BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS GROUP
ENGINEERING MANAGEMENT

BHEL Document No.	TB-316-369-014	Rev No.		Prepared by	Checked by	Approved by
		00	Name	AK	AS	AS
Type of Document	TECHNICAL SPECIFICATION		Sign			
Title	ILLUMINATION SYSTEM		Date	26/05/16	27/05/16	30/05/16
			Group	TBEM		

Customer	**NTPC LTD.**
Projects	**North Karanpura Super TPP (3x660MW)** **1. 400/220kV Switchyard at NKSTPP** **2. 220kV Sub-station at Chatti Bariatu & Kerandari-A Mine**

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Note: GTP shall be submitted during Detailed Engineering.

Rev No.	Date	Altered	Checked		

Distribution						

SECTION 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0.1 This technical specification covers the requirements of design, manufacture, testing at works, packing, dispatch, storage, erection, testing & commissioning of complete Illumination and associated electrical auxiliary system, complete with accessories. No deviation from the requirements specified in various clauses of this specification shall be allowed. A certificate to this effect shall have to be furnished along with the offer as per attached Annexure-3.

1.0.2 The Contract shall be on Bill of Quantity basis for the package. In case of change in scope after award of the contract, the additions/ deletions to the scope shall be as per the breakup unit rates for all the equipment and services furnished by the bidder in his offer. The Contractor shall be responsible for the design and verification of the Illumination system, demonstration of lux levels and other criteria at site.

1.0.3 After placement of order, the bidder has to design the system as per relevant standard/codes to the satisfaction of BHEL/NTPC.

1.0.4 It is not the intent to specify herein all the details of design and manufacturing. The equipment and the system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to Purchaser/Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject material, which in his judgment is not in full accordance herewith.

1.0.5 The Bidder shall have deemed to have understood completely all the Tender drawings and documents and quoted accordingly.

1.0.6 The term "Owner' appearing in this specification shall refer to ultimate customer, the term 'Purchaser" shall refer to BHEL and the term 'Contractor" shall refer to the successful Bidder.

1.0.7 It is the responsibility of the successful Bidder to obtain necessary approval/clearance from statutory organizations wherever applicable for the equipment/systems under the scope specified.

CUSTOMER: **NTPC LTD.**
PROJECT: **North Karanpura Super TPP (3x660MW)**
1. 400/220kV Switchyard at NKSTPP
2. 220kV Sub-station at Chatti Bariatu & Kerandari-A Mine

The specification comprise of following sections:

Section-1: Scope, Specific Technical Requirement & Bill of Quantities.
Section-2: Equipment Specification.
Section-3: Project Details & General technical requirements.
Section-4: Equipment Data Sheet

In case of any conflict between various sections, order of precedence shall be in the

same order as listed above.

1.1 ILLUMINATION & SMALL POWER SYSTEM REQUIREMENT FOR VARIOUS AREAS

The illumination system shall be provided for the following areas:

(i) 400/220kV Switchyard area at NKSTPP – Complete area as marked in the layout drawing (NTPC Drg. No. 4410-001-572-PVE-F-0013, Rev. 03) including Street Lighting.

(ii) 220kV Sub-station at Chatti Bariatu & Kerandari-A mine – 5 No. bays in BHEL scope as marked in layout drawing (NTPC Drg. No. 4410-001-572-PVE-F-0013A, Rev. 02) including Street Lighting.

(iii) Switchyard Control Building as per ARCHITECTURE LAYOUT OF CONTROL BUILDING LAYOUT (NTPC Drg. No. 4410-001-572-PVC-C-0497, Rev 02).

1.2 DESIGN CRITERIA FOR SWITCHYARD AREA

As per NTPC specification for North Karanpura enclosed as Annexure-1 of Section-1 & equipment specification given in Section-2.

[illegible] SCOPE O[illegible] SUPPL[illegible]ES [illegible] SER[illegible]CES

1.3.1 SCOPE OF SUPPLY MATERIAL & ERECTION MATERIAL

a) The main items to be furnished for Substation under this contract are detailed in Bill of Quantity (Annexure-2) and shall be read in conjunction with other clauses of this specification.

b) All associated items, though not specifically mentioned but required for safe and satisfactory operation of equipment/ system will also be treated as included and the same shall be supplied at NO EXTRA COST to Purchaser.

c) Further, in case any type of luminaries/ panels etc not included below but are required to meet the technical specification shall be specifically brought out in the offer/shall be supplied.

d) 415V MSB/ ACDB, 415V EPDB, 415V AC & Ventilation Board and 220V DCDB boards are being supplied and erected by the owner. Illumination contractor will terminate the cables in these panels.

1.3.2 FREE ISSUE ITEMS FROM PURCHASER

Power Cables: Following are the various cable sizes that may be used for project execution. Bidder shall estimate the cables required for successful completion of the full

scope of works and furnish the break up of quantity as an annexure to the un-priced schedule. The quantity of the cables shall be free issued to the successful bidder as per this annexure. The laying and termination of the estimated quantities of cables shall be in the scope of the bidder. No variation shall be admissible to the contractor so far the input remains unchanged.

1) 2core x 2.5 sq.mm (PVC/ Cu.)
2) 2core x 6 sq.mm (PVC/ Al.)
3) 4 core x 6 sq.mm (PVC/ Al.)
4) 4 core x 10 sq.mm (PVC/ Cu.)
5) 4 core x 16 sq.mm (PVC/ Al.)
6) 3.5 core x 70 sq.mm (PVC/ Al.)
7) 3.5 core x 150 sq.mm (XLPE / Al.)
8) 3.5 core x 300 sq.mm (XLPE / Al.)

Earthing Flats: Galvanised Earthing Flat shall be available with the purchaser. Bidder shall estimate the GI Flats for successful completion of the full scope of works and furnish the quantity as an annexure to the un-priced schedule. The quantity of the GI Flat shall be free issued to the successful bidder as per this annexure. The installation of the estimated quantities of GI flats shall be in the scope of the bidder. No variation shall be admissible to the Contractor so far the input remains unchanged. Sizes available are 75x12mm and 50x6mm GI Flats.

GI Conduits: Galvanised conduits of 50mm & 100mm dia shall be available with the purchaser. The installation of the estimated quantities of GI conduits shall be in the scope of the bidder.

1.3.3 SCOPE OF SERVICES

The bidder shall quote for ETC, civil works, cable termination & earthing against each item as applicable. The list is attached as Annexure-2 (BOQ).

1.3.3.1 Erection, Commissioning & Testing

The Contractor shall give the offer for Erection, Testing and Commissioning of the Illumination Equipments at Site.

The scope of ETC shall include receipt of material at site, safe storage of material, handling of equipment/ material at site, erection of equipment / material at site including fabrication, equipment and system testing, commissioning of the entire system.

Conducting lux level measurement as per approved designs to the satisfaction of Owner / purchaser.

Laying and termination of power and control cables for the equipment under the scope of this specification.

All material and consumables required for erection work shall be in Contractor's scope. Erection material shall cover, but not be limited to, Clamps etc for Luminaries,

Connections between Junction Boxes and Luminaries in outdoor area, All cable glands, lugs and ferrules require for cabling/ wiring. Any other material required for erection shall deemed to be in Contractor's scope. Holes shall not be drilled on the Galvanised substation gantry and LM structures.
Earthing of all electrical equipment.

Contractor shall arrange all machinery tools & tackles, instruments and consumables required for erection, commissioning and testing of the system.

Contractor shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The contractor shall furnish a list of Commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the Bidder.

1.3.3.2 Civil Works

Civil works such as foundation for Outdoor Panels, Lighting Poles, 30m Lighting Mast etc. shall be done by the contractor. The rates for these civil works shall be included in the erection rates of respective items.

1.4 TYPE TESTS

The type test reports shall not be more than ten years prior from **28.11.2013**. If any or all test reports are more than ten years old or are not valid then type tests shall be conducted free of charge.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design / manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the Technical Specification on any/all additional type tests not carried out, same shall be carried out without any additional cost implication to the Purchaser.

All type tests as per relevant standards shall be submitted for each type rating of lighting fixtures and lamps with adequate details/drawings to establish equivalence with the offered type.

1.5 QUALITY PLAN

Manufacturer shall follow the Approved Manufacturing & Field Quality Plan of BHEL/ NTPC.

1.6 HANDING & TAKING OVER

It is the responsibility of the Contractor to run and maintain the system supplied by them for a period of 3 months and subsequently hand over the same to BHEL/owner. Contractor shall assist BHEL to hand over the system supplied by them to owner.

1.7 UTILITIES AVAILABLE

Construction water and 415V power shall be available at one point at substation. Bidder shall be required to make own arrangement for taking supplies from there.

ANNEXURE-3

It is confirmed that there are no deviations and the offer is in full compliance with the specification. It is also confirmed that there are no deviations in any other form such as comments, variations and/ or exceptions. Further it is confirmed that at all drawings / data sheets/QP/ type tests reports shall be submitted to BHEL for organizing approval of ultimate customer. Also, furnishing of all relevant information / repetition of type tests (if required for meeting the specification requirement) shall be carried out by us at no extra cost to BHEL & without affecting delivery requirements.

Signature of the authorized representative of Bidder

Name _____

Designation_____

Place_____

Date _____

Company seal

S□ N□		□ESCR□PT□ON	UN□T	N□STPP □T□	M□NE □T□
1	S□□□□	Supply of Main Lighting Distribution Board (MLDB) comprising 415V, 250A, 3-Ph, 4-wire bus and one number Lighting transformer: 100kVA. One incomer TPN SFU of 250A, Ougoing feeders 9 Nos. 63A TPN SFU (Inclusive of CT, Voltmeter, Ammeter, Contactor with timer, indicating lamps etc)	Nos.	2	0
2	ETC	ETC of Main Lighting Distribution Board (MLDB) comprising 415V, 250A, 3-Ph, 4-wire bus and one number Lighting transformer: 100kVA. One incomer TPN SFU of 250A, Ougoing feeders 9 Nos. 63A TPN SFU (Inclusive of CT, Voltmeter, Ammeter, Contactor with timer, indicating lamps etc)	Nos.	2	0
3	S□□□□	Supply of Emergency Lighting Distribution Board (ELDB) comprising 415V, 100A, 3-Ph, 4-wire bus. One number 100kVA lighting transformer having one incomer of 100A TPN SFU and 5 Nos. outgoing feeders of 63A TPN SFU (Inclusive of CT, Voltmeter, Ammeter, Contactor with timer, indicating lamps etc)	Nos.	1	0
4	ETC	ETC of Emergency Lighting Distribution Board (ELDB) comprising 415V, 100A, 3-Ph, 4-wire bus. One number 100kVA lighting transformer having one incomer of 100A TPN SFU and 5 Nos. outgoing feeders of 63A TPN SFU (Inclusive of CT, Voltmeter, Ammeter, Contactor with timer, indicating lamps etc)	Nos.	1	0
5	S□□□□	Supply of Main Lighting Distribution Board (MLDB) for Mine end as per drawing no. 4410-001-572-PVE-P-0011 comprising 415V, 100A, 3-Ph, 4-wire bus and one number Lighting transformer: 100kVA, Ougoing feeders 4 Nos. 63A TPN SFU (Inclusive of CT, Voltmeter, Ammeter, Contactor with timer, indicating lamps etc)	Nos.	0	1
6	ETC	ETC of Main Lighting Distribution Board (MLDB) for Mine end as per drawing no. 4410-001-572-PVE-P-0011 comprising 415V, 100A, 3-Ph, 4-wire bus and one number Lighting transformer: 100kVA, Ougoing feeders 4 Nos. 63A TPN SFU (Inclusive of CT, Voltmeter, Ammeter, Contactor with timer, indicating lamps etc)	Nos.	0	1
7	S□□□□	Supply of Emergency Lighting Distribution Board (ELDB) for Mine end as per drawing no. 4410-001-572-PVE-P-0011 comprising 415V, 100A, 3-Ph, 4-wire bus. One number 100kVA lighting transformer, 3 Nos. outgoing feeders of 63A TPN SFU (Inclusive of CT, Voltmeter, Ammeter, Contactor with timer, indicating lamps etc)	Nos.	0	1
8	ETC	ETC of Emergency Lighting Distribution Board (ELDB) for Mine end as per drawing no. 4410-001-572-PVE-P-0011 comprising 415V, 100A, 3-Ph, 4-wire bus. One number 100kVA lighting transformer, 3 Nos. outgoing feeders of 63A TPN SFU (Inclusive of CT, Voltmeter, Ammeter, Contactor with timer, indicating lamps etc)	Nos.	0	1
9	S□□□□	Supply of Indoor Lighting Panel - Type LP-1	Nos.	3	0
10	ETC	ETC of Indoor Lighting Panel - Type LP-1	Nos.	3	0
11	S□□□□	Supply of Indoor Lighting Panel - Type LP-2	Nos.	1	0
12	ETC	ETC of Indoor Lighting Panel - Type LP-2	Nos.	1	0
13	S□□□□	Supply of Indoor DC Lighting Panel DCLP - Type LP-D1	Nos.	1	0
14	ETC	ETC of Indoor DC Lighting Panel DCLP - Type LP-D1	Nos.	1	0
15	S□□□□	Supply of Switchboard - Type SWB-1	Nos.	23	0
16	ETC	ETC of Switchboard - Type SWB-1	Nos.	23	0
17	S□□□□	Supply of Switchboard - Type SWB-2	Nos.	5	0
18	ETC	ETC of Switchboard - Type SWB-2	Nos.	5	0
19	S□□□□	Supply of Switchboard - Type SWB-3	Nos.	4	0
20	ETC	ETC of Switchboard - Type SWB-3	Nos.	4	0
21	S□□□□	Supply of Switchboard - Type SWB-4	Nos.	5	0
22	ETC	ETC of Switchboard - Type SWB-4	Nos.	5	0
23	S□□□□	Supply of Switchboard - Type SWB-5	Nos.	1	0
24	ETC	ETC of Switchboard - Type SWB-5	Nos.	1	0
25	S□□□□	Supply of Receptacle - 20A (Industrial) RA type	Nos.	20	0
26	ETC	ETC of Receptacle - 20A (Industrial) RA type	Nos.	20	0
27	S□□□□	Supply of Receptacle - 6/16A Decorative RB type	Nos.	53	0
28	ETC	ETC of Receptacle - 6/16A Decorative RB type	Nos.	53	0
29	S□□□□	Supply of Receptacle - 415 V, 63A, 3-PH (Industrial type)	Nos.	2	0
30	ETC	ETC of Receptacle - 415 V, 63A, 3-PH (Industrial type)	Nos.	2	0
31	S□□□□	Supply of 10A, 24V AC, SP, 3 pin Outdoor Receptacle	Nos.	1	0
32	ETC	ETC of 10A, 24V AC, SP, 3 pin Outdoor Receptacle	Nos.	1	0
33	S□□□□	Supply of Indoor lighting fixtures - Recessed LED type	Nos.	35	0
34	ETC	ETC of Indoor lighting fixtures - Recessed LED type	Nos.	35	0
35	S□□□□	Supply of Indoor lighting fixtures - FR2 type	Nos.	25	0
36	ETC	ETC of Indoor lighting fixtures - FR2 type	Nos.	25	0
37	S□□□□	Supply of Indoor lighting fixtures - FR2S type	Nos.	1	0
38	ETC	ETC of Indoor lighting fixtures - FR2S type	Nos.	1	0
39	S□□□□	Supply of Indoor lighting fixtures - FR1 type	Nos.	45	0
40	ETC	ETC of Indoor lighting fixtures - FR1 type	Nos.	45	0
41	S□□□□	Supply of Indoor lighting fixtures - FR1S type	Nos.	1	0
42	ETC	ETC of Indoor lighting fixtures - FR1S type	Nos.	1	0
43	S□□□□	Supply of Indoor lighting fixtures - FI type	Nos.	38	0
44	ETC	ETC of Indoor lighting fixtures - FI type	Nos.	38	0
45	S□□□□	Supply of Indoor lighting fixtures - FI1 type	Nos.	1	0
46	ETC	ETC of Indoor lighting fixtures - FI1 type	Nos.	1	0
47	S□□□□	Supply of Indoor lighting fixtures - FI-1D type	Nos.	1	0
48	ETC	ETC of Indoor lighting fixtures - FI-1D type	Nos.	1	0
49	S□□□□	Supply of Indoor lighting fixtures - FB type	Nos.	10	0
50	ETC	ETC of Indoor lighting fixtures - FB type	Nos.	10	0
51	S□□□□	Supply of Indoor lighting fixtures - FB1 type	Nos.	1	0
52	ETC	ETC of Indoor lighting fixtures - FB1 type	Nos.	1	0
53	S□□□□	Supply of Indoor lighting fixtures - FC type	Nos.	25	0
54	ETC	ETC of Indoor lighting fixtures - FC type	Nos.	25	0
55	S□□□□	Supply of Emergency DC lighting fixtures - IB type	Nos.	15	0
56	ETC	ETC of Emergency DC lighting fixtures - IB type	Nos.	15	0
57	S□□□□	Supply of Emergency DC lighting fixtures - IR type	Nos.	20	0
58	ETC	ETC of Emergency DC lighting fixtures - IR type	Nos.	20	0
59	S□□□□	Supply of Occupancy based Infra Red Sensors	Nos.	15	0
60	ETC	ETC of Occupancy based Infra Red Sensors	Nos.	15	0
61	S□□□□	Supply of Exit Sign Boards	Nos.	20	0
62	ETC	ETC of Exit Sign Boards	Nos.	20	0
63	S□□□□	Supply of Exhaust fans - 600 CMH @ 7mm WC Exhaust fans with metal sheet crawl & bird screen for Toilets	No.	2	0
64	ETC	ETC of Exhaust fans - 600 CMH @ 7mm WC Exhaust fans with metal sheet crawl & bird screen for Toilets	No.	2	0
65	S□□□□	Supply of Exhaust fans - 1000 CMH @ 7mm WC Exhaust fans with metal sheet crawl & bird screen for Toilets	No.	2	0
66	ETC	ETC of Exhaust fans - 1000 CMH @ 7mm WC Exhaust fans with metal sheet crawl & bird screen for Toilets	No.	2	0
67	S□□□□	Supply of Exhaust fans - 1500 CMH @ 7mm WC Exhaust fans with metal sheet crawl & bird screen for Pantry	No.	1	0
68	ETC	ETC of Exhaust fans - 1500 CMH @ 7mm WC Exhaust fans with metal sheet crawl & bird screen for Pantry	No.	1	0
69	S□□□□	Supply of Ceiling fans 1200mm sweep with electronic regulator, fan hook, suspension rod etc.	No.	6	0
70	ETC	ETC of Ceiling fans 1200mm sweep with electronic regulator, fan hook, suspension rod etc.	No.	6	0
71	S□□□□	Supply of Wall mounted fans 400mm sweep	No.	5	0
72	ETC	ETC of Wall mounted fans 400mm sweep	No.	5	0
73	S□□□□	Supply of Step Ladder (SL2) with height 2.1 Mtr./ 3.6 Mtr.	No.	1	0
74	S□□□□	Supply of Outdoor Lighting Panel - Type LP-1	Nos.	11	2
75	ETC	ETC of Outdoor Lighting Panel - Type LP-1	Nos.	11	2
76	S□□□□	Supply of Outdoor Lighting Panel - Type LP-2	Nos.	3	1

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77	**ETC**	ETC of Outdoor Lighting Panel - Type LP-2	Nos.	3	1
78	**S**□□□□	Supply of Outdoor Junction boxes -Type JB-F	Nos.	30	6
79	**ETC**	ETC of Outdoor Junction boxes -Type JB-F	Nos.	30	6
80	**S**□□□□	Supply of Outdoor Junction boxes -Type JB-S	Nos.	100	15
81	**ETC**	ETC of Outdoor Junction boxes -Type JB-S	Nos.	100	15
82	**S**□□□□	Supply of Outdoor Junction boxes -Type JB-M1	Nos.	2	1
83	**ETC**	ETC of Outdoor Junction boxes -Type JB-M1	Nos.	2	1
84	**S**□□□□	Supply of 63A, 3-Phase, 4-Pin Interlocked industrial grade rotatry switch socket, Outdoor Receptacle - RP type (Necessary arrangement for looping incoming supply cables shall be provided)	Nos.	5	2
85	**ETC**	ETC of 63A, 3-Phase, 4-Pin Interlocked industrial grade rotatry switch socket, Outdoor Receptacle - RP type (Necessary arrangement for looping incoming supply cables shall be provided)	Nos.	5	2
86	**S**□□□□	Supply of 2x400W Switchyard Flood-lighting luminaire with HPSV lamp and control gear	Nos.	197	18
87	**ETC**	ETC of 2x400W Switchyard Flood-lighting luminaire with HPSV lamp and control gear	Nos.	197	18
88	**S**□□□□	Supply of 1x400W Switchyard Flood-lighting luminaire with HPSV lamp and control gear	Nos.	100	25
89	**ETC**	ETC of 1x400W Switchyard Flood-lighting luminaire with HPSV lamp and control gear	Nos.	100	25
90	**S**□□□□	Supply of 70W HPSV flood light fixture - SF1 type	Nos.	1	0
91	**ETC**	ETC of 70W HPSV flood light fixture - SF1 type	Nos.	1	0
92	**S**□□□□	Supply of 250W HPSV flood light fixture - SF2 type	Nos.	1	1
93	**ETC**	ETC of 250W HPSV flood light fixture - SF2 type	Nos.	1	1
94	**S**□□□□	Supply of 150W HPSV Street lighting fixture - SS1 type	No.	30	10
95	**ETC**	ETC of 150W HPSV Street lighting fixture - SS1 type	No.	30	10
96	**S**□□□□	Supply of 250W HPSV Street lighting fixture - SS2 type	No.	10	1
97	**ETC**	ETC of 250W HPSV Street lighting fixture - SS2 type	No.	10	1
98	**S**□□□□	Supply of 125W HPMV Post Top Lantern fixture - MP type	No.	1	1
99	**ETC**	ETC of 125W HPMV Post Top Lantern fixture - MP type	No.	1	1
100	**S**□□□□	Supply of 30m high Lighting Tower/ Mast with Lantern Carriage (Winch type) for Switchyard Lighting	Nos.	2	1
101	Civil works & ETC	Civil works & ETC of 30m high Lighting Tower/ Mast with Lantern Carriage (Winch type) for Switchyard Lighting	Nos.	2	1
102	**S**□□□□	Supply of 11m high Lighting Pole for Street-Lighting - Type A1	Nos.	100	15
103	Civil works & ETC	Civil works & ETC of 11m high Lighting Pole for Street-Lighting - Type A1	Nos.	100	15
104	**S**□□□□	Supply of 11m high Lighting Pole for Flood-Lighting - Type C1	Nos.	1	1
105	Civil works & ETC	Civil works & ETC of 11m high Lighting Pole for Flood-Lighting - Type C1	Nos.	1	1
106	**S**□□□□	Supply of 13m high Lighting Pole for Flood-Lighting - Type C2	Nos.	1	1
107	Civil works & ETC	Civil works & ETC of 13m high Lighting Pole for Flood-Lighting - Type C2	Nos.	1	1
108	**S**□□□□	Supply of 4m high Lighting Pole for Post-top Lantern - Type E1	Nos.	6	1
109	Civil works & ETC	Civil works & ETC of 4m high Lighting Pole for Post-top Lantern - Type E1	Nos.	6	1
110	**S**□□□□	Supply of Galvanized rigid conduit of 20mm size with accessories	Mtr.	100	0
111	**ETC**	ETC of Galvanized rigid conduit of 20mm size with accessories	Mtr.	100	0
112	**S**□□□□	Supply of Galvanized rigid conduit of 25mm size with accessories	Mtr.	1500	375
113	**ETC**	ETC of Galvanized rigid conduit of 25mm size with accessories	Mtr.	1500	375
114	**S**□□□□	Supply of Galvanized heavy duty steel conduit of 25mm size with accessories with additional epoxy coating for corrosive areas	Mtr.	250	0
115	**ETC**	ETC of Galvanized heavy duty steel conduit of 25mm size with accessories with additional epoxy coating for corrosive areas	Mtr.	1500	375
116	**S**□□□□	Supply of Galvanized rigid conduit of 40mm size with accessories	Mtr.	100	0
117	**ETC**	ETC of Galvanized rigid conduit of 40mm size with accessories	Mtr.	100	0
118	**S**□□□□	Supply of 1C, 1.5 sqmm PVC insulated stranded Cu. Wire	Mtr.	100	0
119	**ETC**	ETC of 1C, 1.5 sqmm PVC insulated stranded Cu. Wire	Mtr.	100	0
120	**S**□□□□	Supply of 1C, 2.5 sqmm PVC insulated stranded Cu. Wire	Mtr.	100	0
121	**ETC**	ETC of 1C, 2.5 sqmm PVC insulated stranded Cu. Wire	Mtr.	100	0
122	**S**□□□□	Supply of 1C, 4 sqmm PVC insulated stranded Cu. Wire	Mtr.	100	0
123	**ETC**	ETC of 1C, 4 sqmm PVC insulated stranded Cu. Wire	Mtr.	100	0
124		**L**□□□□□**T**□□□□□ □ **C**□□ □ □□□□□□□□ of 2C, 2.5 sqmm PVC insulated, Armoured Cu. Cable	Mtr.	4500	1125
125		**L**□□□□□**T**□□□□□ □ **C**□□ □ □□□□□□□□ of 2C, 6 sqmm PVC insulated, Armoured Al. Cable	Mtr.	2500	625
126		**L**□□□□□**T**□□□□□ □ **C**□□ □ □□□□□□□□ of 4C, 6 sqmm PVC insulated, Armoured Al. Cable	Mtr.	150	150
127		**L**□□□□□**T**□□□□□ □ **C**□□ □ □□□□□□□□ of 4C, 10 sqmm PVC insulated, Armoured Cu. Cable	Mtr.	1000	250
128		**L**□□□□□**T**□□□□□ □ **C**□□ □ □□□□□□□□ of 4C, 16 sqmm PVC insulated, Armoured Al. Cable	Mtr.	100	100
129		**L**□□□□□**T**□□□□□ □ **C**□□ □ □□□□□□□□ of 3.5C, 70 sqmm PVC insulated, Armoured Al. Cable	Mtr.	2500	625
130		**L**□□□□□**T**□□□□□ □ **C**□□ □ □□□□□□□□ of 3.5C, 150 sqmm XLPE insulated, Armoured Al. Cable	Mtr.	150	50
131		**L**□□□□□**T**□□□□□ □ **C**□□ □ □□□□□□□□ of 3.5C, 300 sqmm XLPE insulated, Armoured Al. Cable	Mtr.	100	0
132		**Laying** of 50 mm GI conduits (Provided by BHEL) at a depth of 300 mm including excavation, backfilling, making & repairing of walls in trenches, cutting, threading, fixing of sockets/bends where required etc to complete. Also between pull pit boxes to JB/LP.	Mtr.	600	150
133		**Laying** of 100 mm GI conduits (Provided by BHEL) at a depth of 300 mm including excavation, backfilling, making & repairing of walls in trenches, cutting, threading, fixing of sockets/bends where required etc to complete. Also between pull pit boxes to JB/LP.	Mtr.	400	100
134		**Construction** of Pull Pit Boxes of sizes 400mmx400mmx400mm at the free ends and turning of GI pipes if pipe length exceeds 4M	No.	20	5
135		**S**□□□□ □□ 25x6mm GI Flat for earthing.	Mtr.	350	90
136		**E□r**□□□□ □□□□ 25x6mm GI Flat	Mtr.	350	90
137		**E□r**□□□□ □□□□ 50x6mm GI Flat (provided by BHEL)	Mtr.	500	125
138		**E□r**□□□□ □□□□ 75x12mm GI Flat (provided by BHEL)	Mtr.	100	25
139		**S**□□□□ of 14 SWG GI Wire (For earthing of Lighting fixtures, exhaust fans etc.)	Mtr.	12000	3000
140		**E□r**□□□□ □□□□□□**r**□□□**E**□□□□□□□□□ □□□□□□□ 14 SWG GI Wire	Mtr.	12000	3000
141	**S**□□□□	Supply of Oil Filteration Board comprising 415V, 300A, 3-Ph, 4-wire bus with one incomer TPN MCCB of 300A, Ougoing feeders 3 Nos. 300A TPN MCCB	Nos.	1	0
142	**ETC**	ETC of Oil Filteration Board comprising 415V, 300A, 3-Ph, 4-wire bus with one incomer TPN MCCB of 300A, Ougoing feeders 3 Nos. 300A TPN MCCB	Nos.	1	0
143	**S**□□□□	Supply of 415V, 300A. 3-Phase, 4-Pin TPN Interlocked Plug & Switch with earthing contacts, industrial grade rotatry switch socket, Outdoor Receptacle - RP type for Oil filtration machine (Necessary arrangement for looping incoming supply cables shall be provided)	Nos.	3	0
144	**ETC**	ETC of 415V, 300A. 3-Phase, 4-Pin TPN Interlocked Plug & Switch with earthing contacts, industrial grade rotatry switch socket, Outdoor Receptacle - RP type for Oil filtration machine (Necessary arrangement for looping incoming supply cables shall be provided)	Nos.	3	0
145	**S**□□□□	Supply of Wall mounted panels for supply to Air Conditioner & Ventilation fans comprising of 415V, 100A. 3-Phase TPN MCCB Incomer & 32A TPN MCB as outgoing feeders	Nos.	7	0
146	**ETC**	ETC of Wall mounted panels for supply to Air Conditioner & Ventilation fans comprising of 415V, 100A. 3-Phase TPN MCCB Incomer & 32A TPN MCB as outgoing feeders	Nos.	7	0
147		**S**□□□□ □ **ETC** of EXTRA ITEMS REQUIRED FOR COMPLETION OF JOB AS PER SPECIFICATION BUT NOT COVERED ABOVE, SHALL BE QUOTED SEPARATELY. DETAILS TO BE PROVIDED BY BIDDER AT TENDER STAGE. (Price to be quoted on Lumpsum basis)	Lot	1	1

S□□ N□□		□ESCR□PT□ON	UN□T	N□STPP □T□	M□NE □T□
148	S□□□□□	Supply of Lamps of each type & rating offered (2% or 2nos. whichever is more)	Lot	1	0
149	S□□□□□	Supply of Front Glass of each type & rating offered (2% or 2nos. whichever is more)	Lot	1	0
150	S□□□□□	Supply of Lamp Holders of each type & rating offered (2% or 2nos. whichever is more)	Lot	1	0
151		S□r□□□□□ - Lux measurement at site	Lot	1	1

N□□□□□

1 The above quantities(BOQ) are as per preliminary design only. The detail design wll be submitted by Vendor and subject to approval by Customer. The BOQ quantities which are finalised after approval has to be supplied. BHEL reserves the right for quantity variation due to any reason upto ±30% of total value at same unit rate and terms during execution of contract. The quantity of individual items may however vary upto any extent.

2 ETC items mentioned above are deemed to be inclusive of all the materials required for the erection of the item mentioned in supply i.e. structural steel, brackets, nut, bolts, washers, al flat, cleat, rubber bush etc.

3 Bidder to confirm that it will offer approved Make of the components and fitments at contract stage. In case the offered make is not approved by the customer, then alternate make shall be supplied without any commercial implications to BHEL.

4 All Boards/ LPs shall be as per customer technical specification.

5 Civil Works such as foundation for Lighting Poles, 30m Lighting Mast and minor civil works are deemed to be included in erection rates of respective items.

ANNEXURE-3

SUB–SECTION – B-10

STATION LIGHTING

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 Lighting Fixtures and Accessories

IS:1913	General and safety requirements for luminairies.
IS:2148	Flame proof enclosures of electrical apparatus.
IS:418	Tungsten filament general service electric lamps.
IS:1258	Bayonet lamp holders.
IS:1534	Ballast for fluorescent lamps.
IS:1569	Capacitors for use in tubular fluorescent, high pressure mercury vapour and low pressure sodium vapour discharge lamp circuit.
IS:1777	Industrial luminaire with metal reflectors.
IS:2149	Luminaire for Street lighting.
IS:2215	Starters for fluorescent lamps.
IS:2418	Tubular fluorescent lamps for general lighting services.
IS:3323	Bi-pin lamp holders for tubular fluorescent lamps.
IS:3324	Holders for starters for tubular fluorescent lamps.
IS:4013	Dust-tight electric lighting fittings.
IS:6616	Ballasts for high pressure mercury vapour lamps.
IS:8224	Electric Lighting fittings for Division 2 areas.
IS:9900	High-pressure mercury vapour lamps.
IS:9974	High pressure Sodium vapour lamps.
IS:10276	Edison screw lamp holders.
IS:10322	Luminaires.
IS:13021	AC Supplied Electronic Ballasts for tubular fluorescent lamps.

2.03.00	Lighting Panels, Switch-boxes, Receptacles and Junction Boxes	
	IS:2147	Degree of protection provided by enclosures for low-voltage switchgear and control gear.
	IS:1293	Plugs & socket outlets of rated voltage upto and Including 250volts & rated current upto and including 16 Amps.
	IS:2551	Danger notice plates.
	IS:13947	Low voltage switchgear and controlgear
	IS:3854	Switches for domestic and similar purposes.
	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.
	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. Supplied Electronic control gear for LED modules
	16104:2012	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
	16108:2012	Photobiological safety of Lamps and Lamp Systems
	IS 513	Cold rolled low carbon steel sheets and strips
	IS 12063	Classification of degree of protection provided by enclosures.
	IS 14700 (Part 3/Sec. 2)	Electro magnetic compatibility (EMC) – Limits 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 (Part 2/Sec. 13)	Lamp control gear: particular requirements for DC or AC supplied electronic control gear IS 16004 – 1 and 2)for LED modules.
	IS 4905	Method for random sampling
2.07.00	**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.
	IS:2713	Tubular steel poles for overhead power lines.
	IS:3043	Code of practice for earthing
	IS:5216	Guide for safety procedures and practices in electrical work.
	IS:5571	Guide for selection of electrical equipments for hazardous areas.
	BS:6121	Mechanical cable glands

3.00.00 LIGHTING SYSTEM DESCRIPTION

The illumination of various indoor and outdoor areas in the main plant and off site areas shall be provided as described here. The lighting system of various areas shall comprise of one or more of the following systems:

(a) Normal AC Lighting System

(b) Emergency AC Lighting System

(c) DC Lighting System

3.01.00 **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.

3.02.00 **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. Four (4) nos. 240V AC lighting fixtures fed from UPS (provided by contractor) shall be provided on each stacker reclaimer machine.

3.03.00	**DC Lighting System**
3.03.01	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.
3.03.02	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.
3.03.03	In auxiliary /off site buildings except Coal Handling plant, emergency DC lighting is to be provided through self contained DC emergency fixture at strategic locations. The fixtures shall be switched 'ON' automatically in case of failure of AC supply.
3.03.04	For Coal Handling plant, 100W, 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.
4.00.00	**DESIGN PHILOSOPHY**

1. A comprehensive illumination system shall be provided in the entire project

2. All outdoor lighting system shall be automatically controlled by synchronous timer or photocell. Provision to bypass the timer or photocell shall be provided in the panel.

3. In the Off site area / buildings (except CHP) DC lighting shall be provided by self-contained 4hours duration Emergency lighting fixtures.

4. 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.

5. 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 fluorescent 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).

Further Lighting System shall be designed considering maximum utilization of natural light. To achieve this lighting circuit may be designed with segregation and usage of lux control philosophy. Energy efficiency codes shall be followed in principle.

6. 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.

7. **LED Luminaires:**

LED Luminaires shall be used for the lighting of all the Control Room & Control Equipment areas with false ceiling.

The individual lamp wattage for LED shall be min 3 watt. The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall be not less than 70 Lm/W. Suitable heat sink shall be designed & shall be provided in the luminaire. The LED used in the luminaires shall have colour rendering index (CRI) of Min 65. Colour designation of LED shall be “cool day light” (min 5700K) type. The LED luminaire shall have minimum life of 25,000 burning hours with 80% of lumen maintenance at the end of the life.

The beam angle for LED chip shall be 120 degrees. 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 relevant standards. 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 PTFE cable 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. The entire housing shall be dust and water proof protection as per IS 12063.

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 manufacturer.

LED Drivers may have following control & protections :-

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

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

(a.)	Office area airconditioned	:	0.8
(b.)	Office area non airconditioned and other indoor area	:	0.7
(c.)	Dust prone indoor and outdoor area	:	0.6
(d.)	Coal Handling Plant, Ash Handling Conveyor /Transfer Points etc.	:	0.5

9. All lighting fixtures and control gears shall be powder coated. All outdoor fixtures shall be weather proof and of IP55 degree of protection.

10. Lighting panels shall be powder coated with color shade RAL9002. Lighting panels shall have IP55 degree of protection.

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 isolation transformers of max. rating of 100KVA and fault level restricted to 3 KA at Lighting Panels.

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 (For conveyor gallery and track hopper shed at 30m interval on both sides and for yard conveyor at 50m interval on one side).
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, at 50m interval (starting from one end) on both sides of the conveyor galleries and at 50m interval on one side of the yard conveyor.
In coal handling plant, One no 10A, 24V AC receptacle with IP55 DOP shall be provided in each switchgear/ MCC room, Pump house, TPs, crusher house and on stacker-reclaimer.

14. 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.

15. In the hazardous areas like gas/ liquid fuel storage/ handling areas lighting shall be flame proof.

16. All flourescent fixtures, shall have energy efficient 'T5' type flouresent lamps except the flouresent fixtures used for division 2 hazardous area. The louvers of these fixtures shall be designed for 'T5' type flouresent lamps. All flouresent lamps shall be have "Cool day light" colour designation. The mirror optics type flouresent fixtures shall have no irridescence effect. Fixtures with better efficiency and upgraded proven system may also be considered
In candescent lamps may be used only with DC Lighting.

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.

4.01.00 **Ballasts**

4.01.01 All HPSV and HPMV lamp fixtures shall be provided with wire-wound ballasts. All fluorescent fixtures except for Class-I, Div-II fittings/ increased safety fittings (Div-II/Hazardous Area) shall be provided with electronic ballasts.

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, 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, 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	**Junction Boxes, Conduits, Fitting & Accessories , Pull Out Boxes:** Junction box for indoor lighting shall be made of fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. 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. All switches and receptacles upto 16A shall be modular type. These shall be provided with pre-galvanized/galvanized modular switchbox & plate. 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. 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 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 lead coated steel. 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 galvanised.
4.05.00	**Lighting Wires**
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.

4.06.00	**Lighting Poles**
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 relevant 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. The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB.
4.07.00	**Lighting Masts**
4.07.01	Lighting Mast shall be of continuously tapered polygonal cross section hot dip galvanised. The Mast shall be of 30 M or suitable height with lantern carriage to enable raising/lowering for ease of maintenance, including the Head Frame, Double Drum Winch, continuous stainless steel wire rope, in built power tool, luminaires, suitable aviation warning light, lightning alongwith necessary power cables within the mast. The mast shall be delivered in not more than three sections & shall be joined together by slip stressed fit method at site. No site welding or bolted joints shall be done on the mast The Mast together with the fixtures shall be capable of withstanding the appropriate wind loads as per IS:875. The Mast shall be fabricated from special steel plates conforming to BS-EN10-025 and folded to form a polygonal section. Suitable feeder pillar with TPN MCB, contactors, timer, MCB and other necessary accessories for operation & protection of the mast and fixtures shall be provided.
4.08.00	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.
4.09.00	A.C. normal, AC emergency and DC system wiring shall run throughout in separate conduits. Wires of different phase shall run in different conduits.
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.
4.11.00	Alternately Vendor may offer technically superior and proven product subject to approval of employer.
5.00.00	**TESTS**
5.01.00	All equipment to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. 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.
5.02.00	However if the contractor is not able to submit report of the type test(s) conducted within last ten years 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 contractor shall conduct all such

tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.

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 relevant standards shall be submitted for approval.

SL NO.	DESCRIPTION
i.	Lighting fixtures of each type
ii.	Lamps of each type and rating.(life cycle and rating test only)
iii.	Lighting panel of each type (Degree of Protection)
iv.	Junction Box of each type

5.06.00 Acceptance Test and Routine Test

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.

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 four 1minute 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.

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.

3. The installation shall be then tested and commissioned in presence of the Project manager.

4. The contractor shall provide all, men material and equipment required to carry out the tests.

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.

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.

   (a) Insulation Resistance.

   (b) Testing of earth continuity path.

   (c) Polarity test of single phase switches.

   (d) Functional checks.

7. The lighting circuits shall be tested in the following manner :

   (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.

ANNEXURE-A

Sl No.	Location	Average Illumination Level(Lux)	Type of Fixture
(a)	Turbine Hall operating floor	200	HPSV high/medium bay
(b)	Turbine Hall Other Platforms	200	HPSV high/medium bay, HPSV well glass fixtures
(c)	Switchgear rooms, Charger, Rectifier room	200	Industrial trough type fluorescent
(d)	Control room, computer room, control equipment room	350	Mirror optics with anti-glare features type LED fixtures/ downlighter & halogen downlighter
(e)	Offices, conference rooms, etc.	300	Decorative mirror optics Type fluorescent or CFL downlighter
(f)	Battery rooms	100	Totally enclosed corrosion Proof fluorescent
(g)	Transformer yard	20 (general) 50 (on equipment)	HPSV flood light,
(h)	Boiler platforms	100	HPSV well glass fixtures,
(i)	Diesel generating room, Compressor room, pump house etc.	150	HPSV medium bay/ Industrial trough type fluorescent
(j)	Fuel oil pump house	150	Flame proof fluorescent fixtures suitable for division-2 hazardous area
(k)	Cable galleries/vault	50	Industrial trough type fluorescent
(l)	Street lighting- primary roads secondary roads	 20 10	HPSV street lights
(m)	Outdoor storage handling and unloading area	20	HPSV flood light,
(n)	DM plant, water treatment plant	150	Industrial trough type/ corrosion proof fluorescent, HPSV high/medium bay/ Floodlight
(o)	Cement stores	150	Industrial trough type

			fluorescent dust proof
(p)	Chemical stores/House	150	Corrosion proof fluorescent
(q)	Permanent stores	150	HPSV high/medium bay / industrial trough type fluorescent
(r)	Workshop. Building	150	Industrial trough type Fluorescent, Industrial high bay
(s)	Laboratory General Analysis area	 150 300	 Mirror optics fluorescent Corrosion resistant, fluorescent
(t)	Garage/Car Parking	50	Industrial trough type fluorescent
(u)	AIS Switchyard and Substation	20(general 50(on strategic equipment)	HPSV flood light
(v)	CW pump house, Chlorination plant building, Raw water and fire water pump house	150	Industrial trough type fluorescent/ Well glass HPSV fitting or HPSV high/ medium bay fitting/ HPSV flood light
(w)	Transfer points, crusher house, Sheds, tunnels, bunker house etc.	100	HPSV Dust tight/Well glass type
(x)	Cooling Tower	10 (general) 50 (on equipment)	Well Glass Fixtures
(y)	Facility building, canteen etc	150	Industrial trough type fluorescent
(z)	Hydrogen Plant Building	150	Explosion proof HPMV/ Flourcent fittings suitable for class-I and Division –IIC
(aa)	DC Lighting- Control room	-	In candescent down light fixtures, Decorative recessed type with cylindrical reflector
(ab)	DC Lighting- Other Area	-	Incandescent Industrial Bulkhead
(ac)	Corridors, Walkways	50	Fluorescent type
(ad)	Buiding Periphery Lighting	-	Street Light fixture, HPSV Floodlight fixtures

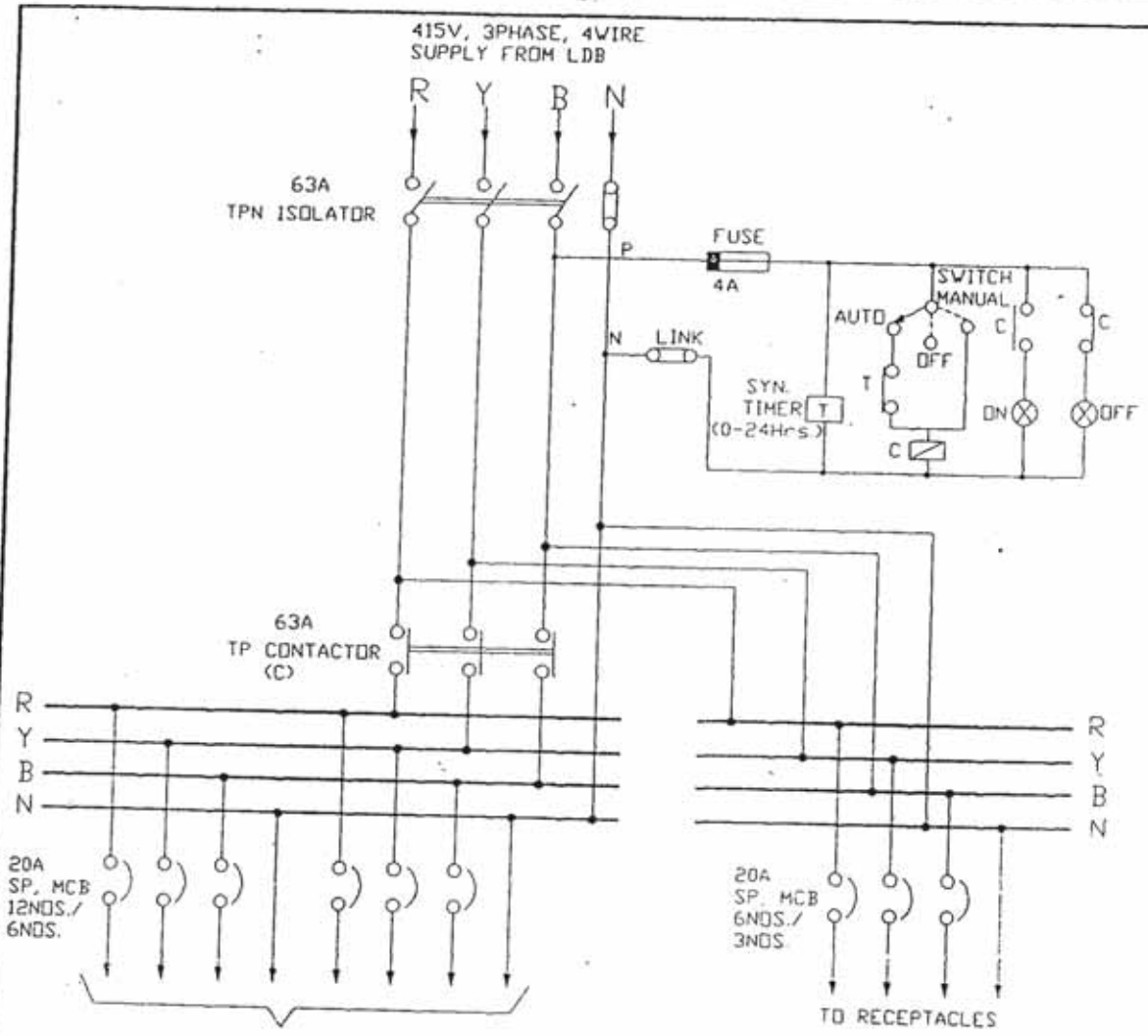
(ae)	Security Lighting along Boundary	10	Street Light fixture, HPSV Floodlight fixtures
(af)	ESP platform	150	HPSV well glass fixtures
(ag)	Gate complex/Time Office	150	HPSV Flood Light/ Fluorescent fixtures

ANNEXURE-B

Sl. No.	Plant Areas	Normal AC Lighting System	Emergency AC Lighting System	220 V DC Lighting System	Portable DC Fixtures
1	TG Building(turbine hall, switchgear room etc)	80%	20%	√	—
2.	Boiler Platform	80%	20%	√	
3	DG Area/ Room	80%	20%		
4	Compressor Room				√
5	ESP Control Room	80%	20%		√
6	Unit Control Room	70%	30%	√	
7	Switchyard Control Room	80%	20%	√	
8	Battery Room	80%	20%		
9	Cable Spreader Room/ Vault	80%	20%	√	
10	Make Up Water Pump House	100%			√
11	Chemical House	100%			√
12	Fuel Oil Pump House	100%			√
13	Ash Handling Plant	100%			√
14	Water Treatment Plant	100%			√
15	CT Switchgear Room	100%			√
16	Cooling Towers	100%			
17	Workshop	100%			√
18	Service Building	100%			
19	Area Lighting	100%			
20	Street Lighting	100%			
21	Transformer Yard and Storage Yard	100%			
22	Coal Handling Plant	100%		√	
23	AIS Switchyard	80%	20%		

DC Emergency Lighting:

	Area	Average Lux Level
1	Unit Control Room	100
2	Control Equipment Room	100
3	Switchyard Control Room	20
4	Strategic Control Points (In TG Building & Boiler Area, Switchgear room, SWAS, Battery Room, UPS Area, TG Hall, Luboil Room etc	20
5	Cable Vault & Galleries	1 fixture at every 20 metres spacing along walkways
6	Boiler Stair Case	1 fixture at every 20 metres spacing along walkways
7	Exit/ Entry of Main Plant Building	1 fixture
8	Fire Exit Sign	1 fixture
9	Coal Handling Plant	Control room - 50 Swgr room - 50 Strategic control points - 20 Others areas(cl3.03.04)- 20



S.NO.	LP TYPE	INCOMER ISOLATOR	OUTGOING 20A MCB'S
1.	LP-1	63A TPN + 63A CONT + SYNC. TIMER + INDICATING LAMPS	12 NOS. SP+ 6 NOS. SP
2.	LP-2	63A TPN + 63A CONT + SYNC. TIMER + INDICATING LAMPS	6 NOS. SP+ 3 NOS. SP

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
					CLEARED BY						
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE				-		-	-	-		

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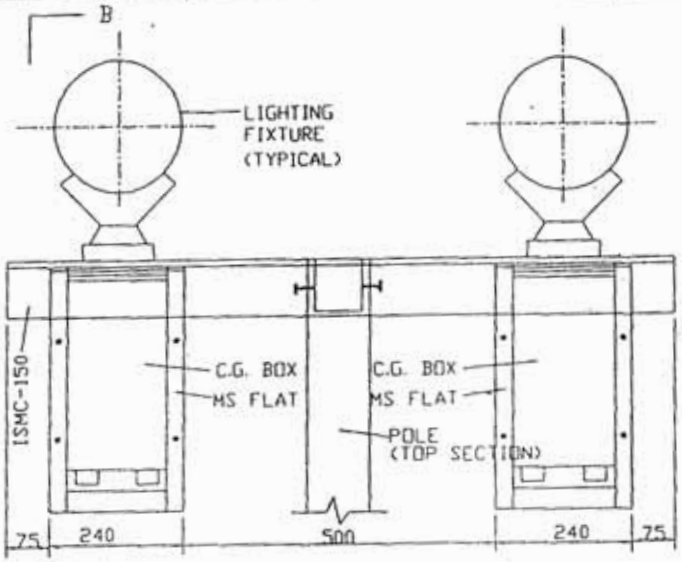
ENGINEERING DIVISION

PROJECT: STANDARD

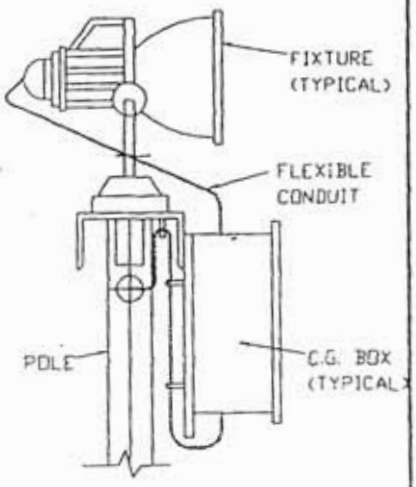
TITLE: SCHEMATIC DIAGRAM FOR LIGHTING PANELS

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-PDE-A-001 SH. 1 OF 20	RB

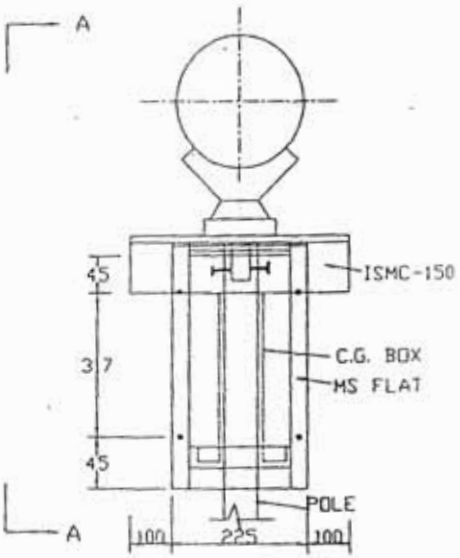
L19.DWG



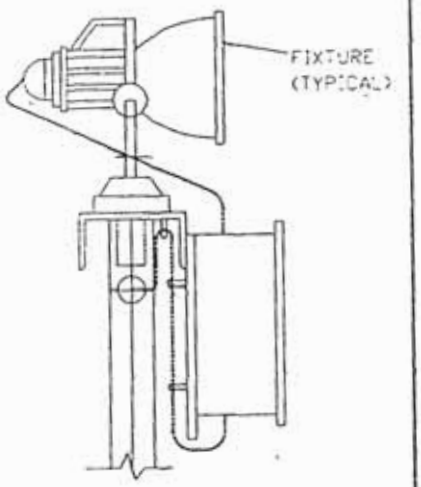
FOR POLE TYPE-C2



VIEW-BB



FOR POLE TYPE- C1 & E2



VIEW-AA

NOTES:

ALL DIMENSIONS ARE IN MM.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE	RSC			-		-	-	-		
RA	FOR TENDER PURPOSE				-		-	-	-		

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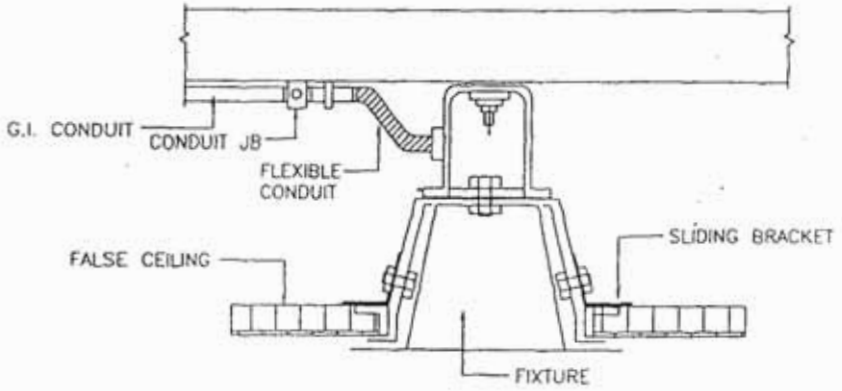
PROJECT	STANDARD			
TITLE	MOUNTING DETAIL OF FLOOD LIGHT FIXTURE & CONTROL GEAR BOX ON POLES.			
SIZE A4	SCALE NTS	DRG. NO. 0000-217-POE-A-001 SH. 8 OF 20		REV. NO. RB

L8.DWG



TYPICAL FIXING DETAIL OF RECESSED LIGHTING FIXTURE IN FALSE CEILING AREA (TYPE-B)

NOTE:

ALL DIMENSIONS ARE IN MM.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
					CLEARED BY						
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE				-		-	-	-		

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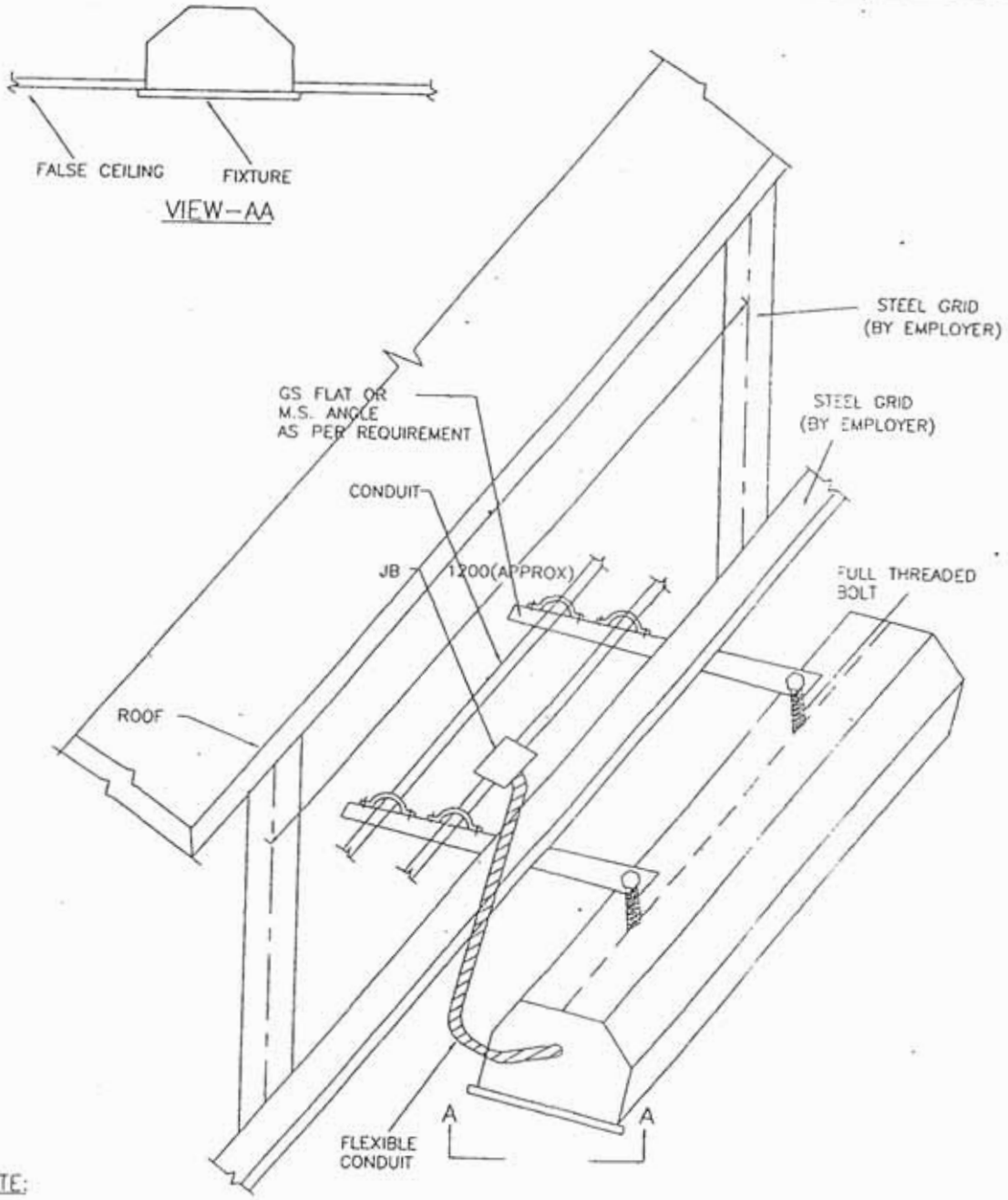
PROJECT: STANDARD

TITLE: TYPICAL MOUNTING DETAIL OF FIXTURES IN FALSE CEILING AREA

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 10 OF 20	RB

L10.DWG



NOTE:

1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR DISTANCE BETWEEN FALSE CEILING AND STRUCTURE SHALL BE 300MM (APPROX.)

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
					CLEARED BY						
RB	FOR TENDER PURPOSE	[illegible]	[illegible]	[illegible]	-	[illegible]	-	-	-	[illegible]	[illegible]
RA	FOR TENDER PURPOSE	NS	[illegible]	[illegible]	-	[illegible]	-	-	-	[illegible]	[illegible]

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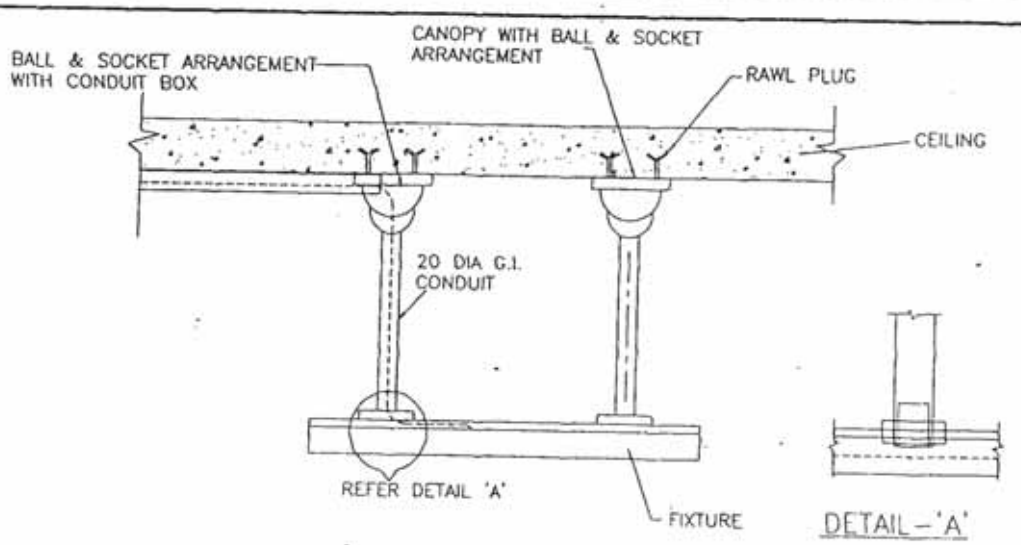
PROJECT: STANDARD

TITLE: TYPICAL MOUNTING DETAIL OF FIXTURES IN FALSE CEILING AREA

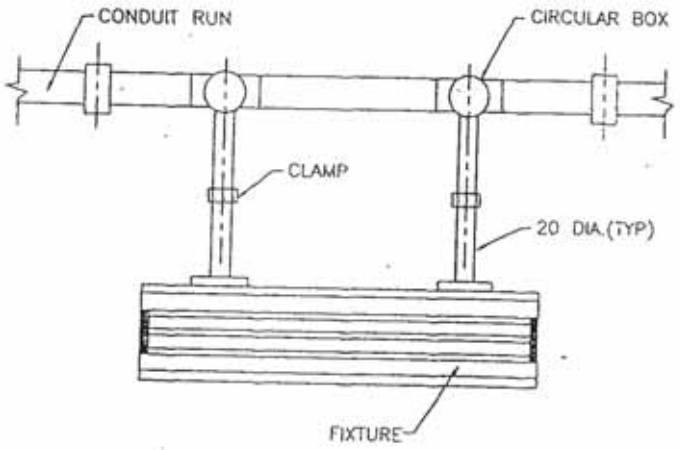
SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 11 OF 20	RB

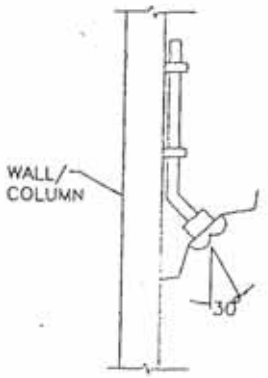
L21.DWG



DETAIL–'A'

TYPE–C





TYPE–D

END VIEW

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
					CLEARED BY						
RB	FOR TENDER PURPOSE	RNG			-		-	-	-		
RA	FOR TENDER PURPOSE	NS			-		-	-	-		

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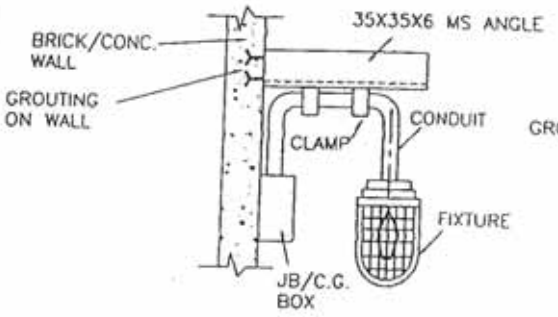
PROJECT: STANDARD

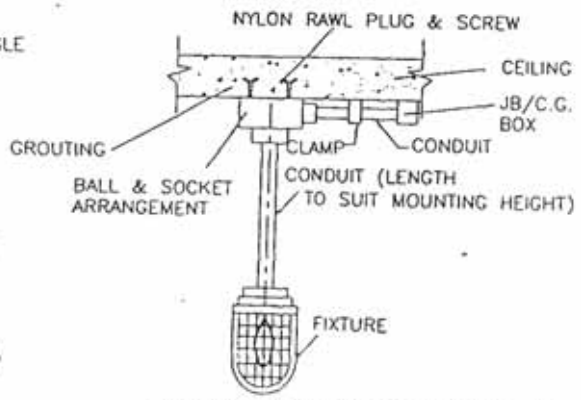
TITLE: TYPICAL MOUNTING DETAIL OF FLUORESCENT FIXTURE

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000–217–POE–A–001 SH. 12 OF 20	RB

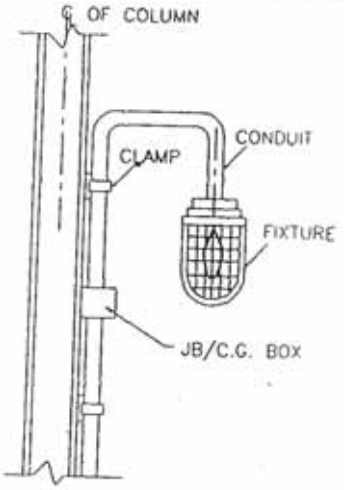
L11.DWG



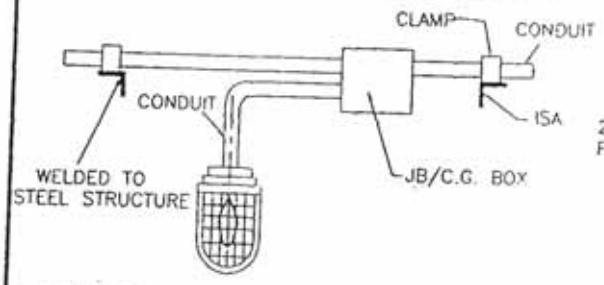
WALL MOUNTING (TYPE-E)



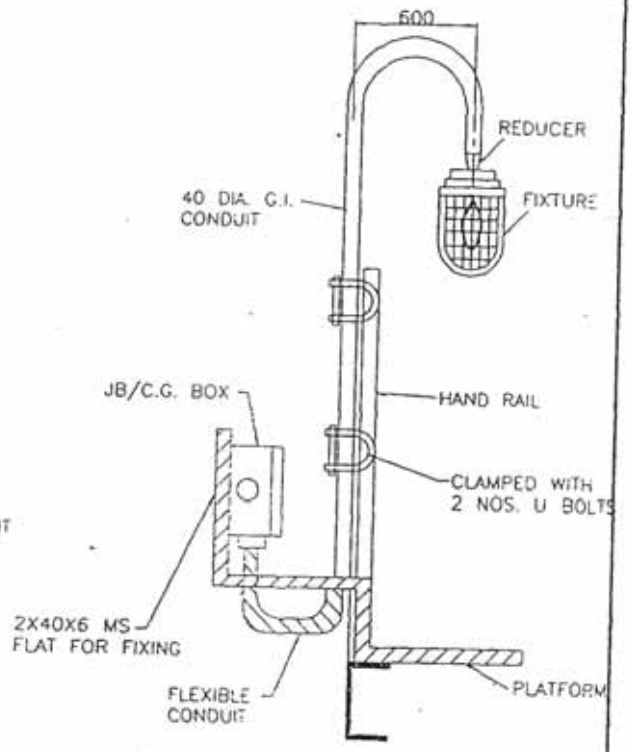
CEILING MOUNTING (TYPE-F)



COLUMN MOUNTING (TYPE-G)



STRUCTURE MOUNTING (TYPE-H)



HAND RAIL MOUNTING (TYPE-I)

NOTES:

ALL DIMENSIONS ARE IN MM.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE			-		-	-	-			
RA	FOR TENDER PURPOSE	NS		-		-	-	-			

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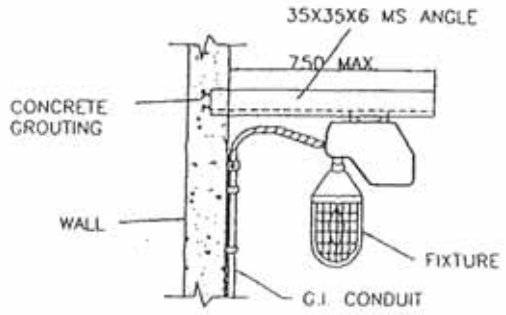
PROJECT: STANDARD

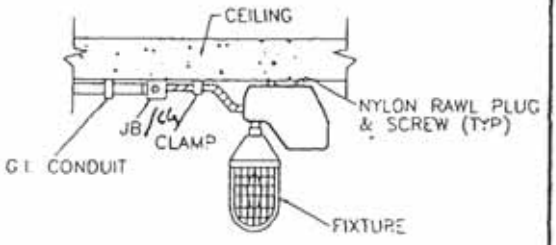
TITLE: TYPICAL MOUNTING DETAIL OF WELL GLASS FIXTURE

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 13 OF 20	RB

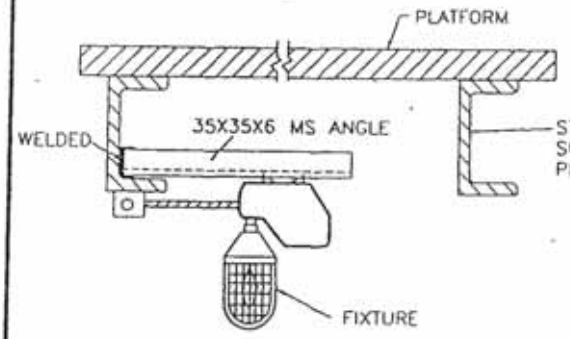
L12.DWG



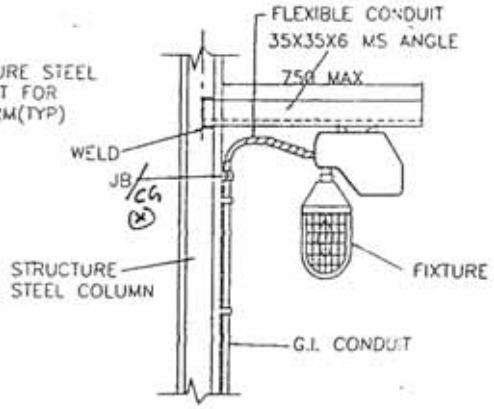
WALL MOUNTING (TYPE-J)



CEILING MOUNTING (TYPE-K)



STRUCTURE MOUNTING (TYPE-L)



COLUMN MOUNTING (TYPE-M)

NOTES:

ALL DIMENSIONS ARE IN MM.

(*) In case of non-integral CG box

REV NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE	NS			-		-	-	-		

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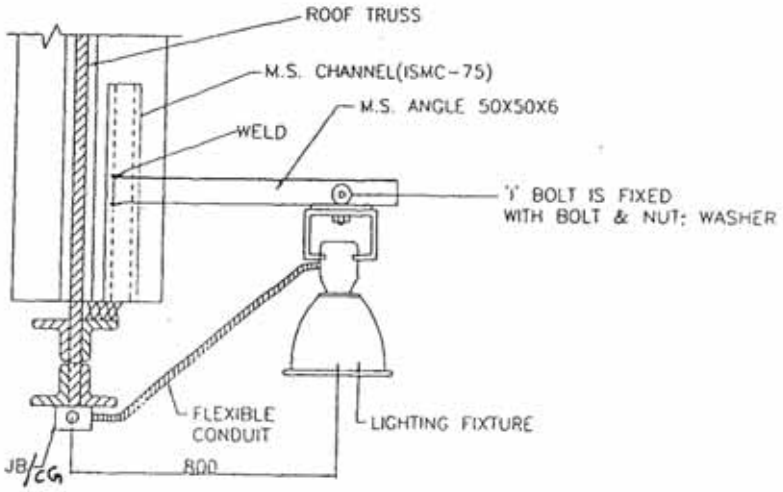
PROJECT: STANDARD

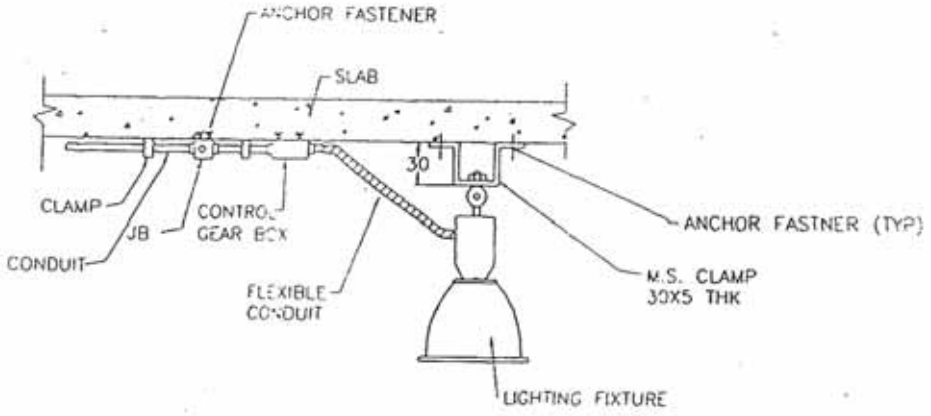
TITLE: TYPICAL MOUNTING DETAIL OF INTEGRAL TYPE WELL GLASS FIXTURE

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 14 OF 20	RB

L13.DWG



STRUCTURE MOUNTING (TYPE-N)



CEILING MOUNTING (TYPE-O)

NOTES:

ALL DIMENSIONS ARE IN MM.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE				-		-	-	-		

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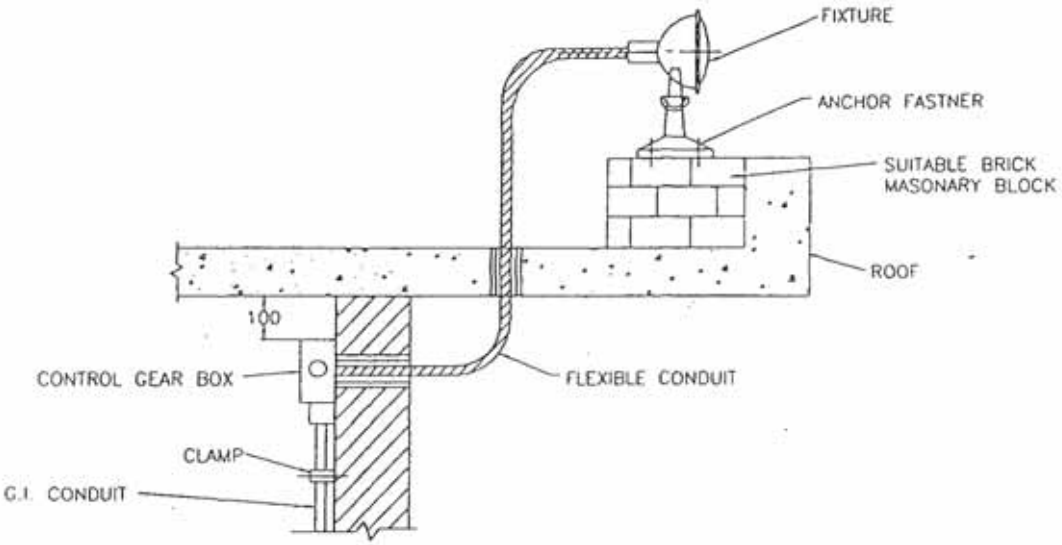
PROJECT: STANDARD

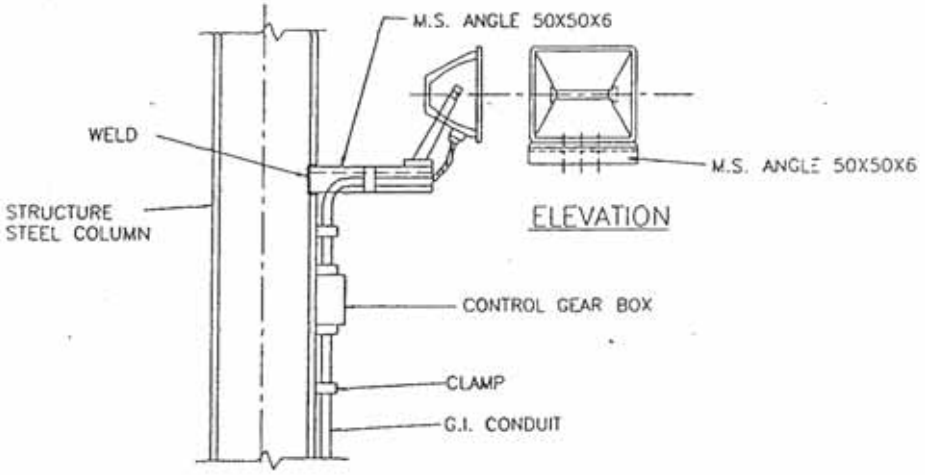
TITLE: TYPICAL MOUNTING DETAIL OF HIGHBAY FIXTURES

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 15 OF 20	RB

L14.DWG



ROOF MOUNTING (TYPE-P)



COLUMN MOUNTING (TYPE-Q)

NOTES:

ALL DIMENSIONS ARE IN MM.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
					CLEARED BY						
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE	NS			-		-	-	-		

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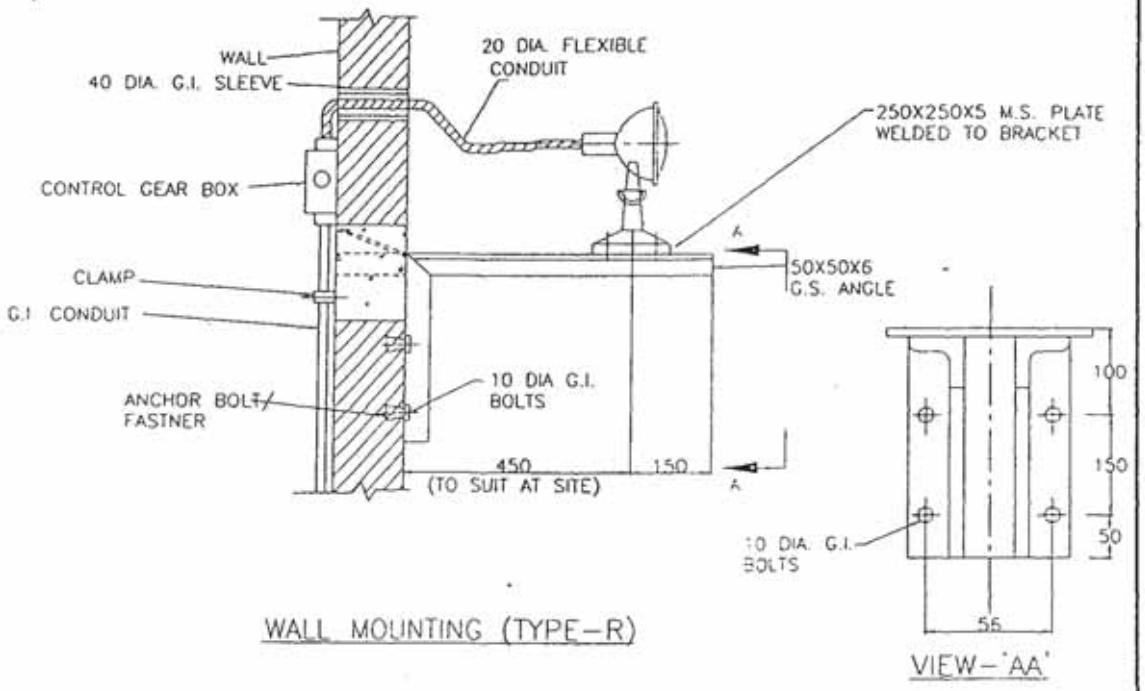
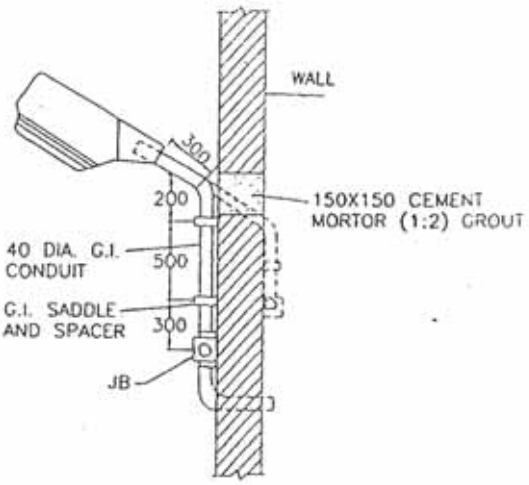
PROJECT	STANDARD		
TITLE	TYPICAL MOUNTING DETAIL OF AREA LIGHTING FIXTURES		
SIZE A4	SCALE NTS	DRG. NO. 0000-217-POE-A-001 SH. 16 OF 20	REV. NO. RB

L15.DWG



WALL MOUNTING (TYPE-R)

VIEW-'AA'



WALL MOUNTING (TYPE-S)

NOTES:

ALL DIMENSIONS ARE IN MM.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
					CLEARED BY						
RA	FOR TENDER PURPOSE	NS			-		-	-	-		
RB	FOR TENDER PURPOSE				-		-	-	-		20-11-96

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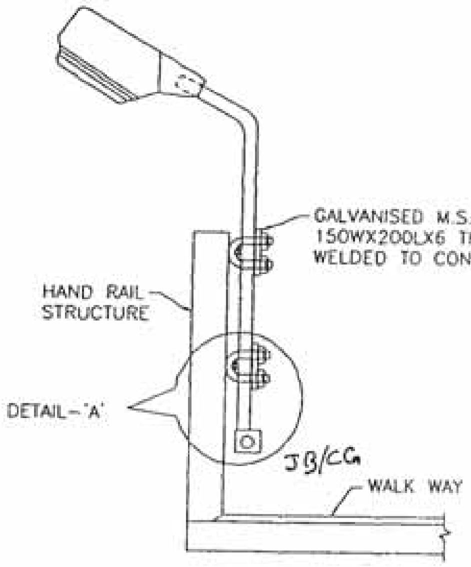
PROJECT: STANDARD

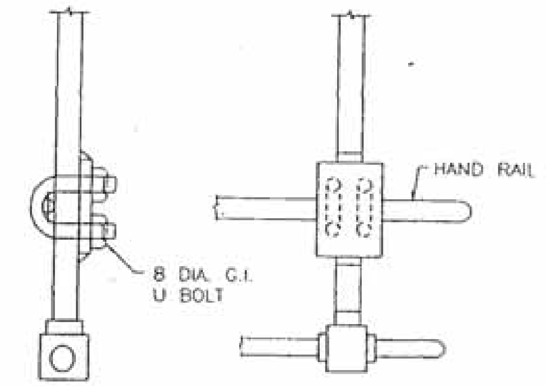
TITLE: TYPICAL MOUNTING DETAIL OF AREA LIGHTING FIXTURES

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 17 OF 20	RB

L16.DWG



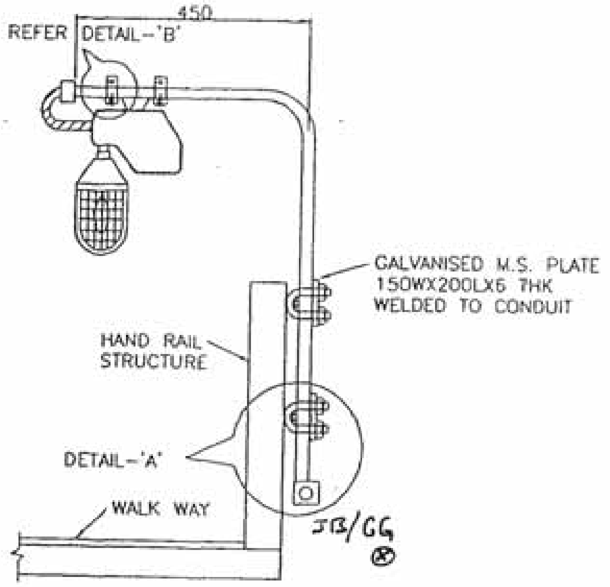
TYPE-T



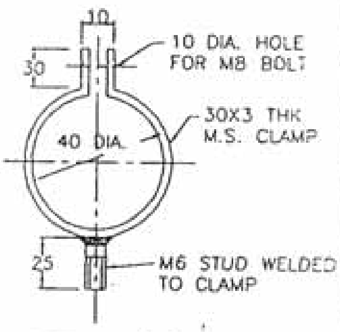
ELEVATION

SIDE VIEW

DETAIL-'A'



TYPE-U



DETAIL-'B'

NOTES:

ALL DIMENSIONS ARE IN MM.

⊗ In case of non-integral control gear

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE	(signed)	(signed)	(signed)	(signed)	-	-	-	-	(signed)	20.11.06
RA	FOR TENDER PURPOSE	MS	(signed)	(signed)	-	(signed)	-	-	-	(signed)	
					CLEARED BY						

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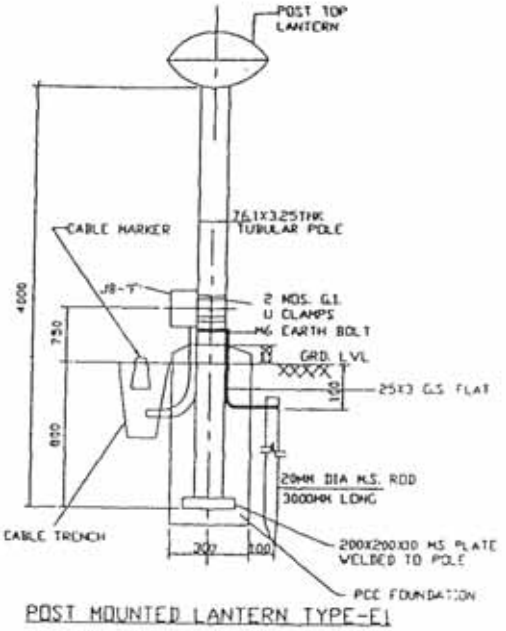
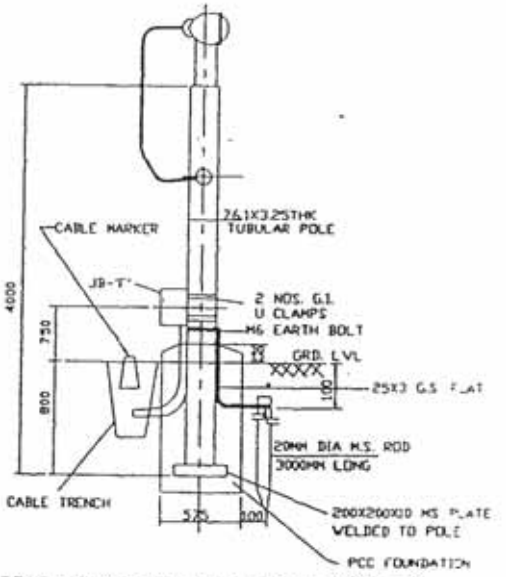
PROJECT	STANDARD
TITLE	TYPICAL HANDRAIL MOUNTING DETAIL OF FIXTURES

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 18 OF 20	RB

L17.DWG



POST MOUNTED LANTERN TYPE-E1



POST MOUNTED FLOOD LIGHT TYPE-E2

NOTES:
1. ALL DIMENSIONS ARE IN MM.
2. FOUNDATION DIMENSIONS SHOWN ARE TENTATIVE ONLY.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE	NS			-		-	-	-		

CLEARED BY

एन टी पी सी NTPC

NTPC Limited
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: STANDARD

TITLE: GENERAL ARRANGEMENT OF POST MOUNTED FIXTURES

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 19 OF 20	RB

LS.DWG

STAT□ON L□□ □T□N□ S□E□□□

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) including LED fixture	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-1117)	Y									Y	Y		
Epoxy & Galvanised Conduit (IS-9537, 2629, 2633, 4759, 6745)	Y	Y									Y		Y

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. LED driver make, model, type & rating may be as per recommendations of LED module manufacturer.
2. Make of all major Bought Out Items will be subject to NTPC approval.

ANNEXURE-4

SUB–SECTION – B-06

LT SWITCHGEARS & LT BUSDUCTS

1.00.00 **DESIGN PHILOSOPHY / PRACTICE FOR LV BOARD SIZING**

The sizing of LV boards shall be primarily dependent on the following conditions such as total load connected onto a Board, diversity factors for various loads connected, Fault Level and Voltage Regulation Considerations.

As far as practicable the system shall provide segregated supplies to main and standby auxiliaries so that failure of supply to main auxiliary shall in no way jeopardize the standby auxiliary feed. Automatic changeover at critical switchgear/ MCC sections shall be provided as necessary to prevent the loss of a unit or to ensure the equipment safety.

1.01.00 **Design Considerations:**

1.01.01 **Sizing of Unit and Station boards**

a) Input KVA for a Drive = (Rating KW X Load Factor) / (Efficiency X Power Factor) where values of load factor , power factor and efficiency are defined below:

b) Load (service) factor for 415 V loads is taken as 0.85

c) Power factor 415 V Uni-Directional drives is taken as 0.8 and efficiency as 0.85

d) Power factor of 415 V bidirectional drive Loads is taken as 0.65 and efficiency as 0.8 for motor rating less than 15 KW For motor ratings above 15 KW and above the corresponding values are 0.75 and 0.8.

e) The Finally selected Bus Bar ratings for switchboards, MCC s and ACDB and Busduct shall include a 10 % margin over the calculated values.

f) The LDB' s shall be considered to be loaded to 70 % of their KVA rating

g) A spare capacity of about 10 % shall be kept for addition of loads during detail engineering as many of the LT loads cannot be predicted during the Rating selection of the Board.

h) Busbar Ratings of valves/dampers boards shall be derived by summing up to 5% of the total KVA load connected. With the largest Value /damper Connected.

i) Welding sockets shall be connected from Welding DBs.

j) ESP consumption for 100 % BMCR operation shall be considered and further this load shall be uniformly divided among ESP Switchgears.

1.01.02 **Sizing of Offsite Boards**

a) The loads for mechanical auxiliary systems shall be met by auxiliary transformers based on the criteria that each switchgear/MCC/Distribution board shall be fed either by 2x100% or 3x50% transformers/feeders and, these shall be rated to carry the maximum load expected to be imposed. Each of the above boards shall be sectionalized.

b) The sizing of Unit Emergency boards shall be in according to the DG rating. The Emergency board shall have tie to both sections of Unit Service Switchgear for catering unit loads in Blackout Conditions.

1.02.00 **Layout Criteria**

The switchboards can be split into two sections based on layout constraints in case of long switchboards to optimize Switchgear room layouts. The two sections of the split shall be connected by Bus duct/Cable as per layout requirements.

1.03.00 **Spare capacity and Future Requirements**

Each of the LV switchboards shall be designed for 1.1 times the required rating as a spare capacity. Further all LV Switchboard shall be provided with 10 % spare modules of each rating and type of module.

1.04.00 **Standardization**

The LV Boards shall be fed through either LT auxiliary transformers. MCC, and Distributed boards are fed further through these main boards. The Standard rating of the main boards fed through Unit Auxiliary Service and Station Service Transformers shall be 3500 Amp .Other Standard ratings used shall be 3000,2500, 2000 Amp, 1600 Amp, 1000 Amp, 600 Amp, 400 & 250 Amp.

Preferred ratings for LV Busduct rating are 3500 Amp, 3000 Amp, 2500 Amp and 1600 amp. It shall be preferred to have all LV Switchboards for the entire plant from a One/Two/Three manufacturer from maintainability and spares management point of view.

It shall be preferred to follow a standardization of Terminal Numbers across all LV Modules for ease of Interconnection and standardization.

1.05.00 **Plant control cable Interconnections**

a) Standard control cable sizes shall preferably be 3CX1.5, 5CX1.5, 7CX1.5 & 10CX1.5
b) Cable size for motor space heater application shall be 2CX2.5
c) Interconnections for Current Transformer terminals shall use two cores of 1.5mm^2 size per phase
d) Core identification shall be using core color for up to 5-core cable and core number for cable with more cores
e) Separate control cables shall be used for current transformers.
f) At least one spare core shall be made available in each of the control cable

1.00.00 CODES AND STANDARDS

1.01.00 All equipment shall, generally, comply with the updated issues of

(a.) Applicable Indian Standards

(b.) Indian Electricity Act.

(c.) Indian electricity rules

1.02.00 Equipment complying with any other authoritative / internationally recognized standards such as IEC, British, U.S.A., German, etc. will also be considered if it ensures performance equivalent or superior to Indian Standards. In such cases the contractor shall clearly indicate the standard adopted and furnish the copy of latest English version of the same along with the bid and bring out the salient features for comparison.

1.03.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as published one month prior to the date of opening of bids. 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 codes and standards.

IS: 5	Colors for ready-mixed paints and enamels.
IS: 694	PVC insulated cables for working voltages upto 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
IS: 2551	Danger Notice Plates
IS: 2629	Hot dip galvanising
IS: 2705	Current Transformers
IS/IEC: 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 / IEC-60947-1	General Requirements for Switchgear and Control gear for voltages not exceeding 1000 V.
IS: 5082	Wrought Aluminum and Aluminum alloys for electrical purposes.
IS: 6005	Code of practice of phosphating of iron and steel.
IS/IEC 60947-5-1 / IEC-60947-5-1	LV switchgear and Control gear Control current devices and switching element.
IS: 8623 (3 parts) / IEC: 60439	Specification for factory built assemblies of Switchgear & Control gear for voltages upto and including 1000 V AC & 1200 V DC.
IS: 8686	Static Relays
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**
IEC 60439(1&2)/ IS 8623(1&2)	**Bus trunking system (sandwich busduct)**

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	50KA(RMS)
2.01.02	**DC SYSTEM**		
	1)	System Voltage	240VDC 2-Wire, Unearthed
	2)	Fault Level	20 KA
2.01.03	**CONTROL SUPPLY VOLTAGE**		
	1)	Trip & closing coil of circuit breaker	240V DC/120V DC
	2)	Spring charging motor	240V DC/120V DC
	3)	MCC control supply	110V AC Neutral solidly earthed
	4)	Space heater & lighting	240V AC Neutral solidly earthed
2.02.00	**CUBICLE DATA**		
	Busbar Rating		
	1)	Continuous Current rating	As per requirement
	2)	Short time rating where	
		a) CB is used as incomer	50KA(RMS) for one sec
		b) Fuse protection is used in Incomer	Prospective current of 50KA(RMS) for the fuse clearing time

	3)	Dynamic Rating where	
		a) CB is used as incomer	105KA(PEAK)
		b) Fuse Protection is used in incomer	Prospective current of 105KA (PEAK) as limited by fuse
	4)	Busbar insulation	
		a) For switchgear	PVC Sleeve insulated
		b) For MCC	PVC Sleeve insulated
		c) ACDB	PVC Sleeve insulated
		d) DCDB	PVC Sleeve insulated
		e) For fuse boards	PVC Sleeve insulated/ epoxy coated
2.03.00	**CIRCUIT BREAKER**		
	1)	Type	Air break spring charged stored energy type
	2)	Operating duty	B-3 MIN-MB-3 MIN-MB
	3)	Symmetrical interrupting	50KA(RMS)
	4)	Short circuit rating	105KA(PEAK)
	5)	Short Circuit Breaking current	
		a) AC Component	50KA(RMS)
		b) DC Component	As per IS/IEC 60947
	6)	Short time withstand	50KA(RMS) for one sec
	7)	No of aux. contacts	4 NO + 4 NC for DDCMIS interface

2.04.00	**METERS**		
	1)	Accuracy class	2.0
	2)	One min. power frequency withstand test voltage	2.0 KV (rms)
2.05.00	**CURRENT TRANSFORMERS**		
	1)	Type	Cast Resin Bar Primary
	2)	Voltage class and frequency	650 V, 50 HZ
	3)	Class of insulation	E or better
	4)	Accuracy class & burden	
		a) For protection	5P20, 5VA
			PS Class for REF
		b) For metering	class 1.0, 5VA (min)
	5)	Short time withstand	
		a) For CT Associated with circuit breaker	50KA(RMS) for 1 sec
		b) For CT Associated with fuse protected feeders	Prospective current of 50KA(RMS) for the Fuse clearing time
	6)	Dynamic withstand	
		a) For CTs Associated with circuit breaker	105KA(PEAK)
		b) For CT Associated with fuse protected feeders	Prospective current of 105KA(PEAK) as Limited by fuse
2.06.00	**BUSDUCT**		
	1)	Type	Non-Segregated
	2)	One minute power frequency withstand voltage	2.5 kV

	3)	One second short ckt withstand current	50KA(RMS)
	4)	Momentary dynamic current withstand	105KA(PEAK)
	BUSDUCT (SANDWICH TYPE)		
	1)	Type	Bus Trunking
	2)	Rated Insulation voltage	1000V
	3)	One second short ckt withstand current	50KA(RMS)
	4)	Momentary dynamic current withstand	105KA(PEAK)
	5)	Power frequency withstand voltage	3.5kv
	6)	Impulse withstand voltage	8kV
	7)	Insulation	Class F
2.07.00	**VOLTAGE TRANSFORMERS**		
	1)	Type	Cast Resin
	2)	Voltage Ratio	415 / 110 V for line PT
			415/√3 / 110/√3 V for Bus PT
	3)	Method of Construction	Vee Vee
	4)	Accuracy Class	0.5
	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

2.08.00	**HRC FUSES**		
	1)	Voltage Class	650 Volts
	2)	Rupturing capacity	80 KA (rms) for AC ckt. 20 KA for DC ckt.
2.09.00	**CONTACTORS**		
		Type	Air break electro magnetic
	2)	Utilising Category	AC3 of IS/IEC 60947 for non reversible AC4 of IS/IEC 60947 for reversible drives
2.10.00	**RELAYS**		
	1)	Power frequency withstand voltage	2.5KV for 1 sec. or 2.0 KV for 1 min.
2.11.00	**CONTROL TRANSFORMERS**		
	1)	Type	Dry / Cast Resin
	2)	Voltage Ratio	415 / 110 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.
2.12.00	**LIGHTING TRANSFORMER / WELDING TRANSFORMER**		
	1)	Type & Rating	Dry type / 100 KVA
	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
	5) Enclosure protection	IP-42
2.13.00	**TRANSDUCERS**	
	1) Current transducers	
	a) Input	0-1 A (CT secondary)
	b) Rated frequency	50HZ
	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	110 V(VT secondary) ,50 HZ (for AC)/240 V DC (for DC)
	b) Output	4-20 mA (2 Nos. decoupled)
	c) Accuracy	1.0
2.14.00	**MCCB**	
	1) Rated voltage	415V
	2) Rated insulation level	690V
	3) Rated ultimate &Service S.C. breaking capacity	50KA
	4) Rated making capacity	105KA
	5) Utilization category	A

3.00.00	**CONSTRUCTIONAL DETAILS OF SWITCHBOARDS**
3.01.00	All Switchboards i.e., 415 V Switchgears, Motor Control Centres (MCCs), AC Distribution Boards (ACDBs), 220 V DC Distribution Boards (DCDBs) and Solenoid Valve Distribution Boards, shall be of metal enclosed, indoor, floor-mounted, free-standing type.
3.02.00	All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material.
3.03.00	All panel edges and cover / door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members. The top covers of the panels should be designed such that they do not permanently bulge/ bend by the weight of maintenance personnel working on it.
3.04.00	The switchboards shall be of bolted design. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cutouts shall be true in shape and devoid of sharp edges.
3.05.00	All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. However, the busbar chambers having a degree of protection of IP: 42 are also acceptable where continuous busbar rating is 1600A and above. Provision shall be made in all compartments for providing IP: 5X degree of protection, when circuit - breaker or module trolley has been removed. All cutouts shall be provided with EPDM / Neoprene gaskets.
3.06.00	Provision of louvers on switchboards would not be preferred. However, louvers backed with metal screen are acceptable on the busbar chambers where continuous busbar rating is 1600 A and above. The enclosure for outdoor oil filteration panels shall be constructed of stainless steel sheets in order to have protection against corrosion.The Degree of protection for outdoor panels shall be IP:65.The panels shall be mounted on a pedestal at a height of 500mm from ground level.
3.07.00	All switchboards shall be of uniform height not exceeding 2450 mm.
3.08.00	Switchboards shall be easily extendable on both sides by the addition of vertical sections after removing the end covers.
3.09.00	Switchboards shall be supplied with base frames made of structural steel sections, along with all necessary mounting hardware required for welding down the base frame to the foundation