufficient nos of risers near the equipment shall be provided as per the system requirement. Ring type earthing around the offsite building shall be provided with interconnection of with main grid at minimum two points.</p>																																						
5.02.00	<p>The earth conductors shall be free from pitting, laminations, rust, scale and other electrical, mechanical defects.</p>																																						
5.03.00	<p>The material of the earthing conductors shall be as follows:</p> <ol style="list-style-type: none"> 1. Conductors above ground level and in built up trenches - Galvanized steel 2. Conductors buried in earth - Mild steel 3. Earth electrodes - Mild steel rod 																																						
5.04.00	<p>The sizes of earthing conductors for various electrical equipments shall be as below:</p> <table border="1" data-bbox="358 840 1419 1491"> <thead> <tr> <th>Equipment</th> <th>Earth conductor buried in earth</th> <th>Earth conductor above ground level & in built-up trenches</th> </tr> </thead> <tbody> <tr> <td>i. Main earth grid</td> <td>Min 40 mm dia. MS rod or as per actual calculation whichever is more</td> <td>65 x 8mm GS flat</td> </tr> <tr> <td>ii. 33kV/11kV/6.6kV/3.3 kV/ switchgear equipment and 415V switchgear</td> <td>---</td> <td>65 x 8mm GS flat</td> </tr> <tr> <td>iii. 415 V MCC/ Distribution boards / Transformers</td> <td>---</td> <td>50 x 6mm GS flat</td> </tr> <tr> <td>iv. LT Motors above 125 KW</td> <td>---</td> <td>50 x 6mm GS flat</td> </tr> <tr> <td>25 KW to 125 KW</td> <td>---</td> <td>25 x 6mm GS flat</td> </tr> <tr> <td>1KW to 25 KW</td> <td>---</td> <td>25 x 3mm GS flat</td> </tr> <tr> <td>Fractional House power motor</td> <td>---</td> <td>8 SWG GS wire</td> </tr> <tr> <td>v. Control panel & control desk</td> <td>---</td> <td>25 x 3 mm GS flat</td> </tr> <tr> <td>vi. Push button station / Junction</td> <td>---</td> <td>8 SWG GI wire</td> </tr> <tr> <td>vii. Columns, structures, cable trays and bus ducts enclosures</td> <td>---</td> <td>50 x 6mm GS flat</td> </tr> <tr> <td>viii. Crane, rails, rail tracks & other non-current carrying metal parts</td> <td></td> <td>25 x 6mm GS flat</td> </tr> </tbody> </table>			Equipment	Earth conductor buried in earth	Earth conductor above ground level & in built-up trenches	i. Main earth grid	Min 40 mm dia. MS rod or as per actual calculation whichever is more	65 x 8mm GS flat	ii. 33kV/11kV/6.6kV/3.3 kV/ switchgear equipment and 415V switchgear	---	65 x 8mm GS flat	iii. 415 V MCC/ Distribution boards / Transformers	---	50 x 6mm GS flat	iv. LT Motors above 125 KW	---	50 x 6mm GS flat	25 KW to 125 KW	---	25 x 6mm GS flat	1KW to 25 KW	---	25 x 3mm GS flat	Fractional House power motor	---	8 SWG GS wire	v. Control panel & control desk	---	25 x 3 mm GS flat	vi. Push button station / Junction	---	8 SWG GI wire	vii. Columns, structures, cable trays and bus ducts enclosures	---	50 x 6mm GS flat	viii. Crane, rails, rail tracks & other non-current carrying metal parts		25 x 6mm GS flat
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5.05.00	<p>Metallic frame of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity, Crane rails, tracks, metal pipes and conduits shall also be effectively earthed at two points. Steel RCC columns, metallic stairs and rails etc. of the building housing electrical equipment shall be connected to the nearby earthing grid conductor by one earthing ensured by bonding the different sections of hand rails and metallic stairs. Metallic sheaths/screens, and armour of multi-core cables shall be earthed at both ends. Metallic Sheaths and armour of single core cables shall be earthed at switchgear end only unless otherwise approved. Every alternate post of the switchyard fence shall be connected to earthing grid by one GS flat and gates by flexible lead to the earthed post. Railway tracks within the plant area shall be bonded across fish plates and connected to earthing grid</p>																																						
	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION	PAGE 12 OF 21																																				


CLAUSE NO.	TECHNICAL REQUIREMENTS		
5.06.00	<p>at several locations. Portable tools, appliances and welding equipment shall be earthed by flexible insulated cable.</p> <p>Each continuous laid lengths of cable tray shall be earthed at minimum two places by G.S. flats to earthing system, the distance between earthing points shall not exceed 30 meter. Wherever earth mat is not available, necessary connections shall be done by driving an earth electrode in the ground.</p>		
5.09.00	<p>Connections between earth leads and equipment shall normally be of bolted type. Contact surfaces shall be thoroughly cleaned before connections. Equipment bolted connections after being tested and checked shall be painted with anti corrosive paint/compound.</p>		
5.10.00	<p>Suitable earth risers as approved shall be provided above finished floor/ground level, if the equipment is not available at the time of laying of main earth conductor.</p>		
5.11.00	<p>Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding.</p>		
5.12.00	<p>Resistance of the joint shall not be more than the resistance of the equivalent length of conductors.</p>		
5.15.00	<p>A minimum earth coverage of 300 mm shall be provided between earth conductor and the bottom of trench/foundation/underground pipes at crossings. Earthing conductors crossings the road can be installed in pipes. Wherever earthing conductor crosses or runs at less than 300 mm distance along metallic structures such as gas, water, steam pipe lines, steel reinforcement in concrete, it shall be bonded to the same.</p>		
5.16.00	<p>Earthing conductors along their run on columns, walls, etc. shall be supported by suitable welding / cleating at interval of 1000mm and 750mm respectively.</p>		
5.17.00	<p>Earth pit shall be of treated type & shall be constructed as per IS:3043. Electrodes shall be embedded below permanent moisture level. Minimum spacing between electrodes shall be 600mm. Earth pits shall be treated with salt and charcoal as per IS:3043. Test links shall be provided with bolted arrangement along with each earth pit, in order to facilitate measurement of earth resistance as & when required.</p>		
5.18.00	<p>On completion of installation continuity of earth conductors and efficiency of all bonds and joints shall be checked. Earth resistance at earth terminations shall be measured and recorded. All equipment required for testing shall be furnished by contractor.</p>		
	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION	PAGE 13 OF 21




CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 																																			
5.19.00	<p>Earthing conductor shall be buried at least 2000mm outside the fence of electrical installations. Every alternate post of the fences and all gates shall be connected to earthing grid by one lead.</p>																																			
5.20.00	<p>Other Requirements of Earthing System:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 60%;">Standard/Code</td> <td colspan="2">IEEE 80, IS 3043</td> </tr> <tr> <td>Earthing System</td> <td colspan="2"></td> </tr> <tr> <td>Life expectancy</td> <td colspan="2">40 Years</td> </tr> <tr> <td>System Fault Level</td> <td colspan="2">System Fault Level 63 KA for 1 sec</td> </tr> <tr> <td>Soil resistivity</td> <td colspan="2">Actual as per site conditions</td> </tr> <tr> <td>Min. Steel corrosion</td> <td colspan="2">0.12mm/year</td> </tr> <tr> <td>Depth of burial of main earth conductor</td> <td colspan="2">600mm below grade level; where it crosses trenches, pipes, ducts, tunnels, rail tracks, etc., it shall be at least 300mm below them.</td> </tr> <tr> <td>Conductor joints</td> <td colspan="2">By electric arc welding, with resistance of joint not more than that of the conductor.</td> </tr> <tr> <td colspan="3">Welds to be treated with red lead for rust protection and then coated with bitumen compound for corrosion protection</td> </tr> <tr> <td>Surface resistivity</td> <td>- Gravel</td> <td>3000 ohm-meter</td> </tr> <tr> <td></td> <td>- Concrete</td> <td>500 ohm-meter</td> </tr> </table>			Standard/Code	IEEE 80, IS 3043		Earthing System			Life expectancy	40 Years		System Fault Level	System Fault Level 63 KA for 1 sec		Soil resistivity	Actual as per site conditions		Min. Steel corrosion	0.12mm/year		Depth of burial of main earth conductor	600mm below grade level; where it crosses trenches, pipes, ducts, tunnels, rail tracks, etc., it shall be at least 300mm below them.		Conductor joints	By electric arc welding, with resistance of joint not more than that of the conductor.		Welds to be treated with red lead for rust protection and then coated with bitumen compound for corrosion protection			Surface resistivity	- Gravel	3000 ohm-meter		- Concrete	500 ohm-meter
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6.01.01	<p>Lightning protection system shall be in strict accordance with IEC : 62305 and latest IS standards.</p>																																			
6.01.02	<p>Lightning conductor shall be of 25x6mm GS strip when used above ground level and shall be connected through test link with earth electrode/earthing system.</p>																																			
6.01.03	<p>Lightning system shall comprise of air terminations, down conductors, test links, earth electrode etc. as per approved drawings.</p>																																			
6.02.00	<p>Down Conductors</p> <ol style="list-style-type: none"> 1. Down conductors shall be as short and straight as practicable and shall follow a direct path to earth electrode. 2. Each down conductor shall be provided with a test link at 1000 mm above ground level for testing but it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point. 3. All joints in the down conductors shall be welded type. 4. Down conductors shall be cleated on outer side of building wall, at 750 mm interval or welded to outside building columns at 1000 mm interval. 5. Lightning conductor on roof shall not be directly cleated on surface of roof. Supporting blocks of PCC/insulating compound shall be used for conductor fixing at an interval of 1500 mm. 6. All metallic structures within a vicinity of two meters of the conductors shall be bonded to conductors of lightning protection system. 7. Lightning conductors shall not pass through or run inside GI Conduits. 8. Testing link shall be made of galvanized steel of size 25x 6mm. 9. Pulser system for lightning shall not be accepted. 10. Hazardous areas handling inflammable/explosive materials and associated storage areas shall be protected by a system of aerial earths. 																																			
	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION	PAGE 14 OF 21																																	

CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 		
<p>7.00.00 7.01.00 7.01.01</p>	<p>TESTS</p> <p>Type Test reports shall be furnished for the following Type tests on Cable Trays support system</p> <p>a) Test 1A: On main support channel type-C2 for cantilever arms fixed on one side only. A 3.5 meter length of main support channel shall be fixed vertically at each end to a rigid structure as per the fixing arrangement as shown in the enclosed drawing. Eight (8) nos. 750 mm cantilever arms shall be fixed to the main channel and each arm shall be loaded over the outboard 600 mm with a uniform working load of 100 kg. Subsequently a point load of 100 kg shall be applied on arm 2. A uniform proof load on all the arms equal to twice the working load shall be then be applied. Deflections shall be measured at the points shown in the enclosed drawings and at the following load intervals:</p> <ol style="list-style-type: none"> i. Working load ii. Working load + point load iii. Off load iv. Proof load + point load v. Off load <p>The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied</p> <p>b) Test 1B Test 1A shall be repeated with Eight Cantilever arms uniformly loaded and with the same point load on arm 2</p> <p>Test 2: On Main support channel type -C2 for cantilever arms fixed on both sides</p> <p>a) Test 2A: A 3.5 m length of main support channel C2 for cantilever arms fixing on both sides shall be fixed at each end to rigid structure as per the fixing arrangement as shown in the enclosed drawing. Six (6), 750 mm cantilever arms shall be attached to each sides and each arm uniformly loaded to a working load of 100 kg over the out board 600 mm. A point load of 100 kg shall than be applied to arm 2, followed by a uniform proof load of twice the working load on all the arms; deflection shall be measured at points shown in the enclosed drawings at the following load intervals.</p> <ol style="list-style-type: none"> i. Working load ii. Working load + point load iii. Off load iv. Proof load + point load v. Off load <p>The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied</p> <p>b) Test 2 B: The test 2 A shall be repeated with the assembly but with an asymmetrical load on the C2 column and point load applied to arm 8. The 100 kg and 200 kg uniformly distributed loads shall be applied to the upper three arms on one side and the lower three arms on the opposite side</p> <p>Test 3: Tests on Channel Fixed on Beam/Floor</p>		
	<p style="text-align: center;">TECHNICAL SPECIFICATIONS SECTION-VI, PART-B</p>	<p style="text-align: center;">SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION</p>	<p style="text-align: center;">PAGE 15 OF 21</p>

CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 		
	<p>A length of main support channel section shall be fixed to steel structure/floor and have loads applied as shown in the drawing enclosed and as detailed below:</p> <p>a) Test 3A: A length of steel structure shall be rigidly supported. It should be fitted on a meter length of channel section using beam clamps welded/bolted. A point load of 1200 kg shall be applied to the centre point via two brackets. No distortion or pulling of the components shall take place</p> <p>b) Test 3B: With the components assembled as in Test 3A, two perpendicular point loads of 600 kg shall be simultaneously applied at positions 150 mm either side of the centre line, no distortion or pulling of the components shall take place</p> <p>c) Test 3C: With the components assembled as in Test 3A, a perpendicular point load shall be applied at a point 150 mm on one side of the centre line</p> <p>The load shall be gradually increased to the maximum value that can be applied without causing distortion or pulling of the components. This value shall be recorded</p> <p>Test 4 : Channel Insert Test</p> <p>A 2.5 m length of C1 channel fixed to the concrete wall/ steel structure as per actual site installation conditions. 6 nos. of 750 mm cantilever arms shall be attached to C1 channel as shown in enclosed drawing. Each arm uniformly loaded to a working load of 100 kg over the out board 600 mm. A point load of 100 kg shall than be applied to arm 2, followed by a uniform proof load of twice the working load on all the arms; deflection shall be measured at points shown in the enclosed drawings at the following load intervals.</p> <ol style="list-style-type: none"> i. Working load ii. Working load + point load iii. Off load iv. Proof load + point load v. Off load <p>The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied.</p> <p>Test 5 : Channel nut slip characteristics (what ever applicable)</p> <p>Tests 5A1,5A2,5A3 : A length of channel C1 section 200mm long shall have fitted bracket with the two bolt fixing as shown in drawing enclosed. With loads applied at the position shown in drawing enclosed nut slip shall be determined with bolt torque of 30NM, 50 NM and 65 NM No fewer than three measurements shall be made for each torque setting. A minimum loading of 720 kg shall be obtained before nut slip with bolt torque of 65 NM</p> <p>Tests 5B1,5B2,5B3: The length of channel C1 section 200 mm long shall have fitted bracket with the one bolt fixing as shown in drawing enclosed. With loads applied at the position shown in drawing, nut slip shall be determined with bolt torques of 30 NM, 50 NM and 65 NM. No fewer than three measurements shall be made for each torque setting</p> <p>A minimum loading of 350 kg shall be obtained before nut slip with a bolt torque of 65 NM</p>		
	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION	PAGE 16 OF 21

CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 			
<p>7.02.02</p> <p>7.03.00</p> <p>7.03.01</p> <p>7.03.02</p> <p>8.00.00</p> <p>8.01.01</p> <p>8.01.02</p>	<p>Test 6 Weld Integrity Test</p> <p>After deflection test as per test 1A, 1B, 2, 3 & 4 weld integrity shall be checked by magnetic particle inspection to detect sub-surface cracks developed, if any.</p> <p>Cable termination kit and straight through joints should have been tested as per IS:13573 for 3.3kV grade & above.</p> <p>Routine/ Acceptance Tests</p> <p>Routine Tests</p> <p>a) Routine tests as per specification and applicable standards shall be carried out on all requirements/items covered in the specification</p> <p>b) Physical & dimensional check on all equipments as per approved drawings/standards</p> <p>c) HV/IR as applicable</p> <p>d) Check/measurement of thickness of paint/zinc coating/nickel-chrome plating as per specification & applicable standard</p> <p>Acceptance Test</p> <p>a) Galvanising Tests as per applicable standards</p> <p>b) Welding checks</p> <p>c) Deflection tests on cable trays</p> <p>One piece each of 2.5m length of cable tray of 300mm & above shall be taken as sample from each offered lot. It shall be supported at both end & loaded with uniform load of 76 kg/meter along the length of cable tray. The maximum deflection at the mid-span of each size shall not exceed 7mm</p> <p>d) Proof load tests on cable tray support system</p> <p>i. Tests on Main Support Channel shall be done if only C1 Channel are in scope of supply and cantilever arms shall be fitted on one side. This test shall be same as test 4 of type test.</p> <p>ii. Test on Main Support Channel shall be done with C2 channel and cantilever arms fitted on both sides, if C2 channels are in scope of supply. This test shall be same as test 2A of type test. Then test (i) above shall not be done.</p> <p>iii. Nut slip characteristic test (it shall support minimum load of 350kg before nut slips with a bolt torque of 65 NM). This test shall be same as test 5B3 of type test</p> <p>The procedure for carrying out tests at "d" above shall be as per details given in Type Tests in specification thereafter Die-Penetration test shall be carried out to check weld integrity</p> <p>e) The above acceptance tests shall be done only on one sample from each offered lot.</p> <p>COMMISSIONING</p> <p>The Contractor shall carry out the following commissioning tests and checks after installation at site. In addition the Contractor shall carry out all other checks and tests as recommended by the Manufacturers or else required for satisfactory performance</p> <p>Cables</p> <p>i. Check for physical damage</p> <p>ii. Check for insulation resistance before and after termination/jointing</p>	<p style="text-align: center;">TECHNICAL SPECIFICATIONS SECTION-VI, PART-B</p>	<p style="text-align: center;">SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION</p>	<p style="text-align: center;">PAGE 17 OF 21</p>

CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 
<p>8.02.00</p> <p>8.03.00</p>	<ul style="list-style-type: none"> iii. HT cables shall be pressure tested (test voltage as per IS:7098) before commissioning v. Check of continuity of all cores of the cables v. Check for correctness of all connections as per relevant wiring diagrams. Any minor modification to the panel wiring like removing/inserting, shorting, change in terminal connections, etc., shall be carried out by the Contractor. vi. Check for correct polarity and phasing of cable connections vii. Check for proper earth connections for cable glands, cable boxes, cable armour, screens, etc. viii. Check for provision of correct cable tags, core ferrules, tightness of connections <p>Cable trays / supports and accessories</p> <ul style="list-style-type: none"> 1. Check for proper galvanizing/painting and identification number of the cable trays/supports and accessories. 2. Check for continuity of cable trays over the entire route. 3. Check that all sharp corners, burrs, and waste materials have been removed from the trays supports. 4. Check for earth continuity and earth connection of cable trays. <p>Earthing and Lightning protection system</p> <ul style="list-style-type: none"> 1. Earth continuity checks. 2. Earth resistance of the complete system as well as sub-system.

	<p style="text-align: center;">TECHNICAL SPECIFICATIONS SECTION-VI, PART-B</p>	<p style="text-align: center;">SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION</p>	<p style="text-align: center;">PAGE 18 OF 21</p>


3. The following clearances shall be maintained for LT Switchboard.

a.) Front Clearance

- i) For one Row of Swgr - 1.5M (Min)
- ii) For two Rows of Swgr - 1.5/1.75M depending upon the depth of panels etc

b.) Back Clearance

- i) For single front - 1.0M (Min)
- ii) For double front - 1.5M (Min)


CLAUSE NO.	<p style="text-align: center;">TECHNICAL REQUIREMENTS</p> 		
	<p>c.) Side Clearance:Min. 800 mm, however provision to be made for any additional panel in future at both ends. Therefore end clearance shall be 800 mm + width of panel.</p> <p>c) Minimum clear working space 1200mm around the equipment</p> <p>d) In buildings having MCC, minimum 2 fire door along with one rolling shutter of adequate size/capacity shall be provided</p> <p>e) The cable entry and exit from switchgear room shall be from 1.5 mtr (minimum) above FGL</p> <p>f) Wash basin with mirror shall be provided in battery room.</p>		
	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB-SECTION B-10 CABLING, EARTHING AND LIGHTNING PROTECTION	PAGE 20 OF 21

SUB-SECTION-B – 11

LIGHTING


CLAUSE NO.	TECHNICAL REQUIREMENTS		
1.00.00	GENERAL		
1.01.00	This specification covers the general description of design, manufacture and construction features, testing, supply, installation, and commissioning of the Station Lighting system equipment.		
2.00.00	CODES AND STANDARDS		
2.01.00	All standards and codes of practice referred to herein shall be the latest edition including all applicable official amendments & revisions as on date of bid opening. In case of conflict between this specification and those (IS codes, standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards & codes.		
2.02.00	<p>Lighting Fixtures and Accessories</p> <p>IS:1913 General and safety requirements for luminaries.</p> <p>IS:2148 Flame proof enclosures of electrical apparatus.</p> <p>IS:1534 Ballast for fluorescent lamps.</p> <p>IS:1777 Industrial luminaire with metal reflectors.</p> <p>IS:2418 Tubular fluorescent lamps for general lighting services.</p> <p>IS:4013 Dust-tight electric lighting fittings.</p> <p>IS:8224 Electric Lighting fittings for Division 2 areas.</p> <p>IS:10276 Edison screw lamp holders.</p> <p>IS:10322 Luminaires.</p> <p>IS:13021 AC Supplied Electronic Ballasts for tubular fluorescent lamps.</p> <p>IS 16103 LED Luminaire Standards</p>		
2.03.00	<p>Lighting Panels, Switchboxes, Receptacles and Junction Boxes</p> <p>IS:2147 Degree of protection provided by enclosures for low-voltage switchgear and control gear.</p> <p>IS:1293 Plugs & socket outlets of rated voltage upto and Including 250volts & rated current upto and including 16 Amps.</p> <p>IS:2551 Danger notice plates.</p> <p>IS:13947 Low voltage switchgear and control-gear</p> <p>IS:3854 Switches for domestic and similar purposes.</p> <p>IS:6875 Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V AC and 1200 V DC.</p>		
	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	Page 1 of 19




CLAUSE NO.	TECHNICAL REQUIREMENTS		
	IS:13703	Low voltage fuses for voltages not exceeding 1000V AC or 1500 V DC.	
2.04.00	Conduits, Pipes and Accessories		
	IS:2667	Fittings for rigid steel conduit for electrical wiring.	
	IS:3837	Accessories for rigid steel conduits for electrical wiring.	
	IS:9537	Conduits for electrical installations.	
2.05.00	Lighting Wires/Cables		
	IS:694	PVC insulated cables for working voltages upto and including 1100 V	
	IS:3961	Recommended current ratings for cables.(PVC Insulated and PVC sheathed heavy duty cables and light duty cables).	
	IS:8130	Conductors for insulated electric cables and flexible cords.	
	IS:10810	Methods of tests for cables.	
2.06.00	LED Luminaries		
	16101:2012	General Lighting. LEDs and LED modules Terms and definitions	
	16102(Part 1):2012	Self Ballasted LED Lamps for General Lighting Services. Part-1 Safety Requirements.	
	16102(Part 2):2012	Self Ballasted LED Lamps for General lighting Services. Part-2 Performance Requirements.	
	16103(Part I):2012	LED modules for General lighting Safety Requirements.	
	15885(Part 2/Sec. 13) :2012	Lamp control gear Part 2 particular Requirements Section 13 d.c. or a.c.	
	16104:2012	Supplied Electronic control gear for LED modules d.c. or a.c. Supplied Electronic control gear for LED modules - Performance Requirements.	
	16105:2012	Method of Measurement of Lumen maintenance of Solid-state Light (LED) Sources.	
	16106:2012	Method of Electrical and photometric Measurements of Solid State Lighting (LED) Products	
	16107:2012	Luminaires Performance	
	16108:2012	Photo-biological safety of Lamps and Lamp Systems	
	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	Page 2 of 19

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.07.00	IS 513	Cold rolled low carbon steel sheets and strips	
	IS 12063	Classification of degree of protection provided by enclosures.	
	IS 14700	Electro magnetic compatibility (EMC) – Limits (Part 3/Sec. 2) for Harmonic current emission – THD < 15% (equipment, input current < 16 Amps. per phase.	
	IS 9000 (Part 6)	Environment testing: Test Z – AD: composite temperature/humidity cyclic test.	
	IS 15885	Lamp control gear: particular requirements for (Part 2/Sec. 13) DC or AC supplied electronic control gear IS 16004 – 1 and 2) for LED modules.	
	IS 4905	Method for random sampling	
	Electrical Installation Practices & Miscellaneous		
	IS:1944	Code of practice for lighting of public thorough fare	
	IS:3646	Code of practice for interior illumination.	
	IS:5572	Classification of Hazardous areas (other than Mines) having flammable gases and Vapours for electrical installation	
	S:6665	Code of practice for industrial lighting.	
	.	National Electrical Code	
	-	Indian Electricity Rules.	
	IS:5	Indian Electricity Act Colour for ready mixed paints & enamels.	
	IS:280	Mild steel wires for general engineering purposes.	
	IS:374	Electric ceiling type fans & regulators.	
	IS:732	Code of practice for electrical wiring installations.	
	IS:1255	Code of practice for installation and maintenance of power cables Upto and including 33KV rating.	
	IS:2062	Steel for general structural purposes	
	IS:2629	Recommended practice for hot-dip galvanizing of iron and steel.	
IS:2633	Methods for testing uniformity of coating of zinc coated articles.		
	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	Page 3 of 19



CLAUSE NO.	TECHNICAL REQUIREMENTS		
	IS:2713 IS:3043 IS:5216 IS:5571 BS:6121	Tubular steel poles for overhead power lines. Code of practice for earthing Guide for safety procedures and practices in electrical work. Guide for selection of electrical equipments for hazardous areas. Mechanical cable glands	
3.00.00 3.01.00 3.02.01 3.02.02 3.03.00 3.03.01 3.03.02 3.03.03	LIGHTING SYSTEM DESCRIPTION The illumination of various indoor and outdoor areas in the main plant & offsite area shall be provided as described here. The lighting system of various areas shall comprise of the following systems as identified in Annexure-B: (a) Normal AC Lighting System (b) Emergency AC Lighting System (c) DC Lighting System Normal AC Lighting System Normal AC lighting system 415V, 3Phase, 4wire, will be fed from lighting panels (LPs) which in turn will be fed from the lighting distribution boards (LDBs)/Switch board MCC. Emergency AC Lighting System This system shall be provided for certain important areas in the main plant. The lighting fixtures connected to this system shall be normally "ON" along with the normal AC system. These will be fed from emergency lighting panels (ELPs) which in turn will be fed 3-phase, 4-wire supply from the emergency lighting distribution boards (ELDB'S). These lights will go off for a few seconds in case of AC supply failure at Emergency Switchgear, but shall be automatically restored when Emergency Switchgear is energised by Diesel generator set. DC Lighting System At strategic locations in the main plant, a few lighting fixtures fed from 220V, DC supply, shall be provided to enable safe movement of operating personnel and access to important control points during an emergency, when both the normal AC and Emergency Lighting system fail. These lighting fixtures will be fed from 220V DC LDBs which in turn will be fed from DC lighting panels. The supply to the DC lighting panels shall be automatically switched ON in case of loss of AC supply at station service switchgear as well as Emergency switch-gear. The DC supply will be automatically switched OFF after about 3 minutes following the restoration of supply to normal AC or emergency AC lighting system. Emergency DC lighting is to be provided, through self-contained DC emergency fixtures with four hours back-up duration, at strategic locations, in auxiliary/offsite buildings wherever DC supply system is not available. The fixtures shall be switched 'ON' automatically in case of failure of AC supply.		
	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	Page 4 of 19

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
3.03.04	<p>For Coal Handling plant/FGD Plant Area 18W, 220V DC Lighting fixture shall be provided in underground portion of conveyor, each switchgear room, control room, office room, pump house, each drive floor of TPs, staircases of various TPs and buildings and each local control area. DC lighting fixtures shall be fed from 220V DC LDB which in turn will be fed from CHP DC system. The supply to the DC lighting panels shall be automatically switched ON in case of loss of normal AC supply.</p>		
4.00.00	<p>DESIGN PHILOSOPHY</p> <ol style="list-style-type: none"> 1. A comprehensive illumination system shall be provided in the entire project areas under bidder's scope. 2. All outdoor lighting system shall be automatically controlled by synchronous timer. Provision to bypass the timer shall be provided in the panel. 3. The system shall include distribution boards, normal/ emergency lighting panels, lighting fixtures, junction boxes, receptacles, switch boards, lighting pole/masts, conduits, cables and wires, etc. The system shall cover all interior and exterior lighting such as area lighting, including Transformer yard & Switch yard area, aviation obstruction lighting, Street lighting, security lighting, etc. The constructional features of lighting distribution boards shall be similar to AC/DC distribution boards described in chapter of LT Switchgear. Outgoing circuits in LPs shall be provided with MCBs of adequate ratings. 4. The illumination system shall be designed on the basis of best engineering practice and shall ensure uniform, reliable, aesthetically pleasing and glare free illumination. The lighting fixtures shall be designed for minimum glare. The design shall prevent glare/luminous patch seen on VDU/ Large video screens, when viewed from an angle. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection. The diffusers/ louvers used in fixtures shall be made of impact resistant polystyrene sheet and shall have no yellowing property over a prolonged period. The Lux levels to be adopted for various area are indicated at Annexure - A. (placed at the end of this Chapter). 5. Different Lighting Systems envisaged for various plant areas are indicated in Annexure-B: While finalizing the detailed layout of lighting fixtures, the position/location and layout of equipments should be taken into account to have adequate illumination at desired locations. For CCR room Dimmable and Tunable downlighter fittings to be provided. 6. LED Luminaires: LED Luminaires shall be used for the lighting of all the indoor & outdoor areas in bidder's scope. However for DC lighting, hazardous areas & aviation lighting etc. conventional/LED type luminaires shall be used. However, aviation light in Lighting Mast shall be of LED type. In false ceiling area LED luminaires shall be recessed mounting type & in non-false ceiling area the LED luminaires shall be surface mounting type. The individual lamp wattage for LED shall be upto 3 watt. Fractional wattage LEDs are also acceptable. The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall be not less than 100 Lm/W. Suitable heat sink shall be designed & provided in the luminaire. The LED used in the luminaires shall have colour rendering index (CRI) of Min 80. Colour designation of LED shall be "cool day light" (min 5700K) type for indoor areas. However for outdoor areas, the colour temperature of LED shall be min. 4000K, including rough & dust prone areas. The 		
	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	Page 5 of 19



TECHNICAL REQUIREMENTS

LED luminaries shall have a minimum life of 25000 burning hours with 80% of lumen maintenance at the end of the life. LED shall conform to the LM 80 requirements.

The max. junction temperature of LED shall be 85 deg C. Further the lumen maintenance at this temperature shall be min 90%. The THD of LED Luminaires shall be less than 10%. Further the EMC shall be as per IS 14700. The power factor of the luminaire shall not be less than 0.9. The marking on luminaire & safety requirements of luminaire shall be as per IS standards. Suitable heat sink with proper thermal management shall be designed & provided in the luminaire.

The connecting wires used inside the system, shall be low smoke halogen free, fire retardant type and fuse protection shall be provided in input side specifically for LED luminaires.

Care shall be taken in the design that there is no water stagnation anywhere in the housing of luminaire. The entire housing shall be dust and waterproof protection as per IS 12063.

7. Driver Circuit

LED modules and drivers shall be compatible to each other. The LED module driver's ratings and makes shall be as recommended by corresponding LED chip manufacturer.

LED Drivers shall have following control & protections: -

- Suitable precision current control of LED.
- Open Circuit Protection
- Short Circuit Protection
- Over Temperature Protection
- Surge Protection

8. Apart from maintenance factor as given below, Temperature correction factor shall be considered in the lighting design for fixtures located in non air conditioned area.

- (a.) Office area (air conditioned) : 0.8
- (b.) Office area (non air conditioned) : 0.7
and other indoor area
- (c.) Dust prone indoor and outdoor area : 0.6
- (d.) Coal Handling area, Ash Handling : 0.5
Conveyor /Transfer Points etc.
- e.) Boiler Area : 0.6

Reflectance Factor:-

- Ceiling :0.8
- Wall : 0.5
- Floor : 0.2

Reflectance factor for CHP areas such as Bunker floor, TPs etc and AHP outdoor areas :-

- Ceiling :0.3
- Wall :0.3
- Floor :0.1



TECHNICAL REQUIREMENTS

- 9. (i) All outdoor fixtures shall be weather proof and of min. IP65 degree of protection.
- (ii) For Indoor type of fixtures:-
 - (a) Surface/Pendent mounting: - IP 54 class of protection.
 - (b) Recess Mounting (False ceiling):- IP 20 class of protection.
- 10. (a) Lighting panels shall be constructed out of 2 mm thick CRCA sheet steel. The door shall be hinged and the panel shall be gasketed to achieve specified degree of protection. Lighting panels shall be powder coated with color shade RAL9002. Lighting panels shall have min. IP55 degree of protection.
- (B) All MCBs/Isolators/Switches/Contactors etc. shall be mounted inside the panel and a fibre glass sheet shall be provided inside the main door such that the operating knobs of MCBs etc., shall project out of it for safe operation against accidental contact.
- (c) Terminal blocks shall be 1100 V grade, clip-on stud type, made up of polyimide 6.6 or better suitable for terminating multicore 35 or 70 Sq. mm. stranded aluminium conductor incoming cable and 10 Sq. mm. stranded aluminium conductor for each outgoing circuits voltage. All terminals shall be shrouded, numbered and provided with identification strip for the feeders.
- (d) MCB's shall be current limiting type with magnetic and thermal release suitable for manual closing and automatic tripping under fault condition. MCB's shall have short circuit interrupting capacity of 9 KA rms. MCB knob shall be marked with ON/OFF indication. A trip free release shall be provided to ensure tripping on fault even if the knob is held in ON position. MCB terminal shall be shrouded to avoid accidental contact.
- (e) Contactors of AC lighting panels shall be 3 no's,63 A, single pole continuous duty MCB, with neutral link,load make-break type suitable for 415 V, 3 phase 4 wire system.
- (f) DC switches shall be rotary type, 2 pole, continuous duty, load break type, quick make quick break, suitable for 220 V DC, 2 wire system. Switch knob shall be provided with ON/OFF indication.
- (g) Programmable Digital Timer shall be Electronic Astronomical Almanac Time switch with battery backup of min. TEN years, 4 Digit LED display, 24 hours range, manual override facility, 10 Amp 3 relay output, with NO/NC Contacts suitable for operation on 240V single phase AC supply.
- (h) Each lighting panel (LP-3) shall be fed from a 415V/42V, 3 phase-4 wire, 3 KVA transformer. The transformer shall be located inside the lighting panel itself. Transformers shall be dry type, natural air cooled with class F insulation or better. Impedance of transformer shall be 5%. Transformers shall be tested as per IS:11171. Off-circuit tap changer with +/- 5% in steps of +/- 1.25% tapping shall be provided. One minute power frequency withstands voltage for lighting transformer shall be 2.5 KV.
- (i) Lighting Panels shall have 20% spare outgoing feeders and shall be of following types:-



TECHNICAL REQUIREMENTS

TYPE	INCOMER FEEDER	OUTGOING FEEDERS	DETAIL OF CONTENTS
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LP-1	3No. 415V, 63 A, SP MCB (31/2Cx70sq.mm cable)	18Nos.,20A, 240V MCB	415V, 63A(min.), AC2 duty contactor and Programmable Digital Timer of 24 hour range 10A, 240V selector switch, fuse, etc. outdoor type and IP:55 degree of protection
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LP-2	3No. 415V, 63 A, SP MCB (31/2Cx70sq.mm cable)	9 Nos.,20A, 240V MCB	415V, 63A(min.), AC2 duty contactor and Programmable Digital Timer of 24 hour range 10A, 240V selector switch, fuse, etc. outdoor type and IP:55 degree of protection
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LP-3	1 No., 4A fuse 3 KVA transformer,40A TPN MCB	24 Nos., 16A, 45V MCB	IP 55 degree of protection. Incomer shall be suitable for receiving 4Cx16 sq. mm cable and outgoing circuit shall be suitable for 2Cx16 sq. mm cable.
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LP-D1	1No. 220V,32 A, DP Isolator (2Cx35sq.mm cable)	6Nos.,16A, 220V DP Switch & Fuse	220V,32A DC Fuse, etc. outdoor type IP:55 degree of protection.
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11. Wires of different phase shall normally run in separate conduit.

12. Power supply shall be fed from 415 / 240 V normal AC supply, emergency AC supply and 220V DC supply through suitable number of conveniently located lighting distribution boards (LDB) and lighting panels (LP). AC lighting supply shall be isolated from main supply by 2x100% isolation transformers of max. rating of 50 KVA for 10/15 nos. outgoing feeder with changeover switch facility. The isolation transformer shall be fed from two different bus sections of MCC and fault level restricted to 3 KA at Lighting Panels.




TECHNICAL REQUIREMENTS


13. Atleast one 6/16A, 240V AC universal socket outlet with switch shall be provided in offices, cabins, etc. Further 20A, 240V AC industrial receptacle with switch shall be provided strategically in all industrial areas.
 Suitable number of 63A, 3ph, 415V AC industrial receptacles shall be provided for entire plant for welding purposes, particularly near all major equipment and at an average distance of 50m. Atleast one 63A, 3ph, 415V AC receptacle shall be provided in each floor of off-site buildings/ structures.
 Receptacles boxes shall be fabricated out of 2 mm thick MS steel hot dip galvanized or of not less than 2.5 mm thick die-cast aluminium alloy or fabricated out of 2 mm thick CRCA sheet with electro static powder coating. IP-degree of protection shall be applicable to receptacles Type 'RA &'RC' only.
 Minimum no of receptacle in TG and SG area shall be provided as per Annex-I, of chapter B-10.


Receptacles shall be of following types:

Type	Switch rating	Socket & plug rating	Type & make of plug & Socket	Terminal Block size
RA	20 A, SP240V AC(Industrial)	20A, 3 pin240 V AC	NTPC appd. make	1-4 way, suitable for loop-in loop-out of 10 sq.mm. Al. Conductor
RB	16A, S.P240V AC	6A+16A6 Pin decorative Piano-key Type Switch	NTPC appd.make	1-4 way, suitable for loop-in loop-out of upto 10 sq.mm. Al. Conductor
RC	20 A, SP24 V AC(Industrial)	20A, 3 pin24 V AC	NTPC appd. make	1-4 way, suitable for loop-in loop-out of 2 core - 16 sq.mm. Al. Cable.

14. In the hazardous areas like Hydrogen generation plant, fuel oil handling areas or any other gas/ liquid fuel storage/ handling areas in bidder's scope, lighting shall be flame proof.

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<div style="text-align: right;"></div> <p>15. The type of fixtures, LP, JB, and receptacle used in Hydrogen generation plant building shall be suitable for group II C as per IS: 2148 or class I, Division II as per NEC 70-428.</p> <p>16. All fluorescent lamps shall be have "Cool day light" colour designation. The mirror optics type fluorescent fixtures shall have no iridescence effect. Fixtures with better efficiency and upgraded proven system may also be considered In candescent lamps may be used only with DC Lighting.</p> <p>17. Aviation warning lights shall be provided as per the recommendations of ICAO and Director general of civil aviation, India. The arrangement of light should be marked such that the object is indicated from every angle in azimuth. The aviation warning lighting system shall also conform to the latest Indian standard IS 4998.</p> <p>18. Contractor shall demonstrate the average lux level achieved for different areas as per specification requirements, after completion of the lighting work, at site to the satisfaction of engineer-in-charge.</p>		
4.01.00	-NOT USED.		
4.02.00	All luminaires and their accessories and components shall be of type readily replaceable by available Indian makes.		
4.03.00	Fans & Regulator		
4.03.01	Ceiling Fans, to be provided in non air-conditioned office/control room area. Further tentatively one (1) no. ceiling fan shall be provided for 10 sq.m area, at suitable mounting height. The ceiling fans shall be suitable for operation on 240 V +/-10%, 50 Hz, AC supply comprising of class 'E' or better insulated copper wound single phase motor, 1200mm sweep, aerodynamically designed well balanced AL blades (3 Nos.), down rod, BEE 5 star rated,die cast aluminium housing, capacitor, suspension hook, canopies etc. finished in stove enameled white or with electro static powder coating. Power factor of fans shall not be less than 0.9. Fan regulators shall be stepped electronic type suitable for operation on 240V +/-10% AC supply.		
4.04.00	<p>Junction Boxes, Conduits, Fitting & Accessories, Pull Out Boxes:</p> <p>Junction box for indoor lighting shall be made of fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type.</p> <p>Junction boxes for street lighting poles and lighting mast if applicable , shall be deep drawn or fabricated type made of min. 1.6 mm thick CRCA Sheet. The box shall be hot dip galvanized. The degree of protection shall be IP55.</p> <p>All switches and receptacles upto 16A shall be modular type. These shall be provided with pre-galvanized/galvanized modular switchbox & plate.</p> <p>Conduits, Pipes and Accessories Galvanised heavy duty steel conduits for normal area and galvanised heavy duty steel conduits with an additional epoxy coating for corrosive area shall be offered. Alternatively glass reinforced epoxy conduits with comparable compressive and impact strength with that of heavy duty steel conduits may be offered. Conduits in walls and ceilings in buildings with RCC and masonry structure such as Administrative, Service, Canteen, Time Office, Auditorium, IT building etc shall be concealed.Rigid steel conduits shall be heavy duty type,hot dip galvanised conforming to IS : 9537 Part-I & II shall be suitable for heavy mechanical stresses, threaded on both sides</p>		
	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	Page 10 of 19

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<div style="text-align: right; margin-bottom: 10px;">  </div> <p>and threaded length shall be protected by zinc rich paint. Conduits shall be smooth from inside and outside. Flexible conduit shall be water proof and rust proof made of heat resistant steel with temperature rating of 150 deg C. Pull out boxes shall be provided at suitable interval in a conduit run .Boxes shall be suitable for mounting on Walls, Columns, Structures, etc.. Pull-out boxes shall have cover with screw and shall be provided with good quality gasket lining. Pull out boxes used outdoor shall be weather proof type suitable for IP: 55 degree of protection and those used indoor shall be suitable for IP: 52 degree of protection. Pull out box & its cover shall be hot dip galvanized.</p> <p>4.05.00 Lighting Wires</p> <p>4.05.01 Lighting wires shall be 1100 V grade, light duty PVC insulated unsheathed, stranded copper/aluminium wire for fixed wiring installation. Colour of the PVC insulation of wires shall be Red, Yellow, Blue and Black for R, Y, B phases & neutral, respectively and white & grey for DC positive & DC negative circuits, respectively. Minimum size of wire shall not be less than 1.5.sq.mm. for copper and 4 sq.mm. for aluminium.</p> <p>4.06.00 Lighting Poles</p> <p>4.06.01 The Street Light system and peripheral lighting shall be designed generally in line with design guidelines. The Poles shall be mounted above ground using base plate and minimum height of pole shall be 8 mtrs The poles shall be hot-dip galvanized as per IS2629/ IS2633/ IS4759. The average coating thickness of galvanizing shall be min. 70 micron. The System shall be capable of withstanding the appropriate wind load etc as per IS 875 considering prevailing soil/ site condition considering all accessories mounting on pole.</p> <p>The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB.</p>		
<p>4.08.00</p> <p>4.09.00</p>	<p>Lighting fixtures shall generally be group controlled directly from lighting panel. However, in office areas, control shall be provided through switch boxes. Each switch shall control a maximum of three fluorescent fixtures.</p> <p>A.C. normal, AC emergency and DC system wiring shall run throughout in separate conduits. Wires of different phase shall run in different conduits.</p>		
	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	Page 11 of 19

CLAUSE NO.	TECHNICAL REQUIREMENTS	
4.10.00	Lighting panels, etc. shall be earthed by two separate and distinct connections with earthing system. Switch boxes, junction boxes, lighting fixtures, fans, single phase receptacles etc. shall be earthed by means of separate earth continuity conductor. The earth continuity conductor 14 SWG GI wire shall be run alongwith each conduit run. Cable armours shall be connected to earthing system at both the ends.	

5.00.00	TESTS						
5.01.00	<p>For LED Fixture</p> <p>a) The contractor shall carry out the type tests as listed in this specification on the following types of LED fixtures to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant price schedule of bid document and the same shall be considered for the evaluation of the bids.</p> <p>LED fixtures (Type test shall be conducted on one rating each of following type of LED fixtures. Rating for test conduction shall be decided by the employer during detailed engineering)</p> <ul style="list-style-type: none"> a) High bay fixture. b) Well glass fixture. c) Street light fixture d) Surface mounted type fixture. e) Recessed mounted type fixture. <p>The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.</p>						
5.02.00	For all other Station lighting equipment:						
5.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.						
5.04.00	Selection of samples for type test, acceptance test & routine test and acceptance criteria for all the items shall be as per relevant I.S						
5.05.00	Type test reports of the following items as per technical specification requirements/ standards shall be submitted for approval.						
	<table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;">SL NO.</th> <th style="text-align: left;">DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td>i.</td> <td>Lighting fixtures of each type</td> </tr> <tr> <td>ii.</td> <td>Lighting panel of each type (Degree of Protection)</td> </tr> </tbody> </table>	SL NO.	DESCRIPTION	i.	Lighting fixtures of each type	ii.	Lighting panel of each type (Degree of Protection)
SL NO.	DESCRIPTION						
i.	Lighting fixtures of each type						
ii.	Lighting panel of each type (Degree of Protection)						



TECHNICAL REQUIREMENTS

iii. Junction Box of each type.
 Type test reports for LED as per standards for following shall be submitted for approval.

1. Visual and Dimension check
2. Proof of procurement of LEDs
3. Safety tests
a) Marking
b) Construction
c) Provision for Earthing
d) External and Internal wiring
e) Protection against electrical shock
f) Endurance and Thermal
g) Insulation resistance & electrical strength
h) Resistance to heat fire & tracking
i) Resistance to Humidity
4. Fire Retardant test
5. Performance tests (electrical, Photometric color and Life)
6. Burn-in Test
7. Power Cycling
8. Temperature rise test
9. Emission Tests
a) Radiated & conducted emission
b) Harmonics & flickers
10. Immunity tests

In addition, following test reports to be submitted for LED chip/LED luminaire:
 a) LED parameters like Lumen per watt, CRI, Beam angle from manufacturer.
 b) LM 80/IS: 16105 report.
 c) LM 79/IS: 16106 report.

5.06.00

Acceptance Test and Routine Test



TECHNICAL REQUIREMENTS

5.06.01 All lighting fixtures, lamps and other items shall be subjected to acceptance and routine test, as per relevant specified standards.

5.06.02 Junction boxes, switch boxes, receptacle enclosure etc. shall be subjected to physical and dimensional checks also. Switch boxes shall be made of 1.6 mm thick MS sheet with 3 mm thick decorative, Perspex cover. Switch box shall be hot dip galvanized.

Switch boxes shall be of following types :

TYPE No.	Switch	Fan Regulator*	Socket
SWB 1	5 A - 2 Nos.	-	-
SWB 2	5 A - 3 Nos.	-	5A - 1.No.
SWB 3*	5 A - 5 Nos.	1	5A - 1.No
SWB 4*	5 A - 7 Nos	3	5A - 1.No.
SWB 5**	5 A - 5 Nos	-	5A - 1.No.

* Space provision shall be kept for fan regulator in switch boxes.

** Shall have the provision for mounting the 16 A contactor.

5.07.00 **Galvanizing Tests**


5.07.01 The quality of galvanizing shall be smooth, continuous, free from flux stains and shall be inspected visually.

5.07.02 In addition following tests shall be conducted as acceptance tests.

- (a) Uniformity of coating - The coating of any article shall withstand for one (1) minute dips in standard copper sulphate solution without the formation of an adherent red spot of metallic copper upon the basic metal.
- (b) The quality of cadmium/zinc plating on items with screw threads shall be free from visible defects such as unplated areas, blisters and modules and shall be inspected visually.
- (c) In addition, the plating thickness shall be determined microscopically/ chemically or electronically.


6.00.00 **COMMISSIONING CHECKS**

1. On completion of installation work, the Contractor shall request the Project manager for inspection and test with minimum of fourteen (14) days advance notice.

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<div style="text-align: right; margin-bottom: 10px;">  </div> <p>2. The Project manager shall arrange for joint inspection of the installation for completeness and correctness of the work. Any defect pointed out during such inspection shall be promptly rectified by the Contractor.</p> <p>3. The installation shall be then tested and commissioned in presence of the Project manager.</p> <p>4. The contractor shall provide all, men material and equipment required to carry out the tests.</p> <p>5. All rectifications repair or adjustment work found necessary during inspection, testing and commissioning shall be carried out by the Contractor without any extra cost. The handing over the lighting installation shall be effected only after the receipt of written instruction from the Employer/his authorized representative.</p> <p>6. The testing shall be done in accordance with the applicable Indian Standards and codes of practices. The following tests shall be specifically carried out for all lighting installation.</p> <ul style="list-style-type: none"> (a) Insulation Resistance. (b) Testing of earth continuity path. (c) Polarity test of single phase switches. (d) Functional checks. <p>7. The lighting circuits shall be tested in the following manner:</p> <ul style="list-style-type: none"> (a) All switches ON and consuming devices in circuit, both poles connected together to obtain resistance to earth. (b) Insulation resistance between poles with lamps and other consuming devices removed and switches ON. 		
	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	Page 15 of 19

SUB-SECTION-B – 06

L.T. SWITCHGEAR

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
1.00.00	CODES AND STANDARDS		
	IS: 5	Colours for ready-mixed paints and enamels.	
	IS: 694	PVC insulated cables for working voltages up to and including 1100V.	
	IS: 722	A.C. Electricity Meters	
	IS: 1248	Electrical Indicating instruments	
	IS/IEC: 60947-1	Degree of protection provided by enclosures for low voltage Switchgear and Control gear	
	IS/IEC: 60947-2	A.C. circuit Breakers, MCCB, MCB, MPCB	
	IS: 2551	Danger Notice Plates	
	IS: 2629	Hot dip galvanising	
	IS: 2705	Current Transformers	
	IS/IEC: 60947-4-1	Contactors and motors starter for voltages not exceeding 1000 V AC or 1200 V DC	
	IS: 3043	Code of practice for earthing.	
	IS: 3072	Code of practice for installation and maintenance of Switchgear	
	IS: 3156	Voltage Transformers	
	IS: 3202	Code of practice for climate proofing of electrical equipment.	
	IS: 3231	Electrical relays for power system protection.	
	IS/IEC 60947	Air-Break Switches, air break disconnectors, air break disconnector and fuse combination units for voltages not exceeding 1000V AC or 1200 V DC.	
	IS/IEC 60947-1	General Requirements for Switchgear and Control gear for voltages not exceeding 1000 V.	
	IS: 5082	Wrought Aluminium and Aluminium alloys for electrical purposes.	
	IS: 6005	Code of practice of phosphating of iron and steel.	
	IS/IEC 60947-5-1	LV switchgear and Control gear Control current devices and switching element.	
IS: 8623 / IEC: 61439-1/2	Low Voltage Switchgear & Control gear assemblies		
IS: 8686	Static Relays		
	TECHNICAL SPECIFICATION SECTION –VI, PART-B	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCTS	PAGE 1 OF 18



IS: 13703 / IEC: 60269	HRC Cartridge fuses
IS: 10118 (4 parts)	Code of practice for selection, installation and maintenance of switchgear and control gear.
IS: 11171	Specification for dry type transformers.
IEC: 60255	Electrical Relays
IEC: 61850	Communication networks and systems in substations
IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals
IS: 12021	Specification of control transformers for switchgear and Control gear for voltage not exceeding 1000V AC.
IEC: 60947-7-1	Terminal blocks for Copper conductors
IS :513 (2008)	Cold Rolled Low Carbon Steel Sheets and Strips

2.00.00

TECHNICAL PARAMETERS

2.01.00

Power Supply

2.01.01

AC SYSTEM

1)	Voltage	415 V ± 10%,3 Phase, 4 wire, solidly earthed
2)	Frequency	50 Hz +/- 5%
3)	Combined variation (in volts & frequency)	10% absolute sum
4)	Fault Level	50 kA(RMS)

2.01.02

DC SYSTEM

1)	System Voltage	220 V DC 2-Wire, Unearthed
2)	Fault Level	20 kA

2.01.03

CONTROL SUPPLY VOLTAGE

1)	(i) Closing coil of circuit breaker	220 V DC
2)	Spring charging motor	220 V DC



2.02.00

3)	MCC control supply	110 V AC Neutral solidly earthed
4)	Space heater & lighting	240 V AC Neutral solidly earthed

CUBICLE DATA

2.03.00

Busbar Rating

1)	Continuous Current rating	As per requirement /Sizing Calculation
2)	Short time rating where	
	a) CB is used as incomer	50 kA(RMS) for one sec (Ph-Ph & Ph-N)
	b)MCCB is used as incomer	Prospective current of 50 kA(RMS) for the MCCB clearing time , (Ph-Ph & Ph-N)
3)	Dynamic Rating where	
	a) CB is used as incomer	105 kA(PEAK) , (Ph-Ph & Ph-N)
	b)MCCB is used as incomer	Prospective current of 105 kA (PEAK) as limited by MCCB (Ph-Ph & Ph-N)
4)	Busbar insulation	
	a) For switchgear /MCC/ACDB/DCDB /MCCB Box	PVC Sleeve insulated(UL224) CE/UL certified
5)	Horizontal Busbar & Jumper Connection	High Conductivity Aluminium Alloy/Copper
6)	Vertical Busbar	Copper Only
7)	Hardware for busbars(Bolts/Nuts/Spring Washer)	High Tensile steels

2.04.00

Enclosure Details

1)	Material	CRCA 2mm: Load bearing Structure and Frame 1.6mm: Doors, covers etc 3mm for Gland Plates (CRCA/HR) 4mm for Gland plates (Non-Magnetic) –Single Core Cable Entry
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2)	Type	Metal enclosed, indoor, floor-mounted, Free Standing Type
3)	Degree of Protection	IP:52 (below 1600 Amp.) (IP:42 for Busbar chamber, 1600 Amp & above, Gasketing arrangement shall be as per type tested design for IP 5X) As per IS/IEC:60947 IP65: Paddle Feeder and Travelling Tripper MCC IP55: Outdoor Panels enclosed in Stainless Steel Mounted on 500 mm Pedestal
4	Design	Complete Closed Door Design
5	Internal Arc Classification	50KA, 0.5 sec
6	Cable Alley Compartment	Form-4B as per IEC-61439
7	Gasket	Steel Reinforced EPDM /PU Foam/Neoprene gaskets
8)	Height	2450mm max
9)	Clearances	25 mm: (Ph-Ph)/(Ph-earth) Insulation Sleeves/Barriers shall be provided for clearance less than 25 mm Incomer Rear Door and Busbar-400mm



2.06.00

METERS

1)	Accuracy Class	2.0
2)	One min. power frequency withstand test voltage	2.0 kV (RMS)

2.07.00

Current Transformers

1)	Type	Cast Resin Bar Primary / Nylon Casing
2)	Voltage class and frequency	650 V, 50 HZ
3)	Class of insulation	E or better
4)	Rated Secondary Current	1 A
5)	Accuracy class & burden	
	a) For protection	5P20, 5VA PS Class for REF
	b) For metering	class 1.0, 5VA (min) class 0.2s, 5VA (min) for feeders indicated in SLD, if any
6)	Instrument Security Factor (ISF) for metering CT	5
7)	Short time withstand	
	a) For CT Associated with circuit breaker	50 kA (RMS) for 1 sec
	b) For CT Associated with MCCB protected feeders	Prospective current of 50 kA (RMS) for the MCCB clearing time
8)	Dynamic withstand	
	a) For CTs Associated with circuit breaker	105 kA (PEAK)
	b) For CT Associated with MCCB protected feeders	Prospective current of 105 kA (PEAK) as Limited by MCCB



2.10.00

VOLTAGE TRANSFORMERS

1)	Type	Cast Resin
2)	Voltage Ratio	415 / 110 V for line PT 415/ $\sqrt{3}$ / 110/ $\sqrt{3}$ V for Bus PT
3)	Method of Construction	V-V
4)	Accuracy Class	0.5 0.2 for feeders indicated in SLD ,if any
5)	Rated Voltage factor	1.1continuous, 1.5 for 30 sec.
6)	Class of insulation	E or better
7)	One minute power frequency withstand voltage	2.5 KV

2.11.00

HRC FUSES

1)	Voltage Class	650 Volts
2)	Rupturing capacity	80 kA (rms) for AC ckt., 20 kA for DC ckt.

2.12.00

CONTACTORS



2.13.00	1)	Type	Air break electro magnetic
	2)	Utilising Category	AC3 of IS/IEC 60947 for non reversible AC4 of IS/IEC 60947 for reversible drives DC3 for DC contactor
	3)	Operating Coil Voltage	(i)110V AC(-15%+10%) Drop out voltage-less than 70% Guaranteed Drop out at 20% of rated voltage (ii)220V DC((-15%+10%)
2.14.00	Relays		
	1)	Power frequency withstand voltage	2.5 kV for 1 sec. or 2.0 kV for 1 min.
2.15.00	CONTROL TRANSFORMERS		
	1)	Type	Dry / Cast Resin
	2)	Voltage Ratio	415 / 110 V with taps \pm 5% in steps of 2.5%
	3)	Class of insulation	Class-B or better
	4)	One minute power frequency withstand voltage	2.5 kV
	5)	Rating	1.5 X Adequate for application.
	LIGHTING TRANSFORMER / WELDING TRANSFORMER		
	1)	Type & Rating	Dry type / 100 KVA(Welding TRF), 50KVA(Minimum)(Lighting TRF)
	2)	Voltage Ratio	415/415V, +/- 5% taps in steps of 2.5%
	3)	Class of insulation	B or better
	4)	One minute power frequency withstand voltage	2.5 KV



2.16.00

5)	Enclosure protection	IP-42
6)	Type Test	As per IS 2026
7)	Fault level	3-5 KA secondary side

TRANSDUCERS

1)	Current transducers	
a)	Input	0-1 A (CT secondary)
b)	Rated frequency	50 Hz
c)	Output	4-20 mA (2 Nos. decoupled)
d)	Over current	Transducer for motor current ammeters shall be capable of withstanding min. 6 times CT sec. current of 1A for a min period of 30 seconds
e)	Accuracy	1.0
2)	Voltage Transducers	
a)	Input	500 V, 50 Hz (for AC) / 250 V / 125 V DC (for DC)
b)	Output	4-20 mA (2 Nos. decoupled)
c)	Accuracy	1.0

2.17.00

MCCB & MPCB

1)	Type	Thermal Magnetic based(in built front adjustable releases)
2)	Rated insulation level	690V
3)	Rated ultimate & Service S.C. breaking capacity	50 kA
4)	Rated making capacity	105 kA
5)	Utilization category	A

2.18.00

NOT USED

2.19.00

MCB

1)	Rated voltage	415V/240V/110V AC 240V DC
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2.20.00

2)	Current breaking Capacity	10 KA
3)	Characteristic Curve	C or above

AC & DC MCCB Box

1)	Construction	(i)Metal Enclosed Fixed Type CRCA:2mm structure :1.6mm enclosure Or (ii)Poly Carbonate (a) Halogen Free, flame Retardant (UL-94,V0) (b) Thickness:4mm (iii) UL224 sleeved Busbars
2)	Degree of Protection	Indoor: IP52 Outdoor: IP54
3)	Characteristic Curve	C or above

2.21.00

Earth Bus and Earthing

Material	GS/Cu/Al of Sufficient cross section Separate Copper Earth bus for Electronic Earthing of IMCs
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2.22.00

Internal Wiring and Control Terminal Blocks

Control Terminal Blocks		
1)	Rating	650V grade, 10 A ,6.6 polyamide UL 94 Separate Copper Earth bus for Electronic Earthing of IMCs
2)	Type	Screw less, push in technology (IEC 60947-7-1 and UL certified)
3)	Spare	20%
Internal Wiring		
1)	Rating	650 V grade, FRLS, single core 2.5 sq. mm cu for CT connection 1.5 sq. mm cu for others

2.23.00

LOCAL/EMERGENCY PUSH BOTTON



1)	Construction	CRCA/Die Cast Al:1.6mm enclosure Or (ii) Poly Carbonate (a) Halogen Free, flame Retardant (UL-94, V0) (b) Thickness:4mm (iii) UL224 sleeved Busbars
2)	Degree of Protection	IP55 IP65(Dusty Area)
3)	Characteristic Curve	C or above
4)	Contacts	Latched Type EPB 2NO+2NC

3.00.00

CONSTRUCTIONAL DETAILS OF SWITCHBOARDS

3.01.00

All switchboards shall be divided into distinct vertical sections (panels), each comprising of the following compartments:

(a.) BUSBAR COMPARTMENT

A completely enclosed bus bar compartment shall be provided for the horizontal and vertical bus bars. Bolted covers shall be provided for access to horizontal and vertical busbars and all joints for repair and maintenance, which shall be feasible without disturbing any feeder compartment. Auxiliary and power bus bars shall be in separate compartments.

(b.) SWITCHGEAR / FEEDER COMPARTMENT

All equipment associated with an incomer or outgoing feeder shall be housed in a separate compartment of the vertical section.



Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables

STANDARD QUALITY PLAN
(CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)

QP NO. 0000-999-QOE-S-041
REV-00 DATE: 03-02-12
Page 1 of 11
VALID UP TO: 02-02-15

REVIEWED BY
INDERJIT SINGH
VIKRAM TALWAR
RAJEEV GARG

APPROVED BY
Dt.
A.K. GARG

Sl. No	Component & Operations	Characteristics	Class	Type of check		Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency			Remarks
				M	C/N	M	C				N			
1	2	3	4	5	6	7	8	9	10	11				

Instructions: 1) Cable manufacturer to maintain records to show co-relation of raw materials to finished cables i.e raw material batch/ lot no. should be traceable to the cable drum.
2) Cable manufacturer to maintain all quality control records identified as per all QP stages enumerated below whether it is identified for NTPC verification or witness or not.

A Raw material/ Brought out Items														
1.01	Aluminum	1. Make	MA	Verify	100%	--	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	MANUFACTURE R APPROVED SOURCES	QCR	V	--	--	
		2. Resistivity	MA	Elect	As per Cable Mnfr Std.	--	ISS082	ISS082	ISS082	-do-	P	--	--	
1.02	PVC / XLPE/compound for insulation	1. Make	MA	Verify	100%	100%	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	MANUFACTURE R APPROVED SOURCES	-do-	V	V	--	
		2. Type/ Grade	MA	Verify	100%	100%	NTPC ADS	NTPC ADS	NTPC ADS	-do-	V	V	V	
		3. All acceptance test as per manufacturer norms including thermal stability test for PVC insulation	MA	Verify	As per manufacturer norms	As per manufacturer norms	NTPC ADS	NTPC ADS	NTPC ADS	-do-	V	V	V	Refer note 1
1.03	PVC Compound for Inner sheath	1. Make	MA	Verify	--do--	--do--	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	MANUFACTURE R APPROVED SOURCES	-do-	V	V	V	
		2. Type/ Grade	MA	Verify	--do--	--do--	NTPC ADS	NTPC ADS	NTPC ADS	-do-	V	V	V	
1.04	Steel wire / Formed Wire (As applicable)	1. Make	MA	Verify	--do--	--do--	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	MANUFACTURE R APPROVED SOURCES	-do-	V	V	V	
		2. Dimension	MA	Meas	1 sample from each size / lot	--	NTPC APPROVED DATA SHEET & IS 3975	NTPC APPROVED DATA SHEET & IS 3975	APPROVED DATA SHEET & IS 3975	-do-	P	--	--	
		3. All acceptance tests as per IS 3975	MA	Verify	As per IS 3975	--	IS 3975	IS 3975	IS 3975	Supplier TC	V	V	--	
1.05	PVC compound for Sheath	1. Make	MA	Verify	100%	100%	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	MANUFACTURE R APPROVED SOURCES	QCR	V	V	--	
		2. Type / Grade	MA	Verify	100%	100%	NTPC ADS	NTPC ADS	NTPC ADS	QCR	V	V	V	
		3. All acceptance test as per manufacturer norms	MA	Verify	As per manufacturer norms	As per manufacturer norms	NTPC ADS	NTPC ADS	NTPC ADS	QCR	V	V	V	Refer note 1



Sl. No	Component & Operations	Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency			Remarks
						M	C/N				D*	M	C	
1	2		3	4	5	6	7	8	9	10				11
			4. Thermal Stability	MA	Chem	One sample / Batch	NTPC ADS	NTPC ADS	QCR	P				
			5. Oxygen Index	MA	Chem	--do--	NTPC ADS/IS 10810 Part 58	NTPC ADS/IS 10810 Part 58	--do--	P				
			6. Acid Gas Emission	MA	Chem	One sample / Batch	NTPC ADS / IEC60754	NTPC ADS / IEC60754	QCR	P				
1.06	Wooden Drum		1. Dimension	MI	Meas	Manuf. Std.	IS 10418	IS10418	--do--	P				
			2. Anti termite treatment	MI	Chem	Cable manuf. std	CABLE MANUF. STD.	CABLE MANUF. STD.	COC	V	V	V	V	COC from drum manuf.
1.07	Steel Drum		1. Dimension	MI	Meas	--do--	--do--	--do--	QCR	P				
			2. Surface finish	MI	Meas	--do--	--do--	--do--	--do--	P				
B	Process & Stage Inspection													
2.01	Wire Drawing		1. Surface finish	MA	Visual	One sample/Settin g of each size	SHOULD BE SMOOTH & FREE FROM SCRATCHES	SHOULD BE SMOOTH & FREE FROM SCRATCHES	QUR	P				
			2. Wire Diameter	MA	Meas	--do--	NTPC ADS	NTPC ADS	--do--	P				
			3. Tensile test	CR	Mech	--do--	--do--	--do--	--do--	P				Refer Sl. No.3.03(iii)
			4. Wrapping test	CR	Mech	--do--	--do--	--do--	--do--	P				
2.02	Bunchling / stranding		1. No. of wires	MA	Meas	--do--	NTPC ADS	NTPC ADS	--do--	P				
			2. Dia of wire	MA	Meas	--do--	--do--	--do--	--do--	P				
			3. Dimension of Conductor	MA	Meas	--do--	--do--	--do--	--do--	P				
			4. Direction of lay	MA	Visual	--do--	--do--	--do--	--do--	P				
			5. Records of strand breakage / welding during conductor stranding	MA	Verify	--do--	IS 8130	IS8130	--do--	P				
			6. Surface finish	MA	Visual	--do--	--do--	--do--	--do--	P				
			7. DC Resistance	CR	Meas	--do--	IS8130/NTPC ADS	IS8130/NTPC ADS	--do--	P				
2.03	Insulation extrusion		1. Surface finish	MA	Visual	One sample/Settin g of each size	NTPC spec	SHOULD BE SMOOTH. NO POROSITY IS PERMITTED.	QCR	P				XLPE/PVC compound shall be preferably loaded in to extruder by suction method.

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 -M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"
 FORMAT NO:QS-01-QAI-P-10/F3-R1



APPROVED BY
 31/03/2012
 A.P. Garg
 D.

REVIEWED BY
 INDERJIT SINGH Ghiloni
 VIKRAM TALWAR Waly
 RAJEEV GARG

QP. NO. 0000-999-QOE-S-041
 REV-00 DATE: 03-02-12
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 VALID UP TO: 02-02-15

STANDARD QUALITY PLAN
 (CONFORMING TO CODE: IS 1554 PART 1, IS 7098
 Part-1 AND NTPC TECHNICAL SPECIFICATION)

Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables

Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency			Remarks
					M	C/N				D*	M	C	
1	2	3	4	5	6	7	8	9	10	11			
		2.Colour of cores	MA	Visual	One sample/Settin g of each size	NTPC ADS	NTPC ADS	QCR	P	--			
		3.Thickness	CR	Meas	--do--	NTPC ADS	NTPC ADS	--do--	P	--			
		4.Spark Test	CR	Elect	100%	CABLE MANUF. STD.	No FAILURE	--do--	P	V	V		1.Spark test failure record is to be verified. 2.Core repairing not permitted
		5. Hot Set	CR	Mech	One sample/Settin g of each size	IS 7098- Part 1	IS 7098- Part 1	--do--	P	--	--		Sample is to be taken from both top & bottom end
2.04	Laying up	1. Core sequence	MA	Visual	--do--	IS 1554 (Part 1) & IS 7098- Part 1	IS 1554 (Part 1) & IS 7098- Part 1	--do--	P	--	--		
		2. Direction of lay	MA	Visual	--do--	--do--	--do--	--do--	P	--	--		
		3. Dia over laid up core	MA	Meas	--do--	NTPC ADS	NTPC ADS	--do--	P	--	--		
2.05	Inner Sheath	1.Colour	MA	Visual	--do--	--do--	--do--	--do--	P	--	--		
		2. Surface Finish	MA	Visual	100%	NTPC SPECIFICATION	FISH EYE, BLOW HOLE NOT PERMITTED	--do--	P	--	--		
		3.Thickness	MA	Meas	One sample/Settin g of each size	NTPC ADS	NTPC ADS	--do--	P	--	--		
		4.Dia over inner sheath	MI	Meas	--do--	--do--	--do--	--do--	P	--	--		
2.06	Armouring (As Applicable)	1.Dimension	MA	Meas	--do--	--do--	--do--	--do--	P	--	--		
		2.No. of wires / strip	MA	Meas.	--do--	--do--	--do--	--do--	P	--	--		
		3. Direction of lay	MA	Visual	--do--	IS 1554 (Part 1) & IS 7098- Part 1	IS 1554 (Part 1) & IS 7098- Part 1	QCR	P	--	--		

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY ENCLOSED BY SUPPLIER IN QA DOCUMENTATION.

FORMAT NO:-QS-01-QA1-P-10/F3-RI



Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables

STANDARD QUALITY PLAN
(CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-1 AND NTPC TECHNICAL SPECIFICATION)

QP. NO. 0000-999- QOE- S-041
REV-00 DATE: 03-02-12
Page 4 of 11
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REVIEWED BY
INDERJIT SINGH
VIKRAM TALWAR
RAJEEV GARG

APPROVED BY
* D. K. Garg

Sl No	Component & Operations	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Remarks					
				M	C/N				D*	M	C	N		
1	4.Coverage & Quality of armouring	MA	Meas.	100%	--	7	8	9	10	11				
	5 Dia over armouring	MA	Meas.	One sample/Section of each size	--	NTPC ADS		--do--						
2.07	Outer Sheath	MA	Visual	100%	--			QCR						
	1. Surface finish	MA	Visual	100%	--			--do--						
	2.Colour of sheath	MA	Visual	One sample/Section of each size	--	NTPC ADS		--do--						
	3. Dia over outer sheath	MA	Meas	--do--	--	NTPC ADS		--do--						
	4.Thickness of outer sheath	CR	Meas	--do--	.	--do--		--do--						
	5. Embossing quality	MA	Visual	100%	-			--do--						
	6. Sequential marking	MA	Visual	Full length	--			--do--						
C	Finished Cables	CR	Doc.	100%	100%	NTPC SPECIFICATION / NTPC ADS / IS 1554 (Part) & IS 7098- Part1		--do--						
3.01	Type test reports clearance from NTPC Engineering													



Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables

STANDARD QUALITY PLAN
(CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-1 AND NTPC TECHNICAL SPECIFICATION)

QP. NO. 0000-999-QOE-S-041
REV-00 DATE: 03-02-12
Page 5 of 11
VALID UP TO: 02-02-15
Reference Document

REVIEWED BY
INDERJIT SINGH
VIKRAM TALWAR
RAJEEV GARG

APPROVED BY
Approved
NTPC

Sl. No	Component & Operations	Characteristics	Class	Type of check		Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency			Remarks
				M	C/N	M	C				N			
1	3.02	1. High Voltage test at room temperature 2. Conductor Resistance	4 CR	5 Elect	6 100%	7 100%	8 100%	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	9 Test certificate	10 P	11 W	12 W	13 W	14 Refer note 2
3.03	Construction of finished Cable	1. OD of Cable 2. Laying of core 3. Core identification 4. Colour of outer sheath 5. Inner sheath thickness 6. Inner sheath colour	MA CR CR MA CR MA	Meas. Visual Visual Visual Meas Visual	Each type & size of cables as per sampling plan of IS 1554 (Part I) & IS 7098- Part I --do-- --do-- --do-- - do - - do -	NTPC ADS NTPC ADS / IS 1554 (Part I) & IS 7098- Part I --do-- NTPC ADS --do-- - do -	NTPC ADS NTPC ADS / IS 1554 (Part I) & IS 7098- Part I --do-- NTPC ADS --do-- - do -	NTPC ADS NTPC ADS / IS 1554 (Part I) & IS 7098- Part I --do-- NTPC ADS --do-- - do -	--do-- --do-- --do-- --do-- --do-- --do--	10 P P P P P	11 W W W W W	12 W W W W W	13 W W W W W	14 Refer note 2 Refer note 2
3.03	Armour wires/ Formed wires (if applicable)	1. Dimensions 2. No. of wires/ formed wire 3. Tensile test 4. Elongation test 5. Torsion test (for round wires only) 6. Wrapping test 7. Resistance test	CR CR CR CR CR CR CR	Meas Mech Mech Mech Mech Mech Mech	--do-- -- do -- --do-- --do-- --do-- --do-- --do--	NTPC ADS / IS 1554(Part I)/IS3975 --do-- --do-- --do-- --do-- --do-- --do--	NTPC ADS / IS 1554(Part I) /IS3975 --do-- --do-- --do-- --do-- --do-- --do--	NTPC ADS / IS 1554(Part I) /IS3975 --do-- --do-- --do-- --do-- --do-- --do--	--do-- --do-- --do-- --do-- --do-- --do-- --do--	10 P P P P P P	11 W W W W W W	12 W W W W W W	13 W W W W W W	14 Refer note 2

Sl. No.	Component & Operations	Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables	STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)			Reference Document	Acceptance Norms	Record Format	APPROVED BY				Remarks
			Class	Type of check	Quantum of check				D*	M	C	N	
1	2	Characteristics	4	5	M	6	7	8	9	10	11		
		8. Mass of Zinc coating	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098-Part I	NTPC ADS /IS1554(Part1)/IS3975	NTPC ADS /IS1554(Part1) /IS3975	Test certificate	✓	P	W	W	
		9. Uniformity of Zinc Coating	CR	Chem.	--do--	--do--	--do--	--do--	✓	P	W	W	
		10. Adhesion test	CR	Mech	--do--	--do--	--do--	--do--	✓	P	W	W	
		11. Freedom from defects	CR	Visual	--do--	--do--	--do--	--do--	✓	P	W	W	
3.03 (iii)	Conductor	1. Resistance Test	CR	Elect	--do--	--do--	--do--	--do--	✓	P	W	W	
		2. Tensile test (For aluminum conductor only)	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part 1)/7098(Part-1)	NTPC ADS/ IS 8130	NTPC ADS/ IS 8130	--do--	✓	P	W	W	Test report of manufacturer to be reviewed as per SI. No. 2.01 for Tensile test & wrapping test (for Aluminum) in case this test is not applicable for cable under inspection as per IS 8130 cl. 6.2
		3. Wrapping test (For aluminum conductor only)	CR	Mech	--do--	--do--	--do--	--do--	✓	P	P	W	--do--

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Page 6 of 11
VALID UP TO: 02-02-15

REVIEWED BY
INDERJIT SINGH
VIKRAM TALWAR
RAJEEV GARG

APPROVED BY
DEPARTMENT
NTPC



Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency			Remarks	
					M	C/N				D*	M	C		N
1			4	5	6		7	8	9	10		11		
3.03 (IV)	PVC/XLPE/Insulation & PVC Sheath	1. Thickness of insulation & PVC Sheath	CR	Meas	Each type & size of cables as per sampling plan of IS 1554 (Part 1)/IS7098(Part-1)		NTPC ADS/IS 1554(Part1) & IS 7098 Part 1	NTPC ADS/IS 1554(Part) & IS 7098 Part 1	Test Certificate	✓	P	W	W	
		2. Tensile strength & elongation at break of insulation & outer sheath (before ageing)	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part 1)/IS7098(Part-1)		NTPC ADS/IS 1554(Part1) & IS 7098 Part 1	NTPC ADS/IS 1554(Part1) & IS 7098 Part 1	Test Certificate	✓	P	W	W	Refer Note 3 Also
		3. Tensile strength & elongation at break of insulation & outer sheath (after Ageing)	CR	Mech	Refer Note 3		--do--	--do--	--do--	✓	P	W	W	Refer Note 3 (a))
		4. Insulation resistance (Volume resistivity method)	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098 Part 1		--do--	--do--	--do--	✓	P	W	W	
		5. High voltage test at room temperature	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098 Part 1		--do--	--do--	--do--	✓	P	W	W	
		6. Hot Set test (for XLPE insulation only)	CR	Phy	--do--		--do--	--do--	--do--	✓	P	W	W	
		7. Thermal stability on PVC insulation and outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		--do--	--do--	--do--	✓	P	W	W	

Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables

STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-1 AND NTPC TECHNICAL SPECIFICATION)

Q.P. NO. 0000-999- QOE- S-041 REV-00 DATE: 03-02-12 Page 7 of 11

REVIEWED BY: INDERJIT SINGH, VIKRAM TALWAR, RAJEEV GARG

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. -M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS, V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W" FORMAT NO:QS-01-QAL-P-10/F3-R1



Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables

STANDARD QUALITY PLAN
(CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-1 AND NTPC TECHNICAL SPECIFICATION)

QP. NO. 0000-999- QOE- S-041
REV-00 DATE: 03-02-12
Page 8 of 11
VALID UP TO: 02-02-15

REVIEWED BY
INDERJIT SINGH
VIKRAM TALWAR
RAMEESH

APPROVED BY
S. J. K. GATE
Approved
DE...
NTPC

Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6	7	8	9	10	11				
		8.Oxygen index Test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes	NTPC ADS / IS10810 Part 58	NTPC A.D.S	--do--	P	W	W			
		9.Smoke density rating test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes	NTPC ADS & ASTM D2843	NTPC ADS	--do--	P	W	W			
		10.Acid gas generation test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes	NTPC ADS & IEC 60754-1	NTPC ADS	Test Certificate	P	W	W			
		11.Flammability test on completed cable	CR	Chem	Refer Note 4	NTPC ADS & IEC 60332 Part-3 (Category-B)	NTPC ADS	--do--	P	W	W			
		12.Surface finish & length measurement.	CR	Visual & Meas	Refer Note 4 One length of each size	(1) Drum no. (2) IS1554-1 / IS7098-1, Cable size, Voltage grade & Words "FRLS" at every 5 meter is to be embossed. Embossing shall be automatic, in line & marking shall be legible & indelible. (3) Sequential marking of length of cable in meter at every one meter is to be embossed / printed. Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible	NTPC ADS	--do--	P	W	W			Pimple, Fish Eye, Burnt particles, Blow Hole etc. not permitted. Repairing on outer sheath not permitted.
		13. Sequence of cores armour coverage, gap between two consecutive armour/formed wire	CR	Visual & Meas	One length of each size	Min. area of coverage of armouring shall be 90%. The gap between armour wires / formed wires shall not exceed one armour wire/ formed wire space & there shall be no cross over/ over riding of armour wire / formed wire. Zn rich paint shall be applied on armour joint surface of G.S. Wire /formed wire	NTPC ADS	--do--	P	W	W			
4	Packing	1. Sealing	MA	Visual	100%	(1) IS1554(Part-1) & IS 7098-Part 1 (2) The surface of the drum and the outer most cable layer shall be covered with water proof cover. (3) Both the ends of cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by "U" nails.	NTPC ADS	QCR	P	--	--			
4.01	Identification	NTPC Sealing	MA	Visual	100%	Sealing shall be visible	NTPC ADS	QCR	P	V	V			



	Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables	STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-1 AND NTPC TECHNICAL SPECIFICATION)	QP. NO. 0000-999- QOE- S-041 REV-00 DATE: 03-02-12 Page 9 of 11 VALID UP TO: 02-02-15 Reference Document	REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG	ACCEPTANCE Norms	Record Format	Remarks
	Component & Operations 2	Characteristics 3	Class 4	Type of check 5	Quantity of check M C/N 6	8	9

Notes:

- 1) If the compound manufacturer is carrying out Ageing test , test report of compound manufacturer is to be reviewed. If the compound manufacturer is not carrying out ageing test, then cable manufacturer is to carry out ageing test & test report is to be reviewed (quantum of ageing test sample shall be one sample /batch)
- 2) (a) **In case of manufacturers / supplier who have supplied cables in the past through Corporate Centre/ Regional Offices :-** Routine Test of manufacturer internal test report are to be verified by NTPC at the time of final inspection.
 2(b) **In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre/ Regional Offices :-** Routine Test are to be witnessed by Main Contractor & NTPC. This is in addition to manufacturer internal test report to be verified by NTPC at the time of final inspection.
Refer table on page 10 & 11 of 11 for Sampling & Acceptance criteria.
- 3) For PVC insulated LT power cable :- For cables with OD less than equal to 30 mm, any size of cable may be clubbed together. For cables where OD is more than 30 mm, clubbing to be done for cables having similar ODs. For XLPE insulated LT Power cable: Clubbing to be done for cables having similar ODs.

LEGEND: NTPC ADS: NTPC approved data sheet, QCR: quality control records of cable manufacturer, CABLE MANUF STD- cable manufacturer's internal plant standard, MI: minor, MA: major, CR: critical, COC- certificate of conformance



Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1354 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-041 REV-00 DATE : 03-02-12 Page 10 of 11 VALID UP TO: 02-02-15	REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG	APPROVED BY [Signature] [Signature]				
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Record Format	Agency	Remarks
1	2	3	4	5	M C/N	7	8	9	D* M C N	10 11

Sampling & Acceptance Criteria			Testing procedure	Remarks
Criteria	Manufacturer experience prerequisite	Condition		
Samples as per relevant IS from every size/ type of cable in the offered lot shall be tested for Tensile Strength & Elongation (before ageing). The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/- 15% tolerance (final values should be more than the minimum values indicated in relevant standard) of the Type Test report	In case of Manufacturers/ Supplier who have supplied cables in the past through Corporate Centre / Regional offices	In case of sizes/ type which meet the criteria	1 Sample of PVC insulation & outer sheath per type of cables offered which have met the criteria, will be put on accelerated ageing test (refer IRS specification no. IRS: S-63/2007 Rev 3.0). The samples shall be aged in air oven at temperature of 130°C +/- 2°C for 5 hours. 1 Sample of XLPE insulation per type of cables offered which have met the criteria, will be put on ageing test as per IS 7098. After wards the samples shall be tested for Tensile Strength & Elongation. Acceptance norms shall be as per relevant IS. This test shall be witnessed by NTPC.	In case the samples do not meet the requirement in accelerated ageing test then 1 sample of that size/ type will be put on ageing test as per IS.
		In case of size /type which do not meet the criteria	Particular size/ type will be put on ageing test as per IS. This test shall be witnessed by NTPC.	



Sl. No.	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency			Remarks		
					M	C/N				D*	M	C		N	
1	Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables		4	5	6	7	8	9	10	11					
STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION) QP. NO. 0000-999-QOE-S-041 REV-00 DATE: 03-02-12 Page 11 of 11 VALID UP TO: 02-02-15				In case of Manufacturers/ Supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre / Regional offices				In case of size /type which meet the criteria In case of size/ type which do not meet the criteria				1. Sample per type out of all sizes which have met the criteria, will be put on aging test and witnessed by NTPC as per relevant IS Particular size / type will be put on ageing test as per IS. This test shall be witnessed by NTPC			

ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.) मद (सामग्री, वर्ग, ग्रेड, रेटिंग, रेंज, आकार आदि): LIGHTING FIXTURES (Conventional and LED type)		STANDARD QUALITY PLAN स्टैण्डर्ड क्वालिटी प्लान			QP NO / क्यूपी सं.:	0000-999-QOE- S - 062	REVIEWED BY: द्वारा समीक्षा की गई:	APPROVED BY: द्वारा अनुमोदित:				
SL. NO क्र.सं.	COMPONENT & OPERATIONS अवयव व संचालन	CHARACTERISTICS/ विशेषताएं	CLASS वर्ग	TYPE OF CHECK जांच के प्रकार	QUANTUM OF CHECK जांच के परिमाण		REFERENCE DOCUMENT संदर्भ दस्तावेज	ACCEPTANCE NORMS/ स्वीकृत मानदंड	FORMAT OF RECORD/ रिकॉर्ड का प्रारूप	AGENCY/ एजेंसी	REMARKS/टिप्पणियां	
					M एम	C/N सी/एन						M
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	** 10	11	
<p>1) LIGHTING FIXTURES SUPPLIER TO ENSURE THAT CONSTRUCTIONAL FEATURES OF LIGHTING FIXTURE (CONVENTIONAL & LED TYPE) ARE AS PER NTPC SPECIFICATION REQUIREMENT.</p> <p>2) LIGHTING FIXTURES SUPPLIER TO MAINTAIN ALL QUALITY CONTROL RECORDS IDENTIFIED IN THIS QP WHETHER IT IS IDENTIFIED FOR NTPC VERIFICATION OR WITNESS OR NOT.</p> <p>3) BOI LIST AND RAW MATERIAL MAKE LIST SHALL BE SUBMITTED FOR PROJECT SPECIFIC PACKAGE FOR ENDORSMENT DURING APPROVAL OF QAP.</p>												
CONVENTIONAL TYPE LIGHTING FIXTURE												
BOUGHT OUT ITEMS / IN-PROCESS CHECKS												
1	Lamps	Make, rating & type	Major	Visual	1 sample per type	1 sample per type	NTPC specification requirements for rating & type, Make to be BIS approved with CML number	NTPC specification requirements for rating & type, Make with CML number		V	-	
1.1	Electronic Ballast (if applicable)	a Certificate of compliance	Major	Visual	-	-	NTPC specification requirements	Certificate of compliance by ballast manufacturer / lighting fixture supplier that ballast meets all NTPC specification requirements	Certificate of compliance	V	-	

1) LIGHTING FIXTURES SUPPLIER TO ENSURE THAT CONSTRUCTIONAL FEATURES OF LIGHTING FIXTURE (CONVENTIONAL & LED TYPE) ARE AS PER NTPC SPECIFICATION REQUIREMENT.

2) LIGHTING FIXTURES SUPPLIER TO MAINTAIN ALL QUALITY CONTROL RECORDS IDENTIFIED IN THIS QP WHETHER IT IS IDENTIFIED FOR NTPC VERIFICATION OR WITNESS OR NOT.

3) BOI LIST AND RAW MATERIAL MAKE LIST SHALL BE SUBMITTED FOR PROJECT SPECIFIC PACKAGE FOR ENDORSMENT DURING APPROVAL OF QAP.

CONVENTIONAL TYPE LIGHTING FIXTURE

BOUGHT OUT ITEMS / IN-PROCESS CHECKS

1	Lamps	Make, rating & type	Major	Visual	1 sample per type	1 sample per type	NTPC specification requirements for rating & type, Make to be BIS approved with CML number	NTPC specification requirements for rating & type, Make with CML number		V	-	
1.1	Electronic Ballast (if applicable)	a Certificate of compliance	Major	Visual	-	-	NTPC specification requirements	Certificate of compliance by ballast manufacturer / lighting fixture supplier that ballast meets all NTPC specification requirements	Certificate of compliance	V	-	

LEGEND:/ संकेतिका: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. / * "टिक" (✓) के साथ प्रमाणित रिकॉर्ड, क्यूए दस्तावेजीकरण में अपूर्तिकर्ता द्वारा अनिवार्य रूप से शामिल किया जाएगा।

** M: MANUFACTURER / SUB-SUPPLIER /निर्माता / उप-आपूर्तिकर्ता C: MAIN CONTRACTOR / मुख्य संविदाकार, N: NTPC/ एनटीपीसी P: PERFORM/ निष्पादन W: WITNESS/ गवाह AND V: VERIFICATION. AS APPROPRIATE/ सत्यापन (जैसा उपयुक्त हो). CHP/ सीएचपी: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W": एनटीपीसी खंड "N" में "W" के रूप में करेगा।

FORMAT NO.: QS-01-QAI-P-07A/F3-R0
1/10
प्रारूप सं.

ENGG. DIV./QA&I
अभि. प्रभाग/क्यूए व आई

SL. NO. क्र.सं.	COMPONENT & OPERATIONS अवयव व संचालन	CHARACTERISTICS/ विशेषताएं	CLASS वर्ग	TYPE OF CHECK जांच के प्रकार	QUANTUM OF CHECK जांच के परिमाण		REFERENCE DOCUMENT संदर्भ दस्तावेज	ACCEPTANCE NORMS/ स्वीकृत मानदंड	RECORD/ रिकॉर्ड का प्रारूप	AGENCY/ एजेंसी	REMARKS/टिप्पणियां
					M एम	C/N सीएन					
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	** 10	11
STANDARD QUALITY PLAN स्टैंडर्ड क्वालिटी प्लान											
ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): मद (सामग्री, वर्ग, ग्रेड, रेटिंग, रेंज, आकार आदि): LIGHTING FIXTURES (Conventional and LED type)											
CONFORMING TO CODE: NTPC TECHNICAL SPECIFICATIONS कोड के अनुरूप: NTPC TECHNICAL SPECIFICATIONS											
QPN NO / क्यूपी सं.: 0000-999-QOE- S - 062 REVNO / संशोधित सं.: 01 DATE/ तिथि 04.10.2022 PAGE/ पृष्ठ 3 OF 10											
REVIEWED BY: द्वारा समीक्षा की गई: POONAM ADHIKARI S N TRIPATHI S K LAL											
APPROVED BY: द्वारा अनुमोदित: S S MISHRA SUDHANS HU SEKHAR MISHRA											

1.4	Pre-treatment and powder coating	Pre-treatment process checks, Powder coating finish, thickness, uniformity of coating and adhesion	Major	Visual, chemical & mech.	Minfr std.	Nominal coating thickness 50 microns or more	Inspection report	P/ V*	P/V* - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
A	Acceptance Tests on Conventional Lighting fixture	a Details of lot offered and Certificate of compliance that lighting fixture supplier has inspected the offered lot as per their own standard	Major	Visual	-	COC	List	V	The list may be used by NTPC for sample selection
		b Lamp make	Major	Visual	100%	Make to be BIS approved with CML number	Certificate of compliance	V	
		c Constructional features including: Internal wiring, terminal block, earthing terminal, safety chain (if applicable)	Major	Visual	1 sample per type	NTPC specification and NTPC approved data sheet/drawing.	Inspection report	P	

LEGEND:/ संकेतिका: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. / * "टिक" (✓) के साथ प्रमाणित रिकॉर्ड, क्यूए दस्तावेजीकरण में अपूर्तिकर्ता द्वारा अनिवार्य रूप से शामिल किया जाएगा।

** M: MANUFACTURER / SUB-SUPPLIER /निर्माता / उप-आपूर्तिकर्ता C: MAIN CONTRACTOR / मुख्य संविदाकार, N: NTPC/ एनटीपीसी P: PERFORM/ निष्पादन W: WITNESS/ गवाह AND V: VERIFICATION. AS APPROPRIATE/ सत्यापन (जैसा उपयुक्त हो). CHP/ सीएचपी: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W": एनटीपीसी खंड "N" में "W" के रूप में करेगा।

FORMAT NO.: QS-01-QAI-P-07A/F3-R0 **3/10**
ENGG. DIV./QA&I
अभि. प्रभाग/क्यूए व आई

ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): मद (सामग्री, वर्ग, ग्रेड, रेटिंग, रेंज, आकार आदि): LIGHTING FIXTURES (Conventional and LED type)		STANDARD QUALITY PLAN स्टैंडर्ड क्वालिटी प्लान				QP NO / क्यूपी सं.:	0000-999-QOE- S - 062	REVIEWED BY: द्वारा समीक्षा की गई:	APPROVED BY: द्वारा अनुमोदित:			
SL. NO क्र.सं.	COMPONENT & OPERATIONS अवयव व संचालन	CHARACTERISTICS/ विशेषताएं	CLASS वर्ग	TYPE OF CHECK जांच के प्रकार	QUANTUM OF CHECK जांच के परिमाण		REFERENCE DOCUMENT संदर्भ दस्तावेज	ACCEPTANCE NORMS/ स्वीकृत मानदंड	RECORD/ रिकॉर्ड का प्रारूप	AGENCY/ एजेंसी	REMARKS/टिप्पणियां	
					M एम	C/N सी/एन						M
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	** 10	11	
		CONFORMING TO CODE: कोड के अनुरूप: NTPC TECHNICAL SPECIFICATIONS		DATE/ तिथि PAGE// पृष्ठ		REVNO / संशोधित सं.:	01	POONAM ADHIKARI	S S MISHRA			
						DATE/ तिथि PAGE// पृष्ठ	04.10.2022 4 OF 10	S N TRIPATHI SHAKTI NATH TRIPATHI	SUNIL SK LAL KUMAR LAL			

SL. NO	CHARACTERISTICS/ विशेषताएं	CLASS	TYPE OF CHECK	QUANTUM	REFERENCE DOCUMENT	ACCEPTANCE NORMS	RECORD	AGENCY	REMARKS
d	Electronic Ballast (if applicable for offered lighting fixtures) THD and pf check	Major	Electrical	1 sample per type	NTPC specification	THD ≤ 10%, pf >= 0.9 for FH type and pf >= 0.95 for other type of fluorescent lighting fixtures	Inspection report	P	At lighting supplier test lab
e	Resistance to moisture test in case of lighting fixtures having IP X4 and above rating	Major	Mechanical	1 sample per type	NTPC approved data sheet	IS 10322 Part I	Inspection report	P	
f	Resistance to dust (applicable if IP5X and above)	Major	Optical	Minfr std.	NTPC approved Data sheet and accepted type test reports	Certificate of compliance	Certificate of compliance	P/ V*	P/N* - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier

LEGEND:/ संकेतिका: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. / * "टिक" (✓) के साथ प्रमाणित रिकॉर्ड, क्यूए दस्तावेजीकरण में अपूर्तिकर्ता द्वारा अनिवार्य रूप से शामिल किया जाएगा।

** M: MANUFACTURER / SUB-SUPPLIER /निर्माता / उप-आपूर्तिकर्ता C: MAIN CONTRACTOR / मुख्य संविदाकार, N: NTPC/ एनटीपीसी P: PERFORM/ निष्पादन W: WITNESS/ गवाह AND V: VERIFICATION. AS APPROPRIATE/ सत्यापन (जैसा उपयुक्त हो), CHP/ सीएचपी: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W": एनटीपीसी खंड "N" में "W" के रूप में करेगा।

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ENGG. DIV./QA&I
अभि. प्रभाग/क्यूए व आई

प्रारूप सं.

SL. NO क्र.सं.	COMPONENT & OPERATIONS अवयव व संचालन	CHARACTERISTICS/ विशेषताएं	CLASS वर्ग	TYPE OF CHECK जांच के प्रकार	QUANTUM OF CHECK जांच के परिमाण		REFERENCE DOCUMENT संदर्भ दस्तावेज	ACCEPTANCE NORMS/ स्वीकृत मानदंड	FORMAT OF RECORD/ रिकॉर्ड का प्रारूप	AGENCY/ एजेंसी	REMARKS/टिप्पणियां
					M एम	C/N सी/एन					
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	** 10	11
STANDARD QUALITY PLAN स्टैंडर्ड क्वालिटी प्लान											
ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): मद (सामग्री, वर्ग, ग्रेड, रेटिंग, रेंज, आकार आदि): LIGHTING FIXTURES (Conventional and LED type)											
CONFORMING TO CODE: कोड के अनुरूप: NTPC TECHNICAL SPECIFICATIONS											
QPN NO / क्यूपी सं.: 0000-999-QOE- S - 062 REVIEWED BY: द्वारा समीक्षा की गई: POONAM ADHIKARI APPROVED BY: द्वारा अनुमोदित: S S MISHRA											
REVNO / संशोधित सं.: 01 DATE/ तिथि 04.10.2022 PAGE/ पृष्ठ 5 OF 10											

SL. NO	DESCRIPTION	CHARACTERISTICS	CLASS	TYPE OF CHECK	Mnfr std.	Mnfr std.	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
g	Photometry check		Major	Optical	1 sample per type	1 sample per type	NTPC accepted type test reports	Certificate of compliance for the batch : that offered lighting fixture LOR is not be less than 90% (refer IS 16107) with reference to type test reports	Certificate of compliance	P/V	P/V* - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
h	Dimensions		Major	Visual	1 sample per type	1 sample per type	NTPC specification and NTPC approved data sheet/drg.	NTPC specification and NTPC approved data sheet/drg.	Inspection report	P/W	
i	HV & IR test		Major	Visual	#	#	IS 10322 part I	IS 10322 part I	Inspection report	P/W	# As per Table 1 (Inspection Level S2) and Table 2CAQL 2.5 of IS 2500

LED TYPE LIGHTING FIXTURE												
BOUGHT OUT ITEMS / IN-PROCESS CHECKS												
A	LED Chip	LED chip efficacy	Major	Visual	Mnfr std.	Mnfr std.	NTPC Spec/ Appd. Data sheet/LM 80 report	NTPC Spec/ Appd. Data sheet	LM 80 report	V	V	At the time of final inspection
		LED chip CRI and CCT	Major	Visual	Mnfr std.	Mnfr std.	NTPC Spec/ Appd. Data sheet/LM 80 report	NTPC Spec/ Appd. Data sheet	LM 80 report	V	V	At the time of final inspection

LEGEND:/ संकेतिका: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. / * "टिक" (✓) के साथ प्रमाणित रिकॉर्ड, क्यूए दस्तावेजीकरण में आपूर्तिकर्ता द्वारा अनिवार्य रूप से शामिल किया जाएगा।

** M: MANUFACTURER / SUB-SUPPLIER /निर्माता / उप-आपूर्तिकर्ता C: MAIN CONTRACTOR / मुख्य संविदाकार, N: NTPC/ एनटीपीसी P: PERFORM/ निष्पादन W: WITNESS/ गवाह AND V: VERIFICATION. AS APPROPRIATE/ सत्यापन (जैसा उपयुक्त हो), CHP/ सीएचपी: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W": एनटीपीसी खंड "N" में "W" के रूप में करेगा।

FORMAT NO.: QS-01-QAI-P-07A/F3-R0 **5/10**
ENGG. DIV./QA&I
अभि. प्रभाग/क्यूए व आई

SL. NO. क्र.सं.	COMPONENT & OPERATIONS अवयव व संचालन	CHARACTERISTICS/ विशेषताएं	CLASS वर्ग	TYPE OF CHECK जांच के प्रकार	QUANTUM OF CHECK जांच के परिमाण	REFERENCE DOCUMENT संदर्भ दस्तावेज	ACCEPTANCE NORMS/ स्वीकृत मानदंड	FORMAT OF RECORD/ रिकॉर्ड का प्रारूप	AGENCY/ एजेंसी	REMARKS/टिप्पणियां
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	11
STANDARD QUALITY PLAN स्टैंडर्ड क्वालिटी प्लान										
ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): मद (सामग्री, वर्ग, ग्रेड, रेटिंग, रेंज, आकार आदि): LIGHTING FIXTURES (Conventional and LED type)										
CONFORMING TO CODE: कोड के अनुरूप: NTPC TECHNICAL SPECIFICATIONS										
QPN NO / क्यूपी सं.: 0000-999-QOE- S - 062 REVNO / संशोधित सं.: 01 DATE/ तिथि 04.10.2022 PAGE// पृष्ठ 6 OF 10										
APPROVED BY: द्वारा अनुमोदित: S S MISHRA <small>SUDHANSHU U SEKHAR MISHRA</small>										
REVIEWED BY: द्वारा समीक्षा की गई: POONAM ADHIKARI <small>SHAKTI NATH TRIPATHI</small> S N TRIPATHI <small>SUNIL KUMAR LAL</small> S K LAL										

SL. NO.	DESCRIPTION	Reported (L80) lifetime of LED chip	Major	Visual	Mnfr std.	Mnfr std.	NTPC Spec/ Appd. Data sheet/LM 80 report	LM 80 report	V	V	At the time of final inspection
	LED Driver	a Compatibility with LED module/chip, controls & protection features as per NTPC spec	Major	Visual	-	-	Certificate of compliance by LED driver manufacturer / lighting fixture supplier that driver meets all NTPC specification requirements	Certificate of compliance	V	V	
	Castings	b THD and pf check	Major	Electrical	Mnfr std.	-	THD < 10% and pf >= 0.9	Inspection report	P/ V*	-	P/V* - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
		Freedom from defects	Major	Visual	Mnfr std.	-	Castings shall be free from any defects such as blow holes, surface blisters, cracks and cavities etc.	Inspection report	P/ V*	-	P/V* - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier

LEGEND:/ संकेतिका: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. / * "टिक" (✓) के साथ प्रमाणित रिकॉर्ड, क्यूए दस्तावेजीकरण में अपूर्तिकर्ता द्वारा अनिवार्य रूप से शामिल किया जाएगा।

** M: MANUFACTURER / SUB-SUPPLIER /निर्माता / उप-आपूर्तिकर्ता C: MAIN CONTRACTOR / मुख्य संविदाकार, N: NTPC/ एनटीपीसी AS APPROPRIATE/ सत्यापन (जैसा उपयुक्त हो), CHP/ सीएचपी: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W" AS "W": एनटीपीसी खंड "N" में "W" के रूप में करेगा।

FORMAT NO.: QS-01-QAI-P-07A/F3-R0
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ENGG. DIV./QA&I
 अभि. प्रभाग/क्यूए व आई

SL. NO. क्र.सं.	COMPONENT & OPERATIONS अवयव व संचालन	CHARACTERISTICS/ विशेषताएं	CLASS वर्ग	TYPE OF CHECK जांच के प्रकार	QUANTUM OF CHECK जांच के परिमाण	REFERENCE DOCUMENT संदर्भ दस्तावेज	ACCEPTANCE NORMS/ स्वीकृत मानदंड	RECORD/ रिकॉर्ड का प्रारूप	AGENCY/ एजेंसी	REVIEWED BY: द्वारा समीक्षा की गई:	APPROVED BY: द्वारा अनुमोदित:
STANDARD QUALITY PLAN स्टैंडर्ड क्वालिटी प्लान											
CONFORMING TO CODE: NTPC TECHNICAL SPECIFICATIONS											
कोड के अनुरूप: NTPC TECHNICAL SPECIFICATIONS											
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	** 10	11
	ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): मद (सामग्री, वर्ग, ग्रेड, रेटिंग, रेंज, आकार आदि): LIGHTING FIXTURES (Conventional and LED type)										
	Sheet metal forming and fabrication	Freedom from defects	Major	Visual	Mnfr std.	NTPC specifications requirements	Sheet metal fabrication / forming etc. should be as per manufacturer standards and good engg practices	Inspection report	P/ V*	-	P/V* - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
	Pre-treatment and powder coating	Pre-treatment checks, Powder coating finish, thickness, uniformity of coating and adhesion	Major	Visual, chemical & mech	Mnfr std.	Mnfr standard, NTPC specifications requirements	Nominal coating thickness 50 microns or more	Inspection report	P/ V*	-	P/V* - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
B	Acceptance Tests on LED Lighting fixture	a Details of lot offered and Certificate of compliance that lighting fixture supplier has inspected the offered lot as per their own standard	Major	Visual	-	Lighting fixture supplier to submit the details of lot offered for NTPC inspection (Type of lighting fixtures, their batch number, sub-vendor name, quantity)	-	List	P	V	The list may be used by NTPC for sample selection
		b LED chip make	Major	Visual	-	NTPC accepted type test reports (LM80/LM79) report	Certificate of compliance	Certificate of compliance	V	V	

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FORMAT NO.: QS-01-QAI-P-07A/F3-R0

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ENGG. DIV./QA&I
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प्रारूप सं.

ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): मद (सामग्री, वर्ग, ग्रेड, रेटिंग, रेंज, आकार आदि): LIGHTING FIXTURES (Conventional and LED type)		STANDARD QUALITY PLAN स्टैण्डर्ड क्वालिटी प्लान			QP NO / क्यूपी सं.:	0000-999-QOE- S - 062	REVIEWED BY: द्वारा समीक्षा की गई:	APPROVED BY: द्वारा अनुमोदित:			
SL. NO क्र.सं.	COMPONENT & OPERATIONS अवयव व संचालन	CHARACTERISTICS/ विशेषताएं	CLASS वर्ग	TYPE OF CHECK जांच के प्रकार	QUANTUM OF CHECK जांच के परिमाण		ACCEPTANCE NORMS/ स्वीकृत मानदंड	RECORD/ रिकॉर्ड का प्रारूप	AGENCY/ एजेंसी	REMARKS/टिप्पणियां	
					M एम	C/N सी/एन					M
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SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM	REFERENCE DOCUMENT	ACCEPTANCE NORMS	RECORD	AGENCY	REMARKS	
c		Constructional features including: Internal wiring, terminal block, earthing terminal, safety chain (if applicable)	Major	Visual	1 sample per type	NTPC specification and NTPC approved data sheet/drg.	NTPC specification and NTPC approved data sheet/drg.	Inspection report	P	W	W
d		Resistance to moisture test in case of lighting fixtures having IP X4 and above rating	Major	Mechanical	1 sample per type	NTPC approved data sheet/drg.	IS 10322 part I	Inspection report	P	W	W
e		Resistance to dust (applicable if IP5X and above)	Major	Optical	Mnfr std.	NTPC accepted type test reports	Certificate of compliance	Certificate of compliance	P/ V*	V	V

LEGEND:/ संकेतिका: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. / * "टिक" (✓) के साथ प्रमाणित रिकॉर्ड, क्यूए दस्तावेजीकरण में आपूर्तिकर्ता द्वारा अनिवार्य रूप से शामिल किया जाएगा।

** M: MANUFACTURER / SUB-SUPPLIER /निर्माता / उप-आपूर्तिकर्ता C: MAIN CONTRACTOR / मुख्य संविदाकार, N: NTPC/ एनटीपीसी P: PERFORM/ निष्पादन W: WITNESS/ गवाह AND V: VERIFICATION. AS APPROPRIATE/ सत्यापन (जैसा उपयुक्त हो), CHP/ सीएचपी: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W": एनटीपीसी खंड "N" में "W" के रूप में करेगा।

FORMAT NO.: QS-01-QAI-P-07A/F3-R0

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ENGG. DIV./QA&I
अभि. प्रभाग/क्यूए व आई

प्रारूप सं.

SL. NO क्र.सं.	COMPONENT & OPERATIONS अवयव व संचालन	CHARACTERISTICS/ विशेषताएं	CLASS वर्ग	TYPE OF CHECK जांच के प्रकार	QUANTUM OF CHECK जांच के परिमाण		REFERENCE DOCUMENT संदर्भ दस्तावेज	ACCEPTANCE NORMS/ स्वीकृत मानदंड	RECORD/ रिकॉर्ड का प्रारूप	AGENCY/ एजेंसी	REMARKS/टिप्पणियां
					M एम	C/N सीएन					
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	** 10	11
STANDARD QUALITY PLAN स्टैंडर्ड क्वालिटी प्लान											
ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): मद (सामग्री, वर्ग, ग्रेड, रेटिंग, रेंज, आकार आदि): LIGHTING FIXTURES (Conventional and LED type)											
CONFORMING TO CODE: NTPC TECHNICAL SPECIFICATIONS कोड के अनुरूप: NTPC TECHNICAL SPECIFICATIONS											
QPN NO / क्यूपी सं.: 0000-999-QOE- S - 062											
REVNO / संशोधित सं.: 01											
DATE / तिथि 04.10.2022											
PAGE / पृष्ठ 9 OF 10											
REVIEWED BY: POONAM ADHIKARI द्वारा समीक्षा की गई:											
APPROVED BY: S S MISHRA द्वारा अनुमोदित:											

f	Photometry check	Major	Optical	Mnfr std.	Mnfr std.	NTPC accepted type test reports, LM 79, IS 16106, IS 16107	Certificate of compliance for the batch: that offered lighting fixture LOR and lighting fixture efficacy is not be less than 90% (refer IS 16107) with reference to type test reports	Certificate of compliance	P/ V-	V	P/V* - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
g	Dimensions	Major	Visual	1 sample per type	1 sample per type	NTPC specification and approved data sheet/drg.	NTPC specification and approved data sheet/drg.	Inspection report	P	W	W
h	LED driver: THD and pf check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	THD < 10% and pf >=0.9	Inspection report	P	W	At lighting fixture supplier test lab
i	LED driver: Precision current control check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W
j	LED driver: Open circuit protection simulation check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W
k	LED driver: Short circuit protection simulation check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W

LEGEND:/ संकेतिका: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. / * "टिक" (✓) के साथ प्रमाणित रिकॉर्ड, क्यूए दस्तावेजीकरण में अपूर्तिकर्ता द्वारा अनिवार्य रूप से शामिल किया जाएगा।

** M: MANUFACTURER / SUB-SUPPLIER /निर्माता / उप-आपूर्तिकर्ता C: MAIN CONTRACTOR / मुख्य संविदाकार, N: NTPC/ एनटीपीसी P: PERFORM/ निष्पादन W: WITNESS/ गवाह AND V: VERIFICATION. AS APPROPRIATE/ सत्यापन (जैसा उपयुक्त हो), CHP/ सीएचपी: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W": एनटीपीसी खंड "N" में "W" के रूप में करेगा।

FORMAT NO.: QS-01-QAI-P-07A/F3-R0

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STATION LIGHTING


Item Components Sub System Assembly Attributes Characteristics	Make, Type, Rating/ TC	Dimension	Pre-Treatment of sheat	Paint Shade Thickness Adhesion & Finish	Galvanization Tests	IP Test	Bought Out Items/ Bill of Material	HV & IR	Functional Check as per spec.	Constructional Feature as per NTPC spec.	Routine Test as per relevant std and spec	Acceptance Test as per relevant std and spec	Item to conform to relevant standard
Luminaries (IS-10322 Part-5 Sec.1 (non –LED type)	Y					Y		Y			Y	Y	Y
Electronic Ballast	Y										Y	Y	Y
Lighting Wire (IS-694)	Y										Y		
Fans (IS-374)	Y										Y		
Pole (IS-2713)	Y			Y						Y	Y	Y	
Lamps (IS-9800, IS-9974)	Y										Y	Y	
Lighting Mast (with raise & lower lantern type)	Y	Y			Y					Y	Y	Y	
Wall Mounted Lighting Panel (IS-513, IS-5)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Switch Box/ Junction Box/Receptacles/ Local Push Button Station / Lighting Panel (IS-513, 2629, 2633, 4759, 6745)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Cable Gland (BS-6121)	Y	Y									Y		
Cable Lug (IS-8309)	Y	Y									Y		
Flexible Conduit	Y										Y		
Lighting Transformer (IS-11171)	Y									Y	Y		
Epoxy & Galvanised Conduit (IS-9537, 2629, 2633, 4759, 6745)	Y	Y									Y		Y

**LED Luminaire quality requirements:**

- 1) **LED modules to conform to IS: 16103 part 2. Manufacturer to issue a certificate of compliance for the same.**
- 2) **Control gear to conform to IS 15885 part 2 section 13. Manufacturer to issue a certificate of compliance for the same.**
- 3) **LED luminaire to conform to IS 16107 part 2 section 1. Manufacturer to issue a certificate of compliance for the same.**
- 4) **LED luminaire marking to be as per IS 16107 part 2 section 1. Manufacturer to issue a certificate of compliance for the same.**
- 5) **Acceptance tests as per IS 16107 part 2 section 1 to be carried out on LED luminaire except long duration tests i.e. a) Chromaticity coordinates & correlated color temperature (CCT); b) Color rendering index (CRI). Manufacturer will submit a COC for above tests i.e. CCT & CRI**
- 6) **LED driver make, model, type & rating may be as per recommendations of LED module manufacturer.**

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Make of all major Bought Out Items will be subject to NTPC approval.

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.		DATE:	
	CUSTOMER:		PROJECT:		QP NO.: PE-QP-999-509-E001_R3		DATE:	
	ITEM: ABOVE GROUND EARTHING MATERIALS		SYSTEM: EARTHING		PO NO.:		DATE:	
	CHARACTERISTICS		CLASS		TYPE OF CHECK		REMARKS	

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	B	B				M	B	C	
1	2	3	4	5	6	7	8	9	*	D	**	M	B	C

Sl. No.	RAW MATERIAL:	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
1.0	MILD STEEL (FLATS & RODS) AS PER SPECIFICATION	1. CHEMICAL & PHYSICAL PROPERTIES 2. DIMENSIONS 3. SURFACE FINISH	MA	VERIFICATION OF TC'S MEASUREMENT VISUAL CHEM. TEST	100% 100% 100% SAMPLE	IS 2062 IS 1730 IS 1079 IS 209	IS 2062 IS 1730 IS 1079 IS 209	MILL TC QC RECORD QC RECORD QC RECORD	P P P P	REFER REMARKS AT SL. NO. 3.1
1.1	ZINC	1. CHEMICAL COMP.	MA	MEASUREMENT	100%	IS 1730	IS 1730	QC RECORD	P	
1.2	IN PROCESS:	1. DIMENSIONS 1. CLEANING, PICKLING, RINSING & FLUXING 2. SURFACE FINISH	MA	VISUAL VISUAL	100% 100%	IS 2629 IS 2629	IS 2629 IS 2629	QC RECORD QC RECORD	P P	
2.0	GALVANISING	1. TEMPERATURE OF BATH 2. DROSS 3. RATE OF IMMERSION 4. SURFACE FINISH	MA	MEASUREMENT VISUAL VISUAL/MEASUREMENT VISUAL	CONTINUOUS PERIODIC 100% 100%	IS 2629 IS 2629 IS 2629 IS 2629	IS 2629 IS 2629 IS 2629 FREE FROM BURRS, ROUGHNESS, SLAG, FLUX, STAIN	QC RECORD QC RECORD QC RECORD QC RECORD	P P P P	GALVANIZATION IS TO BE DONE AT GALVANIZATION PLANT LISTED IN ANNEXURE-1 TO QUALITY PLAN.
3.0	FINISHED ITEMS:	1. CHEMICAL COMP. 2. DIMENSIONS	MA	CHEM. TEST MEASUREMENT	1 IS 2500 (PART 1) LEVEL S-4	IS 2026 IS 1730	IS 2026 IS 1730	LAB TC INSPECTIO N REPORT	P P	NOTE: SAMPLE FOR CHEMICAL TEST SHALL BE SELECTED BY BHEL & TESTING SHALL BE DONE AT NABL/ GOVT. APPD. MS

Sign & Date	BIDDER/SUPPLIER			ENGINEERING			QUALITY			FOR CUSTOMER REVIEW & APPROVAL		
	Seal	Checked by: <i>[Signature]</i>	Reviewed by: <i>[Signature]</i>	Sign & Date	Checked by: <i>[Signature]</i>	Reviewed by: <i>[Signature]</i>	Sign & Date	Checked by: <i>[Signature]</i>	Reviewed by: <i>[Signature]</i>	Doc No:	Sign & Date	Name

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO. QP NO.: PE-QP-999-509-E001, R3		DATE:	
	CUSTOMER:		PROJECT:		PO NO.:		DATE:	
ITEM: ABOVE GROUND EARTHING MATERIALS		SYSTEM: EARTHING		SHEET 2 OF 2				

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD			AGENCY	REMARKS
					M	B			9	D	M		
1	2	3	4	5	6	7	8		*				

	3. SURFACE FINISH	MA	VISUAL	IS 2500 (PART 1) LEVEL S-4	IS 2500 (PART 1) LEVEL S-4	-	FREE FROM BURRS, ROUGHNESS, SLAG, FLUX, STAIN ETC.	QC RECORD	✓	P	W		
	4. MASS OF ZINC COATING	MA	CHEM. TEST	IS 4759	IS 4759	IS-6745	FLATS 5 MM THICK AND OVER 610 GM/SQ.M. FLATS UNDER 5 MM, BUT NOT LESS 2 MM 460 GM/SQ.M.	INSP. REPORT	✓	P	W		
	5. UNIFORMITY OF ZINC COATING	MA	CHEM. TEST	IS 4759	IS 4759	IS-2633	IS-2633	INSP. REPORT	✓	P	W		
	6. THICKNESS OF ZINC COATING	MA	MEASUREMENT	IS 4759	IS 4759	IS-4759	FLATS 5 MM THICK AND OVER=AVG 86 MICRON AND MINIMUM 75 MICRON. FLATS UNDER 5 MM THICK, BUT NOT LESS 2 MM =AVG 65 MICRON	INSP. REPORT	✓	P	W		
	7. ADHESION	MA	MECH. TEST	IS 4759	IS 4759	IS 2629	IS 2629	INSP. REPORT	✓	P	W		

4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	BHEL APPROVED DOC	BHEL APPROVED DOC	INSP. REPORT	✓ <th>P <th>V <th>- </th></th></th>	P <th>V <th>- </th></th>	V <th>- </th>	-
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NOTES:
 1 LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ASME/IEC ETC.) INDICATED IN QP SHALL BE REFERRED.
LEGENDS:
 *RECORDS, IDENTIFIED WITH "TICK"(V) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION, D: DOCUMENTATION
 C: CUSTOMER, P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE MA: MAJOR, MI: MINOR, CR: CRITICAL
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: BHEL/THIRD PARTY INSPECTION AGENCY,

BIDDER/SUPPLIER				BHEL				FOR CUSTOMER REVIEW & APPROVAL			
Sign & Date	Checked by	Sign & Date	Name	Checked	Sign & Date	Name	Doc No:	Reviewed by:	Sign & Date	Name	Seal
	Reviewed by:			by:				Approved by:			

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
1.	Flexible cable trays Support Structure	3. In Black Condition a) Weld Quality b) Burs	4. Major	5. Visual	100%	Random	7. Manufacturer's Plant Std	8. Manufacturer's Plant Std	9. Inspection Report	P	V	V	0
2.	Finished Galvanized	2. After Galvanizing 2.1 General physical inspection including Galvanizing Quality/Defects, Dieromating, White Rusting etc. 2.2 Dimensional Check & Thickness Check 2.3 Galvanizing Tests a) Coating thickness measurement survey by Elcometer b) Mass of zinc coating c) Uniformity of zinc coating/dip test d) Adhesion Test	Major	5. Visual	100%	5 Sample/Lot	7. IS-2629-1985 IS-4759-1996	8. IS-2629-1985 IS-4759-1996	9. -do-	P	W	W	0
			Major	5. Measurement	-do-	-do-	NTPC/Main Supplier Approved Drg.	NTPC/Main Supplier Approved Drg.	-do-	P	W	W	
			Critical	5. Measurement	IS-4759-1996	-do-	IS-4759-1996 IS-3203-1982	IS-4759-1996 IS-3203-1982	-do-	P	W	W	
			Critical	5. Measurement	-do-	1 coupon sample of each thickness	IS-6745-1972 IS-4759-1996	IS-6745-1972 IS-4759-1996	-do-	P	W	W	
			Critical	5. Measurement	-do-	-do-	IS-2633-1986 IS-4759-1996	IS-2633-1986 IS-4759-1996	-do-	P	W	W	
			Critical	5. Visual	-do-	-do-	IS-2629-1985	IS-2629-1985	-do-	P	W	W	

ITEM: (MATERIAL, CLASS, GRADE, RATING, SIZE ETC) GALVANISED FLEXIBLE CABLE TRAYS SUPPORT SYSTEM

STANDARD QUALITY PLAN
CONFORMING TO
CODE: Design as per NTPC Specification

QP NO. 0000-999-Q0E-S-38
REV:00 DATE: 01.09.04
PAGE 1 OF 2
VALID UPTO:31.08.07

REVIEWED BY
S.D.SINGH
O.P.NIRANJAN
I.J.SINGH

APPROVED BY
ANIL KUMAR
NTPC, N.C.

LEGEND: RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY THE CONTRACTOR IN QA DOCUMENTATION
 **M: MANUFACTURER/SUB-SUPPLIER, C: Main Supplier: NTPC, N: NTPC. INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION AS APPROPRIATE
 "CHP" BY NTPC SHALL BE IDENTIFIED IN COLUMN "N" AS "WP"
 FORMAT NO. QS-01-QAI-P-10/F3-R0

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		
					M	C/N				M	C	N
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	APPROVED BY ANIL GUPTA NTPC, New W		

ITEM: (MATERIAL, CLASS, GRADE, RATING, SIZE ETC.)

STANDARD QUALITY PLAN

CONFORMING TO CODE: Design as per NTPC Specification

QP NO. 0006-999-QOE-S-38
REV:00 DATE: 01.09.04
PAGE 2 OF 2
VALID UPTO: 31.08.07

REVIEWED BY
S.D.SINGH
O.P.NIRANJAN
L.J.SINGH

APPROVED BY
ANIL GUPTA
NTPC, New W

1. The supplier to ensure procurement of steel from main producers like SAIL/TISCO, Rasmiya Ispat/Ispat Ind. Jindal/Essex/Lloyds/IS Co. and Zinc from Hindustan Zinc Ltd.

2. Welding shall be done by qualified welders as per supplier system.

3. Material shall be galvanized at NTPC approved sources only.

4. Pre-treatment of cable trays support system shall be carried out in seven tank process as per IS-2629. All the process parameters e.g. Concentration, temperature, density etc. to be maintained and recorded by the galvaniser.

5. The process of pre-treatment shall be verified by NTPC on surveillance basis during inspection of Galvanised Flexible Cable Trays support system.

6. (i) Test on Main support Channel shall be done if only CI channel are in scope of supply and cantilever arms shall be fitted on one side. This test shall be same as test 4 of type test as per tech. Spec.
(ii) Test on Main Support Channel shall be done with C2 Channel and cantilever arms fitted on both sides, if C2 channels are in scope of supply. This test shall be same as test 2 A of type tests. Then test at (i) above shall not be repeated.
(iii) Nut slip characteristic test (It shall support minimum load of 350 Kg. Before Nut Slips with bolt torque of 65 NM). This test shall be same as test 5 B of type tests.
(iv) The procedure for carrying out above test shall be as per details given in Type Tests Specification.

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"CHP" BY NTPC SHALL BE IDENTIFIED IN COLUMN "N" AS "WP"
FORMAT NO. QS-01-QAF-P-10/F3-R0

2/2 ENGG. DIV./QA&I

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
					M	C	N				M	C	N		
1	FINISHED CABLE TRAYS & ACCESSORIES.	1 In Black Condition a) Weld Quality b) Burs 2 After Galvanising 2.1 General Physical inspection including Galvanising Quality/ Defects, Dicromatizing, White rusting etc. 2.2 Dimensional check & Sheet Thickness 2.3 Galvanising tests a) Coating thickness measurement survey by Elcometer b) Mass of zinc coating c) Uniformity of zinc coating/dip test d) Adhesion test 2.4 Deflection Test	4	5	6	7	8	9	10	11					
			Major	Visual	100% Random	Manufacturer's Plant Std	Manufacturer's Plant Std No Burs	Inspection report	P	P				A) The cable trays shall be galvanised at NTPC approved sources only. B) The supplier to ensure procurement of steel from main producers like SAIL/TISCO, Rastriya Ispat/Ispat Ind. Jindal/Esker/Loyal/ISS Co. and Zinc from Hindustan Zinc Ltd. C) Welding shall be done by qualified welders as per supplier system. D) Pre-treatment of fabricated cable trays shall be carried out in screen tank process as per IS 2629. All the process parameters e.g. Concentration, temperature, density etc. to be maintained and recorded by the Galvaniser E) The process of pretreatment shall be verified by NTPC on surveillance basis during inspection of cable trays	
			Major	Visual	Random	IS-2629-1985 IS-4759-1996	IS-2629-1985 IS-4759-1996	-do-	P	P					
			Major	Visual	IS-4759-1996 5 sample/lot	IS-4759-1996	IS-4759-1996	-do-	P	P					
			Major	Measurement	-do-	NTPC/Main Supplier Approved Drawing	NTPC/Main Supplier Approved Drawing	-do-	P	P					
			Critical	Measurement	-do-	IS-4759-1996 IS-3203-1982	IS-4759-1996 Table-I	-do-	P	P					
			Critical	Measurement	1 coupon sample of each thickness	IS-6745-1972 IS-2633-1986	IS-4759-1996 Table-I	-do-	P	P					
			Critical	Measurement	-do-	IS-2629-1985 IS-2633-1986 IS-4759-1996	IS-4759-1996 cl. 9.3	-do-	P	P					
			Critical	Visual	-do-	IS-2629-1985	IS-2629-1985	-do-	P	P					
			Critical	Measurement	1 sample from each size type/lot	*F*	*F*	-do-	P	P				*F* One piece each of 2.5 meter length size of cable tray of 300 mm & above shall be taken as sample from each offered lot for inspection. It shall be supported at both ends & loaded with uniformly distributed load of 76kg/meter along the length of cable tray. The maximum deflection at mid span of each sample shall not exceed 7mm.	
			Critical	Measurement	lot			-do-	P	P					

LEGEND: RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY THE CONTRACTOR IN QA DOCUMENTATION
 ** M: MANUFACTURER/SUB-SUPPLIER, C: CONTRACTOR/NOMINATED INSPECTION AGENCY, N: NTPC, INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION AS APPROPRIATE
 CFP BY NTPC SHALL BE IDENTIFIED IN COLUMN "N" AS "W".
 FORMAT NO: QS-01-QAL-P-10/E3-R0

ANNEXURE -1 to Quality plan
List of NTPC / DVC approved galvanisers

LIST OF GALVANIZERS IS ATTACHED AS PART OF SUB VENDOR LIST

AMARKANTAK CHIMNEY PACKAGE- ELECTRICAL PORTION

INDICATIVE SUB VENDOR LIST

SI No	Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
1	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	ADVANCE POWER PRODUCTS LLP	Mr. Manmohan Damani 24A, Rabindra Sarani, Kolkata Phone- 033-22252463 Pincode : 700073 Email : sales@advancepowerproducts.in	Works-1->Mr. Shrutika Mohta Others Lakshmanpur Industrial Area, Lakshmanpur Domjur -Howrah-WEST BENGAL INDIA Phone- 033-6290750612 FAX : Pincode : 711114 Email : sales@advancepowerproducts.in
2	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	AVAIDS TECHNOVATORS PVT. LTD.	Shri Rajesh Piplani 4A/58, Shankar Road NEW DELHI Phone- 9910481854 Pincode : 110060 Email : rajendra@avaids.biz,papandey@avaids.biz	Works-1->Mr Krishan Kaira DGM 131, Matsya Industrial Area -Alwar-RAJASTHAN INDIA Phone- 9958096168 FAX : Pincode : 301001 Email : engineering@avaids.biz
3	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	EROS INFRASTRUCTURES PVT. LTD.	Mr. Amit Pande MIDC Industrial Area, Butibori, G-97, Nagpur Phone- 0712-3205305 Pincode : 441103 Email : amitp@erosgroup.co.in	Works-1-> MIDC Industrial Area, Butibori, G-97, -Nagpur-MAHARASHTRA INDIA Phone- 0712-3205305 FAX : 0712-2734474 Pincode : 441103 Email : chippa@erosgroup.co.in
4	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	Hobb Internatinal Pvt Ltd	P.s. Pace 10th Floor Suite no 1001 1/1A Mahendra Roy Lane KOLKATA Phone- 9830079313 Pincode : 700046 Email : vedant@hobbinternational.com	
5	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	INDIA ELECTRICALS SYNDICATE	Mr. Suresh Kumar Agarwal 55, Ezra Street, Mo. 9038668684 Kolkata Phone- 033-22354047 Pincode : 700001 Email : cabletray@cabletray.net	Works-1->Mr. Suresh Kumar Agarwal (W) 80, Jawpore Road, -Kolkata-WEST BENGAL India Phone- 033-22354047 FAX : 033-22154005 Pincode : 700074 Email : cabletray@cabletray.net;info@cabletray.net
6	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	INDUSTRIAL PERFORATION (I) PVT.LTD.	MR. A. K. SAHA 327, R.N.GUHA ROAD, DUM DUM KOLKATA Phone- 9830241788 Pincode : 700028 Email : mail@ippi.co.in	Works-1->MR. G. CIJAKRABORTY/MR. A. CIJAKRABORTY 327, R.N.GUHA ROAD,DUM DUM -KOLKATA-WEST BENGAL India Phone- 983093187 FAX : 033 2549 1826 Pincode : 700028 Email :
7	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	PATNY SYSTEMS (P) LTD	PATNY PLAZA 160, SARDAR PATEL ROAD SEUNDRABAD SECUNDRABAD Phone- 040-27902451 Pincode : 500003 Email : mr.mkt@patnysystems.com	Works-1->MR.SURESH/MR.SESIBHUSHAN 9/A, S.V.C.I.E, BALANAGAR, -HYDERABAD-TELANGANA INDIA Phone- 040-27902451 FAX : 040-27902451 Pincode : Email : info@patnysystems.com
8	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	PREMIER POWER PRODUCTS (CAL) PVT. LTD.	Chatterjee International Centre, 33A, Jawaharalal Nehru Road, 6th Floor, Suit No. - 11A, Kolkata, Phone- 9331008739 Pincode : 700071 Email : pppdaga4@gmail.com;info@thepremierpower.co	Works-1->Mr. C.Nayak Jalan Industrial Estate , Gate No. 1,Nr. N.H. - 6 , Village -Howrah-WEST BENGAL INDIA Phone- 9331325598 FAX : Pincode : 711411 Email : pppdaga@vsnl.com;pppdaga@airtelmail.in
9	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	RABI ENGINEERING WORKS PVT. LTD.	MR. TAPAN KUMAR SEN/MR. SIDDHARTHA 327, R.N. GUHA ROAD, DUM DUM, KOLKATA Phone- 9748753002 Pincode : 700028 Email : rabiengineering@gmail.com	
10	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	RAJASTHAN METAL SMELTING CO.	D-80, Road No. 7, V.K.I.A., Jaipur Phone- 9928966443 Pincode : 302013 Email : info@rmscoindia.com	Works-1-> Others D-80, Road No. 7, V.K.I.A., -Jaipur-RAJASTHAN INDIA Phone- FAX : Pincode : 302013 Email : info@rmscoindia.com
11	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	MR. G.D. SINGHEE/MR. MAHESH SINGHEE 26, P.K. TAGORE STREET, MAIN BUILDING KOLKATA Phone- 9830177331 Pincode : 700006 Email : mahesh@ratans.com	Works-1-> Sankral Industrial Park, Bhagabatipur Mauja,Dhulagarh, -Howrah-WEST BENGAL INDIA Phone- FAX : Pincode : 711302 Email :
12	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	RUKMANI ELECTRICAL & COMPONENTS PVT LTD	11A, MAHARISHI DEBENDRA ROAD 1ST FL., ROOM NO.4 KOLKATA Phone- Pincode : 700007 Email : maruthikabra@gmail.com	Works-1->Maruthi Kabra Village : Kharijal, P.O : Dankuni Coal Co, Dist : Hooghly, -Kolkata-WEST BENGAL INDIA Phone- 9330255908 FAX : 033-26590251 Pincode : 712 310 Email : maruthikabra@gmail.com Works-2-> Maruthi Kabra Village, Industrial Area -11A, Coopers, District
13	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	Saral Industries	Mr. Y.K. Gupta L-1, L-2, Industrial Area-1 Sultanpur Road Rae Bareli Phone- 0535-2702474 Pincode : 229010 Email : saralindustries@gmail.com	Works-1->Mr. Y.K. Gupta Others L-1, L-2, Industrial Area-1, Sultanpur Road -Rae Bareli-UTTAR PRADESH INDIA Phone- 0535-2702474 FAX : 0535-2702473 Pincode : 229010 Email : saralindustries@gmail.com
14	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	SV METAL AND EXTRUSIONS PRIVATE LIMITED	Mr. Lalit Kumar Daga E-108, SITE-B, SURAJPUR INDUSTRIAL AREA, GAUTAM BUDDHA NAGAR Phone- 9716627929 Pincode : 201306 Email : info@svmecabletray.com	Works-1->Mr. Lalit Kumar Daga E-108, SITE-B, SURAJPUR INDUSTRIAL AREA, -GAUTAM BUDDHA NAGAR-UTTAR PRADESH INDIA Phone- FAX : Pincode : 201306 Email : info@svmecabletray.com
15	ABOVE GROUND EARTHING & LIGHTNING PROTECTION MATERIALS	UNITECH FABRICATORS and ENGINEERS PVT LTD	INDRAPRASHTHA APARTMENT 24 , M.B.RAOD , BIRATI KALABAGAN KOLKATA KOLKATA Phone- 9836381647 Pincode : 700051 Email : ufepl@rediffmail.com;ufepl@vsnl.net;	Works-1->KAMAL KUMAR BHATTACHARJEE NH-6, BOMBAY ROAD, KONA-CHAMRAIL, -HOWRAH-WEST BENGAL INDIA Phone- 9831 1 79391 FAX : 03212-246428 Pincode : 711 114 Email : ufepl@rediffmail.com
1	MS ROD FOR BELOW GROUND EARTHING	MSP STEEL & POWER LTD.	16/S, BLOCK -A, 1st Floor NEW ALIPORE, KOLKATA Phone- 7381028976 Pincode : 700053 Email : somen.rana@mspsteel.com	Works-1->Somen Rana AGM - Sales & Marketing Vill.-Manuapali, P.O.- Jamgaon , -Raigarh-CHHATTISGARH INDIA Phone- 7381028976 FAX : Pincode : 496001 Email : somen.rana@mspsteel.com
2	MS ROD FOR BELOW GROUND EARTHING	RASHTRIYA ISPAT NIGAM LIMITED	NBCC HOUSE, 1ST FLOOR NEAR SAHAJANAND COLLEGE AMBAWADI AHMEDABAD-380015 Phone- Pincode : Email : rinibsochenai@gmail.com	
3	MS ROD FOR BELOW GROUND EARTHING	Ratusaria Industries Pvt. Ltd	Plot no.643 & 644/A,URLA INDUSTRIAL AREA,URLA RAIPUR Phone- 9752512999 Pincode : 493221 Email : raunak@ratusaria.com	Works-1->Mr. Raunak Agarwal Others PLOT NO.643 &644/A,URLA INDUSTRIAL AREA -RAIPUR-CHHATTISGARH INDIA Phone- 9752512999 FAX : Pincode : 493221 Email : raunak@ratusaria.com
4	MS ROD FOR BELOW GROUND EARTHING	SANVIJAY ROLLING AND ENGINEERING LIMITED	9, Late Shri Puralalaji Agrawal Road, (Formerly Imambada Road) Nagpur Phone- 9850397423 Pincode : 440018 Email : steel@sanvijay.com;tender@sanvijay.com	Works-1->Mr. Sanjay Pradhan Others Unit H3, F-41/43 & F-11/12, MIDC Industrial Area, -Hingna Road, Nagpur-MAHARASHTRA INDIA Phone- 07104-235064 FAX : Pincode : 440016 Email : steel@sanvijay.com
5	MS ROD FOR BELOW GROUND EARTHING	STEEL AUTHORITY OF INDIA LTD.	ISPAT BHAWAN LODI ROAD NEW DELHI Phone- Pincode : 110 003 Email : bmind@sail-steel.com	

ITEM CODE	ITEM/SERVICE DESCRIPTION	SL NO.	VENDOR CODE	ADDRESS		REMARKS	REMARKS
ES16	GI CONDUITS					BIS APPROVED MAKE	
ES17	GI CONDUIT (EPOXY PAINTED)					BIS APPROVED MAKE	
ES18	FLEXIBLE CONDUITS (LEAD COATED)	1	P03	PLICA INDIA PVT. LTD.	V.P.AGARWAL MANAGING DIRECTOR, PLICA INDIA PVT. LTD. 149, MODEL TOWN EAST GHAZIABAD - 201009	M - 9810052131 / 0120-4563979 / 9810557567 Mail: agr@plicaindia.com	
ES19	FLEXIBLE CONDUIT (PVC COATED)					REPUTED MAKE	
ES11	CABLE GLANDS	1	E1201	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA	Mr. Vijay Mohan Sood +(91)-(120)-2525694 +(91)-(120)-3052594 +(91)-(11)-23287156 vijay_mohansood@yahoo.com	
	CABLE GLANDS	2	E1017	ARUP ENGG & FOUNDARY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068	033 2473 0850	
	CABLE GLANDS	3	E1206	BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI-600018	44-24995505,22680990-4	
	CABLE GLANDS	4	E1036	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063	91-022-26852961/62/63 comet@vsnl.net	
	CABLE GLANDS	5	DW08	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	CEO : Mr. Jayantibhai S. Patel TEL: 022-32504770./022-29270876/ 022-29270878.	
	CABLE GLANDS	6	E1044	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	91-22-28324829 / 66919034 devang@electromacglands.com	
	CABLE GLANDS	7	I01	INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001	91-33-2480161/62/63/64 Fax : 91-33-2485766	
ES12	CABLE LUGS	1	E1040	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	CEO : Mr. Jayantibhai S. Patel TEL: 022-32504770./022-29270876/ 022-29270878.	
	CABLE LUGS	2	E1149	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001	033 2282 2540	
ES10	CABLE CLAMPS & CABLE TIES	1	E1045	ELECTROMAC IND.CORPN.	27/28 AF,NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E), MUMBAI-400059	91-22-28324829 / 66919034/ Mr. Devang Patel/ 91-9867074600 devang@electromacglands.com	
	CABLE CLAMPS & CABLE TIES	2	I01	INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001	91-33-2480161/62/63/64 Fax : 91-33-2485766	
	CABLE CLAMPS & CABLE TIES	3	N05	NOVOFLEX MARKETING PVT. LTD.	RAIKVA' - 5TH FLOOR, UNIT-6 3A, RAM MOHAN MULLICK GARDEN LANE KOLKATA - 700 010	Phone: +91 33 2372 0088 Email: sales@novoflex.co.in, novoflex cal@vsnl.net	
ES2	AC LOAD BREAK SWITCH	1	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12- A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
	AC LOAD BREAK SWITCH	2	L01	LK (Formerly L&T)	Lauritz Knudsen Electrical & Automation A/600, SHIL – Mahape Road, TTC Industrial Area, MIDC Thane, Mumbai, Maharashtra 400710	Pranjal Tyagi, Pranjal.Tyagi@lk- ea.com, Mobile - 8976907537, Telephone: +91 22 69327800	
	AC LOAD BREAK SWITCH	3	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com	
	AC LOAD BREAK SWITCH	4	E1076	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687	
	AC LOAD BREAK SWITCH	5	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
ES21	CONTROL SWITCHES/ SELECTOR SWITCH	1	E1076	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687	
	CONTROL SWITCHES/ SELECTOR SWITCH	2	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12- A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
	CONTROL SWITCHES/ SELECTOR SWITCH	3	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479000	
	CONTROL SWITCHES/ SELECTOR SWITCH	4	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	

	CONTROL SWITCHES/ SELECTOR SWITCH	5	SRC01	M/s Shrenik & Co.	39A/3, PANCHRATNA INDUSTRIAL ESTATE, SARKHEJ-BAVLA ROAD, CHANGODAR, AHMEDABAD – 382 213	
	CONTROL SWITCHES/ SELECTOR SWITCH	6	RE05	RECOM PVT. LTD.	M/S RECOM PVT. LTD.,16A , 2ND FLOOR A, WING RAJ INDUSTRIAL COMPLEX, MILITARY ROAD , MAROL ANDHERI (EAST) ,MUMBAI ,MAHARASHTRA STATE : 400059	Mr. Chandrashekar Kamath (MD) : 09820249503
ES45	LIGHTING SWITCH , SOCKET & S/F UNIT	1	F04	ELEXPRO ELECTRICALS PVT/ LTD.	C 1/27 & 37 GIDC KABILPORE NAVSARI- 396424	02637-265140, Mr. Jssk kumar
	LIGHTING SWITCH , SOCKET & S/F UNIT	2	E1012	ANCHOR	STEEL HOUSE, B WING, PLOT NO. 24, MAHAL INDUSTRIAL ESTATE, MAHAKALI CAVES ROAD, NEAR PAPER BOX, ANDHERI (E), MUMBAI, MAHARASHTRA. - 400093	022-30418888.
	LIGHTING SWITCH , SOCKET & S/F UNIT	3	E1076	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687
	LIGHTING SWITCH , SOCKET & S/F UNIT	4	L01	LK (Formerly L&T)	Lauritz Knudsen Electrical & Automation A/600, SHIL – Mahape Road, TTC Industrial Area, MIDC Thane, Mumbai, Maharashtra 400710	Pranjal Tyagi, Pranjali.Tyagi@lk- ea.com, Mobile - 8976907537, Telephone: +91 22 69327800
	LIGHTING SWITCH , SOCKET & S/F UNIT	5	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
	LIGHTING SWITCH , SOCKET & S/F UNIT	6	E1068	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222
ES55	MODULAR SWITCH BOARD	1	E1012	ANCHOR	STEEL HOUSE, B WING, PLOT NO. 24, MAHAL INDUSTRIAL ESTATE, MAHAKALI CAVES ROAD, NEAR PAPER BOX, ANDHERI (E), MUMBAI, MAHARASHTRA. - 400093	022-30418888.
	MODULAR SWITCH BOARD	2	F04	ELEXPRO ELECTRICALS PVT/ LTD.	C 1/27 & 37 GIDC KABILPORE NAVSARI- 396424	02637-265140, Mr. Jssk kumar
	MODULAR SWITCH BOARD	3	HI01	HAVELLS INDIA LIMITED	QRG TOWERS , 2D SECTOR-126, NOIDA- 201301	GIRISH KUMAR SHRIVASTAVA +91-9810528922
ES61	SWITCH BOX	1	E1012	ANCHOR	STEEL HOUSE, B WING, PLOT NO. 24, MAHAL INDUSTRIAL ESTATE, MAHAKALI CAVES ROAD, NEAR PAPER BOX, ANDHERI (E), MUMBAI	022-30418888.
	SWITCH BOX	2	F04	ELEXPRO ELECTRICALS PVT/ LTD.	C 1/27 & 37 GIDC KABILPORE NAVSARI- 396424	02637-265140, Mr. Jssk kumar
	SWITCH BOX	3	B05	BAJAJ ELECTRICALS	BAJAJ ELECTRICALS LTD. ENGINEERING & PROJECTS BU (NORTH) 3rd FLOOR, GULMOHARHOUSE, COMMUNITY CENTRE 161/0, A	CONTACT PERSON : Mr. S. SREEMANY. SR. MANAGER (PROJECTS) CONTACT DETAILS : (+91) 0271025705
	SWITCH BOX	4	A03	AJMER INDUSTRIES & ENGG. WORKS	AJMER INDL. AND ENGG. WORKS. AJMER HOUSE, A-61 / KHAIRANE MIDC. , TTC INDL. AREA, NAVI MUMBAI – 400705.	Tel : 022 27620299 / 97 / 96 'mail@ajmer.net
	SWITCH BOX	5	SB02	S.B. ELECTRICAL ENGINEERING CORPORATION	03, SARDAR GRIHA BUILDING, LOHAR CHAWAL, MUMBAI-400002	022- 22069831; 022-66637259
ES51	MCB	1	E1088	MDS SWITCHGEAR LTD	314-317SHAH NAHAR ESTATE	011 - 25793021
	MCB	2	E1068	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222
	MCB	3	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
	MCB	4	E1120	S&S POWER SWITCHGEAR LTD,	NEW NO. 67, OLD NO. 19, DR. RANGA ROAD, MYLAPORE, CHENNAI - 600004	044 - 24988056, 044 - 24988057, 044 - 24988058
ES7	AUXILIARY RELAYS	1	A24	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449
	AUXILIARY RELAYS	2	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000
	AUXILIARY RELAYS	3	E1075	JYOTI LTD.	JYOTI LIMITED, E&CS DIVISION,3/15, BIDC, GORWA,VADODARA - 390 016, E-MAIL ID: ECS@JYOTI.COM	Ph. No.:+91-265-2281214 , Fax No.:+91-265-2281214
	AUXILIARY RELAYS	4	E1099	OEN INDIA LTD	29/1479, VYTILLA, COCHIN - 682 019 KERALA, INDIA	Phone : +91 484 2301132, 2303709 Fax : +91 484 2302287, 2302221 sales@oenindia.com
	AUXILIARY RELAYS	5	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com
ES28	FUSE BASE	1	E1068	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222
	FUSE BASE	2	G01	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12- A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI- 600032	044-49681447
	FUSE BASE	3	L01	LK (Formerly L&T)	Lauritz Knudsen Electrical & Automation A/600, SHIL – Mahape Road, TTC Industrial Area, MIDC Thane, Mumbai, Maharashtra 400710	Pranjal Tyagi, Pranjali.Tyagi@lk- ea.com, Mobile - 8976907537, Telephone: +91 22 69327800
	FUSE BASE	4	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
	FUSE BASE	5	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 ;amit.bhadauria@siemens.com
	FUSE BASE	6	A24	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449

	FUSE BASE	7	S02	SPACEAGE SWITCHGEARS LTD.	68 & 13-A INDUSTRIAL DEVELOPMENT COLONY, MEHRAULI ROAD GURGAON, HARYANA-122001	0124-2302711, 4085091	
	FUSE BASE	8	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
	FUSE BASE	9	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000	
	FUSE BASE	10	E1050	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060	
ES29	HRC FUSES	1	E1068	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222	
	HRC FUSES	2	G01	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
	HRC FUSES	3	L01	LK (Formerly L&T)	Lauritz Knudsen Electrical & Automation A/600, SHIL – Mahape Road, TTC Industrial Area, MIDC Thane, Mumbai, Maharashtra 400710	Pranjal Tyagi, Pranjali.Tyagi@lke- ea.com, Mobile - 8976907537, Telephone: +91 22 69327800	
	HRC FUSES	4	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
	HRC FUSES	5	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 ;amit.bhadauria@siemens.com	
	HRC FUSES	6	A24	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449	
	HRC FUSES	7	S02	SPACEAGE SWITCHGEARS LTD.	68 & 13-A INDUSTRIAL DEVELOPMENT COLONY, MEHRAULI ROAD GURGAON, HARYANA-122001	0124-2302711, 4085091	
	HRC FUSES	8	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
	HRC FUSES	9	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000	
	HRC FUSES	10	E1050	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060	
ES1	AC CONTACTORS	1	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com	
	AC CONTACTORS	2	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
	AC CONTACTORS	3	E1144	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	TAKEN OVER BY SCHNEIDER
	AC CONTACTORS	4	L01	LK (Formerly L&T)	Lauritz Knudsen Electrical & Automation A/600, SHIL – Mahape Road, TTC Industrial Area, MIDC Thane, Mumbai, Maharashtra 400710	Pranjal Tyagi, Pranjali.Tyagi@lke- ea.com, Mobile - 8976907537, Telephone: +91 22 69327800	
	AC CONTACTORS	5	B04	BCH	20/4, MATHURA ROAD, FARIDABAD, HARYANA-121006	0129-4293000	
ES3	AC MCCB	1	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
	AC MCCB	2	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
	AC MCCB	3	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com	
	AC MCCB	4	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
	AC MCCB	5	L01	LK (Formerly L&T)	Lauritz Knudsen Electrical & Automation A/600, SHIL – Mahape Road, TTC Industrial Area, MIDC Thane, Mumbai, Maharashtra 400710	Pranjal Tyagi, Pranjali.Tyagi@lke- ea.com, Mobile - 8976907537, Telephone: +91 22 69327800	
	AC MCCB	6	C02	CROMPTON GREAVES	RAIL TRANSPORTATION SYSTEMS,VANDANA BUILDING, 11, TOLSTOY MARG, TOLSTOY MARG, NEW DELHI, DL 110001	011 3041 6300	
ES14	EARTH LEAKAGE CB	1	L01	LK (Formerly L&T)	Lauritz Knudsen Electrical & Automation A/600, SHIL – Mahape Road, TTC Industrial Area, MIDC Thane, Mumbai, Maharashtra 400710	Pranjal Tyagi, Pranjali.Tyagi@lke- ea.com, Mobile - 8976907537, Telephone: +91 22 69327800	
	EARTH LEAKAGE CB	2	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com	
	EARTH LEAKAGE CB	3	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
	EARTH LEAKAGE CB	4	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
	EARTH LEAKAGE CB	5	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
	EARTH LEAKAGE CB	6	A24	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449	
	EARTH LEAKAGE CB	7	E1068	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222	

	EARTH LEAKAGE CB	8	E1088	MDS SWITCHGEAR LTD	314-317SHAH NAHAR ESTATE	011 - 25793021	
	EARTH LEAKAGE CB	9	E1120	S&S POWER SWITCHGEAR LTD,	NEW NO. 67, OLD NO. 19, DR. RANGA ROAD, MYLAPORE, CHENNAI - 600004	044 - 24988056, 044 - 24988057, 044 - 24988058	
ES63	TIMERS - PNEUMATIC	1	B04	BCH	20/4, MATHURA ROAD, FARIDABAD, HARYANA-121006	0129-4293000	
	TIMERS - PNEUMATIC	2	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000	
	TIMERS - PNEUMATIC	3	L01	LK (Formerly L&T)	Lauritz Knudsen Electrical & Automation A/600, SHIL – Mahape Road, TTC Industrial Area, MIDC Thane, Mumbai, Maharashtra 400710	Pranjal Tyagi, Pranjal.Tyagi@lk- ea.com, Mobile - 8976907537, Telephone: +91 22 69327800	
	TIMERS - PNEUMATIC	4	E1144	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	TAKEN OVER BY SCHNEIDER
	TIMERS - PNEUMATIC	5	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
	TIMERS - PNEUMATIC	6	E01	ELECTRONIC AUTOMATION PVT. LTD.	20, KHB INDUSTRIAL AREA YELAHANKA BANGLORE-560064	080 -28567561 / 080 -28567562 / 080 -42802345	
ES64	TIMERS - ELECTRONIC	1	E1050	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060	
ES76	MPCB	1	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
	MPCB	2	L01	LK (Formerly L&T)	Lauritz Knudsen Electrical & Automation A/600, SHIL – Mahape Road, TTC Industrial Area, MIDC Thane, Mumbai, Maharashtra 400710	Pranjal Tyagi, Pranjal.Tyagi@lk- ea.com, Mobile - 8976907537, Telephone: +91 22 69327800	
	MPCB	3	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com	
	MPCB	4	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
	MPCB	5	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
	MPCB	6	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
ES79	RCCB	1	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
	RCCB	2	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
	RCCB	3	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com	
	RCCB	4	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
	RCCB	5	L01	LK (Formerly L&T)	Lauritz Knudsen Electrical & Automation A/600, SHIL – Mahape Road, TTC Industrial Area, MIDC Thane, Mumbai, Maharashtra 400710	Pranjal Tyagi, Pranjal.Tyagi@lk- ea.com, Mobile - 8976907537, Telephone: +91 22 69327800	
	RCCB	6	C02	CROMPTON GREAVES	RAIL TRANSPORTATION SYSTEMS,VANDANA BUILDING, 11, TOLSTOY MARG, TOLSTOY MARG, NEW DELHI, DL 110001	011 3041 6300	
ES49	LIGHTING PANEL (FLAME PROOF)	1	E1206	BALIGA ELECTRICALS	63A,CP RAMASWAMY ROAD, PB NO 6910, CHENNAI-600018	44-24995505,22680990-4	
	LIGHTING PANEL (FLAME PROOF)	2	SS01	SUDHIR SWITCHGEAR	305/6, APEEJAY HOUSE, 130, BOMBAY SAMACHAR MARG, MUMBAI - 400 023, INDIA	Telephone Nos. : 40460000 (100 lines) Fax Nos. : ++-91-22-22049381 Email : md@sudhirsutchgears.com ; works@sudhirsutchgears.com ; scud@vsnl.com	
ES91	LED BASED HIGH INTENSITY AVIATION WARNING LIGHTS	1	INS1	M/s INSTA POWER LIMITED	Correspondence Address: M/s Insta Power Limited, S-19, Panch Shila Park, New-Delhi-110017 Manufacturing Unit: M/s Insta Power Limited, Khasra No. 103M, Raipur Industrial Area, Raipur, Bhagwanpur, Roorkee, Uttrakhand-247661	Manu Thakur (electrical1@instapower.com) Deepak Gupta (deepak.gupta@instapower.com) Abhijit R Vaish (abhijit.rai@instapower.com) Satyajit R Vaish (satyajit@instapower.com)	
	LIGHTING FIXTURES (LED)	1	NE01	Neev Luminaries	B-6/3 Okhla Industrial Area Phase-2 New Delhi 110020	Phone: 011 40604830-31, M:8826995888 Fax: +91 11 4060 4831 info@neevenergy.in, Jitendra Sahu <jsahu@neevenergy.com>	
	LIGHTING FIXTURES (LED)	2	HI01	HAVELLS INDIA LIMITED	QRG TOWERS , 2D SECTOR-126, NOIDA-201301	GIRISH KUMAR SHRIVASTAVA +91-9810528922, girish.srivastava@havells.com\	

ES40	LIGHTING FIXTURES (LED)	3	B05	BAJAJ ELECTRICALS	BAJAJ ELECTRICALS LTD. ENGINEERING & PROJECTS BU (NORTH) 3rd FLOOR, GULMOHARHOUSE, COMMUNITY CENTRE 161/B-4, GAUTAM NAGAR, YUSUF SARAI NEW DELHI – 110049	CONTACT PERSON : Mr. S. SREEMANY. SR. MANAGER (PROJECTS) CONTACT DETAILS : (+91) 9871025705. MAIL ID : srabans@bajajelectricals.com;	
	LIGHTING FIXTURES (LED)	4	SR01	SURYA ROSHNI LIMITED		011-25810093 ; 9810071832 (Akhilesh Agrawal) aagrawal@sroshni.com	
	LIGHTING FIXTURES (LED)	5	P01	PHILIPS	9TH FLOOR,DLF 9B, DLF CYBER CITY, DLF PHASE-III,GURGAON-122002	01244606001, Sharad (+919871150447), Mr. Guruseelan M 8939693949, Mr Ashish Sethi 9007077089	
	LIGHTING FIXTURES (LED)	6	HP01	M/S HPL ELECTRIC & POWER PVT. LTD	M/S HPL ELECTRIC & POWER PVT. LTD. PLOT NO. 76-B,PHASE-IV, SEC-57, HSIIDC, INDL. AREA , KUNDLI, DIST.- SONEPAT (HARYANA) - 131028	mohitsharma@hplindia.com, Mr. Nitesh Verma 8851036938, Mr Ajay lakra 9560045423	
	LIGHTING FIXTURES (LED)	7	INS1	INSTA POWER	PLOT NO. - 457 PHASE - V, UDYOG VIHAR, GURGAON - 122016	124-4124000, Mr amit Bhardwar: 8800508090	
	LIGHTING FIXTURES (LED)	8	PT13	Pyrotech Electronics Pvt. Ltd.	M/s Pyrotech Electronics Pvt. Ltd.(Unit -1) Led Light, Sensor Division F-16A, Road No.3 Mewar Industrial Area, Madri Udaipur -313003, Rajasthan,	Concern Person – Mr. Praveen sisodiya : 9314310042(ipsisodia@pyrotechlighting.com) Ms Ritika 9509245814	
	LIGHTING FIXTURES (LED)	9	HN13	M/s Halonix Technologies Limited	M/s Halonix Technologies Limited B-31 , Phase –II, Noida Distt. Gautam Budh Nagar (U.P.) Pin- 201305	Mr. Mohit Gautam 'Tel: +919568152111 'mohit.gautam@halonix.co.in'; M: 9891868793'rahul.singh@halonix.co.in'	
	LIGHTING FIXTURES (LED)	10	JA13	M/s JAQUAR & COMPANY PVT. LTD.	M/s JAQUAR & COMPANY PVT. LTD. Plot No.3 , Sector M-11, IMT Manesar. Gurgaon- 122050 Haryana	Mr. Dhruv Kumar 'Tel: +919350043727 dhruv.kumar@jaquar.com ; gaurav.bhalla@jaquar.com ; 9582950282	
	LIGHTING FIXTURES (LED)	11	CR13	M/s CROMPTON GREAVES CONSUMER ELECTRICALS LTD.	M/s CROMPTON GREAVES CONSUMER ELECTRICALS LTD.Tower-3, 1st Floor, East Wing Equinox Business Park LBS Marg, Kurla (West), Mumbai-400070	Mr S L Sivakumar 'Sivakumar L' <sivakumar.sl@crompton.co.in> M: 9176609363	
	LIGHTING FIXTURES (LED)	12	WI13	M/s WIPRO ENTERPRISES PRIVATE LTD.	M/s WIPRO ENTERPRISES PRIVATE LTD. L-8, MIDC Waluj, Aurangabad-431136, Maharashtra, India	Ms Dhanya K K 'dhanya.kk8@wipro.com' M 9891815476, Mr Puneet kalia 'puneet.kalia@wipro.com'	
	LIGHTING FIXTURES (LED)	13	NI13	M/s Nessa Illumination Technologies Pvt. Ltd.	M/s Nessa Illumination Technologies Pvt. Ltd.36/A Devraj Industrial Park, Opp. Sameep Fabrics, Pipalaj Pirana Road, Piplaj, Ahmedabad	Mr. Dhaval Shah <dhalval@nessa.in> M 9825650354, Mr. Akshat Khare <akshat@nessa.in> M: 9016111723	
	LIGHTING FIXTURES (LED)	14	FE13	M/s. Forus Electric Pvt. Ltd.	M/s. Forus Electric Pvt. Ltd. B-313, Okhla Industrial Area, Phase-1, New delhi-110020	Mr. Amit Bharadwaj <amit.bharadwaj@foruselectric.com > M 8800508090, Mr. Uttam Goyal <uttam@foruselectric.com> M: 8527652687	
	LIGHTING FIXTURES (LED)	15	OE13	M/s. ORIENT ELECTRIC LIMITED.	C- 130, Sector-63, Noida-201301, Uttar Pradesh, D-209, Sector-63, Noida-201301, Uttar Pradesh	Birjendra Kumar Yadav <birjendra.yadav@orientelectric.com > P. +91-120-4894900 , +91-9599848491	
	LIGHTING FIXTURES (LED)	16	ME13	M/s Mika Engineers	Survey no. 47, shed no. 2, AGHAI, Shahpurwada road, AGHAI Thane, Maharashtra-421601	"deepak" <deepak@mikaengineers.com>MOB: 8976737543	
	LIGHTING FIXTURES (LED)	17	KI13	M/s Kalingia Illuminatn Pvt Ltd.	15/3/2 SITE-IV SAHIBABAD INDUSTRIAL AREA GHAZIABAD UP 201010	Bidyut Mandal' <bidyut.mandal@kalingialights.com> (M: 9555367941 / 9315029882), 'Suresh Shiromani' <suresh.shiromani@kalingialights.com>, 'info@kalingialights.com', 'kalingialights@gmail.com'	
	LIGHTING FIXTURES (LED)	18	LL13	Ledure Lightings Limited	Registered Office Address: 115, First Floor, Devika Tower Nehru Place, New Delhi - 110091 Works Address: A-40, Sector-58, Noida, Gautam Buddha Nagar, Uttar Pradesh - 201301	Mr. Umang Aggarwal Email ID: tenders@ledure.com; Ph. No.: 9313370712	
	RECEPTACLES - DECORATIVE	1	E1012	ANCHOR	STEEL HOUSE, B WING, PLOT NO. 24, MAHAL INDUSTRIAL ESTATE, MAHAKALI CAVES ROAD, NEAR PAPER BOX, ANDHERI (E), MUMBAI, MAHARASHTRA.- 400093	022-30418888.	
	RECEPTACLES - DECORATIVE	2	F04	ELEXPRO ELECTRICALS PVT/ LTD.	C 1/27 & 37 GIDC KABILPORE NAVSARI-396424	02637-265140, Mr. Jssk kumar	

ES59	RECEPTACLES - DECORATIVE	3	B05	BAJAJ ELECTRICALS	BAJAJ ELECTRICALS LTD. ENGINEERING & PROJECTS BU (NORTH) 3rd FLOOR, GULMOHARHOUSE, COMMUNITY CENTRE 161/B-4, GAUTAM NAGAR, YUSUF SARAI NEW DELHI – 110049	CONTACT PERSON : Mr. S. SREEMANY. SR. MANAGER (PROJECTS) CONTACT DETAILS : (+91) 9871025705. MAIL ID : srabans@bajajelectricals.com;	
	RECEPTACLES - DECORATIVE	4	A03	AJMERA INDUSTRIES & ENGG. WORKS	AJMERA INDL. AND ENGG. WORKS. AJMERA HOUSE, A-61 / KHAIRANE MIDC. , TTC INDL. AREA, NAVI MUMBAI – 400705.	Tel : 022 27620299 / 97 / 96 'mail@ajmera.net	
ES68	RECEPTACLE (NON FLAME PROOF)	1	A03	AJMERA INDUSTRIES & ENGG. WORKS	AJMERA INDL. AND ENGG. WORKS. AJMERA HOUSE, A-61 / KHAIRANE MIDC. , TTC INDL. AREA, NAVI MUMBAI – 400705.	Tel : 022 27620299 / 97 / 96 'mail@ajmera.net	
	RECEPTACLE (NON FLAME PROOF)	2	C02	CROMPTON GREAVES	3RD FLOOR, EXPRESS BUILDING,9-10, BAHADUR SHAH ZAFAR MARG, NEAR ITO CROSSING,NEW DELHI-110002, INDIA	91 11 23460700 - 999 'Sunil.Das@cgglobal.com	
	RECEPTACLE (NON FLAME PROOF)	3	E1207	CYCLO ELECTRIC DEVICE & SERV.CO.	: A-3, NEAR ANTHEM BIOSCIENCE, KSSIDC INDUSTRIAL AREA, BOMMASANDRA, BOMMASANDRA INDUSTRIAL AREA, BANGALORE, KARNATAKA 560099	Mr. H.Jaishanker +919845039081, 080 - 27833102 , 080 - 27833103 : +91 80 41460985 'cycloelectric@gmail.com	
	RECEPTACLE (NON FLAME PROOF)	4	B04	BCH	20/4, MATHURA ROAD, FARIDABAD - 121006, HARYANA, INDIA	0(129)-4063000, 9015800189(Ramesh Giri) 'ramesh.giri@bchindia.com	
	RECEPTACLE (NON FLAME PROOF)	5	B02	BEST & CROMPTON	BEST & CROMPTON ENGINEERING LTD 28C, AMBATTUR INDUSTRIAL ESTATE (NORTH) AMBATTUR, CHENNAI - 600 098	Ph : +91 44 4551 4724 , MRKT DGM Mr. VI Raj: 9840593411 'bestcromptonviraj@gmail.com	
ES80	PVC WIRES	BIS APPROVED MAKE					
ES46	LIGHTING TRANSFORMER	1	E1021	AUTOMATIC ELECTRIC LTD.	ADDRESS : 96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482	
	LIGHTING TRANSFORMER	2	E1066	INDCOIL	PLOT NO. A- 150/ 151, 23RD U ROAD, WAGLE ESTATE, THANE WEST, CST RD, FRIENDS COLONY, HALLOW PUL, KURLA WEST, MUMBAI, MAHARASHTRA 400070	Phone:022 2583 8305	
	LIGHTING TRANSFORMER	3	E1103	POWER PACK ENTERPRISES	POWER PACK ENTERPRISES MR. NEHAL SHAH / MR. SHARAD SHAH (PARTNER) NO. 3, JAYSHREE SADAN, 1ST FLOOR, OLD NAGARDAS ROAD, ANDHERI EAST MUMBAI - 400069, MAHARASHTRA, INDIA	Call Us:08447573761 Mobile: +(91)-9821787821 +(91)-9821035604	
	LIGHTING TRANSFORMER	4	E1155	VIJAY ELECTRICALS LTD.	6-3-648/1&2, OFF RAJ BHAVAN ROAD, SOMAJIGUDA, HYDERABAD - 500 082. ANDHRA PRADESH, INDIA.	Vijay Electricals Mr. Bharat Giri / Ajay Giri (CEO) B 79, Gali No. 60, Sanjay Colony, Sector- 23 Faridabad - 121005, Haryana, India Call Us: 09953353612 websales@vijajelectricals.com	
	LIGHTING TRANSFORMER	5	E1057	GILBERT & MAXWELL	WORKS PLOT G-28 , M.I.D.C., AMBAD NASHIK - 422010, MAHARASHTRA, INDIA	Mr. Sanjeev Kulkarni, (Marketing Manager) Cell: 9822586724 sanjeevkulkarni@gilbert-maxwell.in Phone : + 91 - 253 - 238 25 51 Fax : + 91 - 253 - 238 25 52	
	LIGHTING TRANSFORMER	6	K18	KAPPA ELECTRICALS	KAPPA ELECTRICALS, KAPPA CONSOLIDATED PVT. LTD., SOUTHERN ELECTRIKS 14, CART TRACK ROAD, MADUVANKARAI, CHENNAI - 600 042, INDIA.	PHONE: +91 - 44 - 22454709, 22454516, 22450794, 22450795 FAX: +91 - 44 - 22351662, 22451693 E-MAIL: mira@kappaelectricals.com sales@kappaelectricals.com	
	LIGHTING TRANSFORMER	7	AIE01	Ames Impex Electricals Pvt. Ltd	C-18/1207, PHASE IV, GIDC NARODA, AHMEDABAD, GUJARAT 382330	Phone:079 2282 1648	
	LIGHTING TRANSFORMER and Control transformer	1	GPID01	Gujarat Plug - In Devices Pvt Ltd	565, Village - Latipura, Taluka – Padra, Vadodra – 391440	GPD Marketing' <marketing1@gpd- transformers.com>; 'Gitesh Chitaliya' <gitesh@gpd-transformers.com> Mr Gitesh: 9925237223	Registered on 08.08.14, renewed on 15.04.24

Makes of sub-vendor and equipment/components mentioned in the above list are indicative and shall be subject to Customer/BHEL approval. The bidder may propose name of additional sub-vendors makes based on their experience, which will be subject to Customer/BHEL approval.