BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS HVDC ENGINEERING & SYSTEMS

DOCUMENT No.	**TB-409-316-030**	Rev. No.	**00**	Prepared	Checked	Approved
TYPE OF DOC.	**TECHNICAL SPECIFICATION**		SIGN			
TITLE			NAME	**NS**	**SKS**	**AG**
Illumination System			DATE	17/05/20	17/05/20	17/05/20
			GROUP	**HVDC**	W.O. No	I19TB00002 Rev0

CUSTOMER	***POWERGRID FATEHGARH TRANSMISSION LIMITED- A 100% wholly owned subsidiary of Power Grid Corporation of India Limited***
PROJECT	**Substation Package - SS02 for (i) 765kV Fatehgarh-2 (PG) S/S Extension and (ii) 765kV Bhadla-2 (PG) S/s Extension under Transmission System Associated With LTA applications from Rajasthan SEZ Part-B (Rajasthan SEZ Part-B Project) through Tariff Based Competitive Bidding (TBCB) Route**
NOA NO.	**FTL/765kV/SS02/NOAI/2(I) For Supply of Goods Contract Dated 05-11-19 & FTL/765kV/SS02/NOAII/2(II) For Supply of Service Contract Dated 05-11-2019**
Station	**Fatehgarh-2, Rajasthan and Bhadla-2, Rajasthan**

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	To	HVDC	TBMM	TBQM	Vendor
	Copies	1	1	1	4

SECTION-1

Scope, Bill of Quantity, Specific Technical Requirements

1.1 Scope

This technical specification covers the requirements of design, engineering, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to project site of Illumination equipment complete in all respect for efficient & trouble-free operation mentioned under this specification.

The Illumination System shall be provided for the following areas:

- Outdoor extension switchyard area under present scope.

Complete lighting and illumination for the above shall be provided by the bidder as per BOQ in Annexure 1.

The area of the outdoor switchyard to be illuminated are as marked on the enclosed drawings under Annexure 2. Other relevant drawings are also enclosed under Annexure 2.

The Contract shall be on item rate basis for the Outdoor Switchyard. In case of change in the requirement for Outdoor Switchyard during detailed design after placement of order, additions / deletions to the scope shall be settled as per unit rates furnished in the Contract.

After placement of order, the bidder has to design the system as per relevant standards/codes, practice to the satisfaction of BHEL/ ultimate Customer i.e. POWERGRID.

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 any work and material, which in his judgment is not in full accordance herewith.

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

In case of any deviation, the bidder shall indicate separately the clause wise deviation with respect to the specification in the "Schedule of deviations". Deviations in any other form including clarifications / assumptions etc. will not be considered and it will be construed as the bid conforming strictly to the specification.

In case of any conflict between the technical details mentioned in this section and the remaining sections of this document, then Section-1 shall prevail and is to be considered as binding requirement. The order of precedence in case of any conflict shall be section 1, section 2 & section 3 in that order.

Note: The terms used in this specification namely, "Employer/Purchaser/Owner" refers to Powergrid, "Contractor "refers to BHEL & "Sub-contractor" refers to successful bidder.

The equipment is required for the following project:

Name of the customer	:	**POWERGRID FATEHGARH TRANSMISSION LIMITED- A 100% wholly owned subsidiary of Power Grid Corporation of India Limited**
Name of the project	:	**Substation Package - SS02 for (i) 765kV Fatehgarh-2 (PG) S/S Extension and (ii) 765kV Bhadla-2 (PG) S/s Extension under Transmission System Associated With LTA applications from Rajasthan SEZ Part-B (Rajasthan SEZ Part-B Project) through Tariff Based Competitive Bidding (TBCB) Route**
Site	:	**Fatehgarh-II, Rajasthan & Bhadla-II, Rajasthan**

Refer Section - III for Project Details and General Specifications.

1.2 Bill of Quantities

1.2.1 The quantities for Bhadla II & Fatehgarh II shall be as per the enclosed Annexure-1.

Notes:

a. Quantity Variation: Total PO value may vary by ±40%, however individual items can vary up to any extent.
b. All floor/structure mounting hardware shall be Hot Dip Galvanised and to be supplied complete with hardware i.e. nut bolt washers etc.

1.3 Specific Technical Requirements

Refer section 2 for the detailed requirement.

1.3.1 Design Criteria

a. The illumination System for outdoor Switchyard shall comprise of:
   - Normal AC lighting
   - Emergency AC Lighting

25% of lighting fixtures shall be connected on AC emergency lighting.

b. The outdoor switchyard shall be illuminated using 150W FL-1 type (LED flood light luminaries) & 250W FL-2 type (LED flood light luminaries). Please refer Section 2 for detailed parameters of FL-1 and FL-2 type luminaries. LED fixtures will be mounted at 28 m height on the tower in switchyard area. LED fixtures may also be mounted on fire wall in Reactor area.
c. In an area, the lighting fixtures shall be arranged in different phase / LPs such that even in case one phase is faulty complete lighting should not be affected. In case of any location the lighting shall be arranged from all three phases for normal as well as normal/ emergency supply.
d. Detailed lighting design calculations considering the number of fittings as per BOQ shall be submitted by bidder for approval of BHEL / ultimate customer.
e. The detailed drawings showing lighting layout, disposition and location of lighting fixtures, receptacles, switchboards etc, wiring scheme, wiring & conduit layout, fixing details, OGAs of all equipment, Cable schedule for switchyard etc shall be submitted for approval.
f. Earthing of Junction box & Lighting Panels etc. is to be done by 50X6 GI Flat.
g. All lighting panels, junction boxes, receptacles fixtures, conduits etc. shall be grounded in compliance with the provision of I.E. rules.

1.3.2 Scope of Supplies

a. The equipment / services to be furnished for Substations under this contact are detailed hereunder and shall be read in conjunction with other clauses of this specification. All such items though not specifically mentioned but required to meet specification and 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.
b. Tentative quantities are mentioned in BOQ. Actual quantities to be supplied shall be as per the quantities approved based on design drawings. Bidder has to work out the design and indicate at bid stage, if change in quantity is required.

c. The Following items are not in bidder's scope of supply:
(a) Multicore 3.5CX70 sqmm Al., 4CX16sqmm Al. (2CX6sq.mm Al.)/(2CX2.5 sq. mm Cu) - PVC Power Cables
(b) 75X12 & 50X6 mm Galvanized strip for earthing
(c) 110mm / 50mm PVC Pipe for buried cable trench
(d) 40mm MS Rod

d. LIGHTING JUNCTION BOX - The bidder shall supply junction boxes complete with terminals as required. The brackets, bolts, nuts, screws etc required for erection are also included in the scope of the bidder.

e. Mounting structure/accessories for mounting of LED Fixtures, Lighting Panels, outdoor power receptacles etc. required for erection are also included in the scope of bidder.

f. Bidder shall indicate in his offer catalogue numbers of all equipment offered.

g. Supply of all other items such as wires, steel wire etc. required to complete the works are in bidder's scope.

1.3.3 Scope of Services

a. Design of outdoor lighting system including design, engineering, Lux Level calculation, Lighting Layout, Power Distribution scheme, detailed Cable Schedule & Bill of Qty is in bidder's scope as per attach Annexure 1 and bid price schedule.

b. Site execution / Erection Testing & commissioning works at site is not in bidder's scope. However, Bidder to provide procedure / inputs / manual for installation purpose and provide necessary engineering support for commissioning.

1.4 Technical Pre-Qualifying Requirement for Illumination System:

The bidder should have satisfactorily designed and supplied Illumination System for at least two projects of State Electricity Boards/ Central Utilities/State or Central Transmission Utilities/ Industrial Installations, in the last 5 years as on the date of technical bid opening.

Bidder has to submit proof of design, by submitting the approved design documents and/or drawings,
Bidder has to submit proof of supply by submitting the Purchase Order copy and performance certificates/MRC etc.

1.5 Type Tests

i. All equipment being supplied shall conform to type tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective sections.

ii. The reports for all type tests as per technical specification shall be furnished by the Bidder along with equipment / material drawings. However, type test reports of

similar equipment/ material already accepted in POWERGRID shall be applicable for all projects with similar requirement. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by POWERGRID or representative authorized by POWERGRID or Utility or representative of accredited test lab.

Unless otherwise specified elsewhere, the type test reports submitted shall be of the tests conducted on or after 05-Nov-2009. In case the test reports are of the test conducted earlier than 05-Nov-2009, the bidder shall repeat these test(s) at no extra cost to the BHEL/Employer.

Further, in the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification or any/all type tests not carried out, same shall be carried out without any additional cost implication to the BHEL/Employer.

The Bidder shall intimate the Employer/BHEL the detailed program about the type tests atleast two (2) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.

iii. The Employer reserves the right to witness any or all the type tests. The Employer shall bear all expenses for deputation of Employer's representative(s) for witnessing the type tests.

iv. The list of makes of various items, for which Type test reports are not required to be submitted are specified in Compendium of Vendors (COV).

1.6 Drawings & Engineering Documents

The successful bidder shall have to extend all possible support like timely submission/resubmission of drawings, visits to end customer to facilitate documents approval without any commercial implications to BHEL. Acceptance of bidder's documents shall be subject to end customer approval.

Date of Submission of first lot of drawings will be counted only from the date of submission of reasonably correct drawings. List of drawings required for technical clearance of manufacturing are as follows:

1. The bidder shall submit detailed calculation for reaching the Lux level (as applicable) for Employer's approval during detailed engineering.

2. Detailed lighting design calculations considering the number of fittings as per BOQ shall be submitted by bidder for approval of BHEL / ultimate customer.

3. Lighting layout, disposition and location of lighting fixtures, receptacles, switchboards etc, wiring scheme, wiring & conduit layout, fixing details, OGAs of all equipment, Cable schedule etc.

4. Approved Type Test Reports.

1.7 Deviations

The bidder shall list all the deviation from the specification separately. Offers without specific deviation will be deemed to be totally in compliance with the specification and NO DEVIATION on any account will be entertained at a later date.

ILLUMINATION SYSTEM - Fatehgarh II - Annexure 1 (REV 00)				SS02 Annexure 1
S.No.	**DESCRIPTION**	**UNIT**	**QTY**	**REMARKS**
765kV Fatehgarh II Substation				
A.	**SUPPLY**			
A.1	SUPPLY- ILLUMINATION EQUIPMENT : LIGHTING PANEL (OUTDOOR) TYPE ACP-2	NO	1	Complete in all aspects including mounting arrangement and other accessories/materials etc. as required for complete installation and commissoning
A.2	SUPPLY- ILLUMINATION EQUIPMENT : OUTDOOR SUB-LIGHTING PANEL (TYPE SLP)	NO	3	Complete in all aspects including mounting arrangement and other accessories/materials etc. as required for complete installation and commissoning
A.3	SUPPLY- ILLUMINATION EQUIPMENT : OUTDOOR POWER RECEPTACLE FOR OIL FILTRATION UNIT (250A)	Set	2	Type RQ1 - Complete in all aspects including mounting arrangement and other accessories/materials etc. as required for complete installation and commissoning
A.4	SUPPLY- ILLUMINATION EQUIPMENT : LED FLOOD LIGHTING FIXTURES- TYPE " FL1" AS PER TECHNICAL SPECIFICATION	NO	2	Including lighting wires & flexible conduit (if required) from junction box to lighting fixture, mounting arrangement and other accessories/materials etc. as required for complete installation and commissoning of lighting fixture
A.5	SUPPLY- ILLUMINATION EQUIPMENT : LED FLOOD LIGHTING FIXTURES- TYPE " FL2" AS PER TECHNICAL SPECIFICATION	NO	16	Including lighting wires & flexible conduit (if required) from junction box to lighting fixture, mounting arrangement and other accessories/materials etc. as required for complete installation and commissoning of lighting fixture
A.6	SUPPLY- ILLUMINATION EQUIPMENT : OUTDOOR JUNCTION BOX	NO	6	Complete in all aspects including mounting arrangement and other accessories/materials etc. as required for complete installation and commissoning
B.	**SERVICES**			
B.1	SERVICES- ILLUMINATION EQUIPMENT : DESIGN OF OUTDOOR LIGHTING SYSTEM INCLUDING LUX LEVEL CALCULATION, LIGHTING LAYOUT, POWER DISTRIBUTION SCHEME, DETAILED CABLE SCHEDULE & DETAILED BILL OF QTY	LOT	1.0	

ILLUMINATION SYSTEM - Bhadla II - Annexure 1 (REV 00)				SS02 Annexure 1
S.No.	**DESCRIPTION**	**UNIT**	**QTY**	**REMARKS**
765kV Bhadla II Substation				
A.	**SUPPLY**			
A.1	SUPPLY- ILLUMINATION EQUIPMENT : LIGHTING PANEL (OUTDOOR) TYPE ACP-2	NO	1	Complete in all aspects including mounting arrangement and other accessories/materials etc. as required for complete installation and commissoning
A.2	SUPPLY- ILLUMINATION EQUIPMENT : OUTDOOR SUB-LIGHTING PANEL (TYPE SLP)	NO	3	Complete in all aspects including mounting arrangement and other accessories/materials etc. as required for complete installation and commissoning
A.3	SUPPLY- ILLUMINATION EQUIPMENT : LED FLOOD LIGHTING FIXTURES- TYPE " FL1" AS PER TECHNICAL SPECIFICATION	NO	2	Including lighting wires & flexible conduit (if required) from junction box to lighting fixture, mounting arrangement and other accessories/materials etc. as required for complete installation and commissoning of lighting fixture
A.4	SUPPLY- ILLUMINATION EQUIPMENT : LED FLOOD LIGHTING FIXTURES- TYPE " FL2" AS PER TECHNICAL SPECIFICATION	NO	8	Including lighting wires & flexible conduit (if required) from junction box to lighting fixture, mounting arrangement and other accessories/materials etc. as required for complete installation and commissoning of lighting fixture
A.5	SUPPLY- ILLUMINATION EQUIPMENT : OUTDOOR JUNCTION BOX	NO	4	Complete in all aspects including mounting arrangement and other accessories/materials etc. as required for complete installation and commissoning
B.	**SERVICES**			
B.1	SERVICES- ILLUMINATION EQUIPMENT : DESIGN OF OUTDOOR LIGHTING SYSTEM INCLUDING LUX LEVEL CALCULATION, LIGHTING LAYOUT, POWER DISTRIBUTION SCHEME, DETAILED CABLE SCHEDULE & DETAILED BILL OF QTY	LOT	1.0	

Technical Pre-Qualifying Requirements – For Illumination System – Fatehgarh II and Bhadla II

The bidder should have satisfactorily designed and supplied Illumination System for at least two projects of State Electricity Boards/ Central Utilities/State or Central Transmission Utilities/ Industrial Installations, in the last 5 years as on the date of technical bid opening.

Bidder has to submit proof of design, by submitting the approved design documents and/or drawings,
Bidder has to submit proof of supply by submitting the Purchase Order copy and performance certificates/MRC etc.

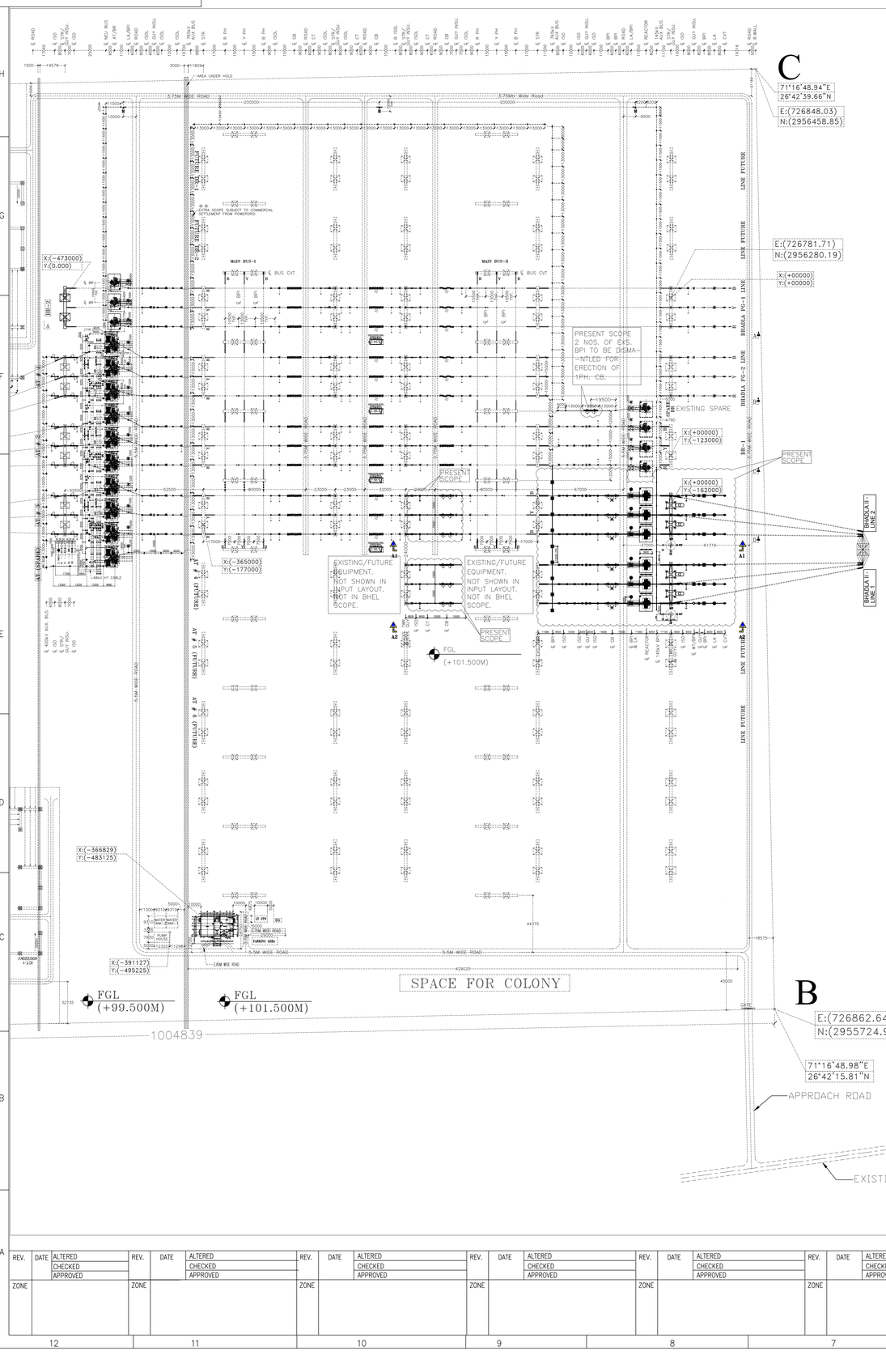
Prepared By: Nishant Singh (Sr Engineer)

Checked By: Sanjeev K. Shrivastava (DGM)

Approved By: Aruna Gulati (AGM)

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No. TB-0-409-316-031-F



EXISTING/FUTURE - NOT IN BHEL SCOPE

BHEL SCOPE

N

STATION: FATEHGARH II EXTENSION

BILL OF EQUIPMENTS - 765kV:-

S.NO.	DESCRIPTION	ENGG. QTY. (NOS)	SUPPLY QTY. (NOS)	QTY. AS PER BPS (NOS)	SYMBOL	MAKE
1.0	765kV CIRCUIT BREAKER WITH CR & WITHOUT CSD (3150A, 40KA 1 SEC, 3PH.)	2	4	4		##
2.0	765kV CIRCUIT BREAKER WITHOUT CR(3150A, 40KA 1 SEC, 3PH.) SUITABLE FOR 1 PHASE REACTOR SWITCHING	2	2	2		##
3.0	CONTROL SWITCHING DEVICE (CSD) FOR 765kV CIRCUIT BREAKER WITHOUT CR(3150A, 40KA 1 SEC, 3PH.) SUITABLE FOR 1 PHASE REACTOR SWITCHING	2	2	0		##
4.0	765kV CIRCUIT BREAKER WITHOUT CR (3150A, 40KA 1 SEC, 1PH.) SUITABLE FOR 1 PHASE REACTOR SWITCHING	1	1	1		##
5.0	765kV ISOLATOR WITH TWO EARTH SWITCH (3-Ph.) 3150A, 40KA 1 SEC	0	2	2		##
6.0	765kV ISOLATOR WITH ONE EARTH SWITCH (3-Ph.) 3150A, 40KA 1 SEC	4	8	8		##
7.0	765kV ISOLATOR WITH ONE EARTH SWITCH (1-Ph.) 2000A, 40KA 1 SEC	6	6	7		##
8.0	765kV ISOLATOR WITHOUT EARTH SWITCH (1-Ph.) 2000A, 40KA 1 SEC	12	12	11		##
9.0	765kV CURRENT TRANSFORMER 3000A, 40KA,1 SEC, 1-Ph.	6	12	12		##
10.0	765kV CAPACITIVE VOLTAGE TRNSFORMER 8800PF, 1-Ph.	6	6	6		BHEL
11.0	624kV SURGE ARRESTOR, CLASS V	12	12	12		##
12.0	765kV, 1 mH LINE TRAP (3150A, 40KA 1 SEC, 1PH.)	4	4	4		##
13.0	800 KV, 1PH. BUS POST INSULATOR - 8KN	23	23	36		##
14.0	800 KV, 1PH. GUY INSULATOR	18	18	--		BHEL

CLEARANCE TABLE AS PER POWERGRID SPECIFICATION:-

Sl.No.	DESCRIPTION	765KV SYSTEM
1	PHASE TO PHASE FOR CONDUCTOR-CONDUCTOR CONFIGURATION FOR ROD-CONDUCTOR CONFIGURATION	7600mm 9400mm
2	PHASE TO EARTH FOR CONDUCTOR-CONDUCTOR STRUCTURE FOR ROD-CONDUCTOR CONFIGURATION	4900mm 6400mm
3	SECTIONAL CLEARANCE	10300mm
4	MIN HEIGHT OF EGPST BUS CENTRE LINE ABOVE PLINTH LEVEL	+14000mm
6	VERTICAL DISTANCE BETWEEN LOWEST PART OF INSULATOR TO PLINTH	2550mm

BILL OF EQUIPMENTS - NGR RELATED:-

S.NO.	DESCRIPTION	QTY. AS PER SLD	QTY. AS PER BPS	SYMBOL	MAKE
1.0	145kV CIRCUIT BREAKER (1-PH) FOR NGR BY-PASSING ARRANGEMENT	2	2		##
2.0	33kV NEUTRAL CURRENT TRANSFORMER FOR EACH 765kV REACTOR BANK	2	2		##
3.0	145 KV, 1PH. BUS POST INSULATOR - 6KN	13	15		##

CONDUCTOR & STRINGING DETAILS -765kV

SL.NO.	DESCRIPTION	LEVEL FROM PLINTH	SUB-CONDUCTOR	SUSPENSION/TENSION INSULATOR STRING/PHASE
1.	JACKBUS	(AT 39M HEIGHT)	QUAD AAC BULL CONDUCTOR WITH 450MM SUB-CONDUCTOR SPACING	DOUBLE TENSION 210 KN TWIN POLYMER ROD INSULATOR
2.	DROPPERS/JUMPERING	-	QUAD AAC BULL CONDUCTOR WITH 450MM SUB-CONDUCTOR SPACING	V-SUSPENSION STRING 210kN
3.	EQUIPMENT INTERCONNECTION	(AT 14M HEIGHT)	4.5" IPS AL. TUBE (120mm OD)/QUAD AAC BULL CONDUCTOR WITH 450MM SPACING & TWIN AAC BULL FOR EHT AND LA.	
4.	EARTHWIRE	(AT 45M HEIGHT)	7/3.66mm GI WIRE (10.98mm DIA)	
5.	145kV AUX NEUTRAL BUS	(AT 6.5M HEIGHT)	3" IPS AL. TUBE (88.9mm OD)	

THE TECHNICAL PARAMETERS FOR WHICH THE SYSTEM IS DESIGNED ARE:	
A. SYSTEM OPERATING VOLTAGE	765KV
B. MAX. SYSTEM VOLTAGE (RMS)	800KV
C. LIGHTNING IMPULSE WITHSTAND VOLTAGE (DRY & WET)	2100KVP
D. SWITCHING IMPULSE WITHSTAND VOLTAGE (DRY & WET)	1550KVP
E. ONE MIN. POWER FREQUENCY WITHSTAND VOLTAGE (DRY & WET)	830KV (RMS)
F. NOMINAL CREEPAGE DISTANCE - FOR EQUIPMENT	20000MM (25MM/KV)
G. NOMINAL CREEPAGE DISTANCE - FOR INSULATOR STRING	8400MM (31MM/KV)
H. MAXIMUM FAULT LEVEL	40KA/1SEC.
I. CORONA EXTINCTION VOLTAGE	508kV
J. SYSTEM NEUTRAL EARTHING	EFFECTIVELY EARTHED
K. RATED FREQUENCY & NO. OF PHASE	50Hz & 3

NOTES :-

1. DEAD END TOWER ERECTION AND OUTGOING STRINGING OF LINE CONDUCTOR & SHIELD WIRE ARE NOT IN BHEL SCOPE BUT CONNECTION OF EQUIPMENT TOWARDS LINE SIDE SHALL BE DONE BY BHEL. SUPPLY OF TENSION INSULATOR STRING ON LINE SIDE OF TAKE OFF GANTRY IS IN BHEL SCOPE OF WORK INCLUDING TENSION CLAMP FOR EARTHWIRE.
2. INTER EQUIPMENT DIMENSION ARE PLANNED SO AS TO ACHIEVE REQUIRED PHYSICAL AND ELECTRICAL CLEARANCE. HOWEVER IF ELECTRICAL CLEARANCE ARE NOT AVAILABLE AT SITE AND MODIFICATIONS ARE REQUIRED TO ACHIEVE IT, THE REQUIRED MODIFICATION WILL BE DONE BY BHEL WITHOUT ANY EXTRA COST IMPLICATION TO OWNER.
3. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
4. LOCATION OF MT SHOWN IS INDICATIVE ONLY. EXACT LOCATION SHALL BE FINALIZED DURING ERECTION COMMISSIONING STAGE BASED ON LINE PARAMETERS/ LEAST ATTENUATION, FOUNDATION FOR WAVE TRAP SHALL BE CONSTRUCTED FOR ALL THREE PHASES IN 765kV AREA.
5. DETAILS OF BMC, CTUB, CVT JUNCTION BOX & SWITCHYARD PANEL ROOM (SPR) LOCATION SHALL BE SHOWN IN CABLE TRENCH LAYOUT DRAWING.
6. PLINTH HEIGHT OF FOUNDATION WILL BE MIN. 300MM FROM FINISHED GROUND LEVEL (F.G.L).
7. LINE SIDE EQUIPMENT FOUNDATIONS TO BE CONSTRUCTED AFTER CONFIRMATION OF DEAD END TOWER LOCATION FROM POWERGRID SITE. ANY DISCREPANCY MAY BE BROUGHT TO NOTICE OF TBEM.
8. SUPPLY, ERECTION, TESTING, COMMISSIONING OF 765kV REACTOR INCLUDING (OLTC) & (NGR, 120kV LA OF REACTOR), IS NOT IN BHEL SCOPE. HOWEVER, EXTENSION OF EXISTING AUXILIARY REACTOR BUSES ALONG WITH BPI & ITS STRUCTURE EARTHING AND EARTHING OF OWNER SUPPLIED TRANFORMERS/ REACTORS & ASSOCIATED CIVIL WORKS IS COVERED IN SCOPE OF WORK AS PER BPS AND TS.
9. FIRE RESISTANT WALL BETWEEN 765kV REACTORS UNITS ARE IN BHEL SCOPE.

NOA NO.	FTL/765kV/SS02/NDAI/2(I) For Supply of Goods Contract Dated 05-11-2019 & FTL/765kV/SS02/NDAII/2(II) For Supply of Service Contract Dated 05-11-2019
ADDITIONAL INFORMATION W.O.No.	xzkgd@ifj; ksU (A 100% WHOLLY OWNED SUBSIDIARY OF POWERGRID)
STATUS OF DRAWING	NAME OF CUSTOMER/PROJECT SUBSTATION PACKAGE - SS02 for (i) 765kV FATEHGARH-2 (PG) S/S EXTENSION AND (ii) 765kV BHADLA-2 (PG) S/S EXTENSION - TBCB
DISTRIBUTION OF PRINTS	BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION

	NAME	gLFA/STGD	VENDOR
DRAWN	NS		31-12-19
CHECKED	SKS		31-12-19
APPROVED	AG		31-12-19

REV.	DATE	ALTERED
01	09-04-2020	NS
		CHECKED SKS
		APPROVED AG

REVISED AS PER POWERGRID'S COMMENTS DATED 21-01-2020 AND MEETING DATED 29-01-2020.

765 kV LAYOUT PLAN AND SECTION

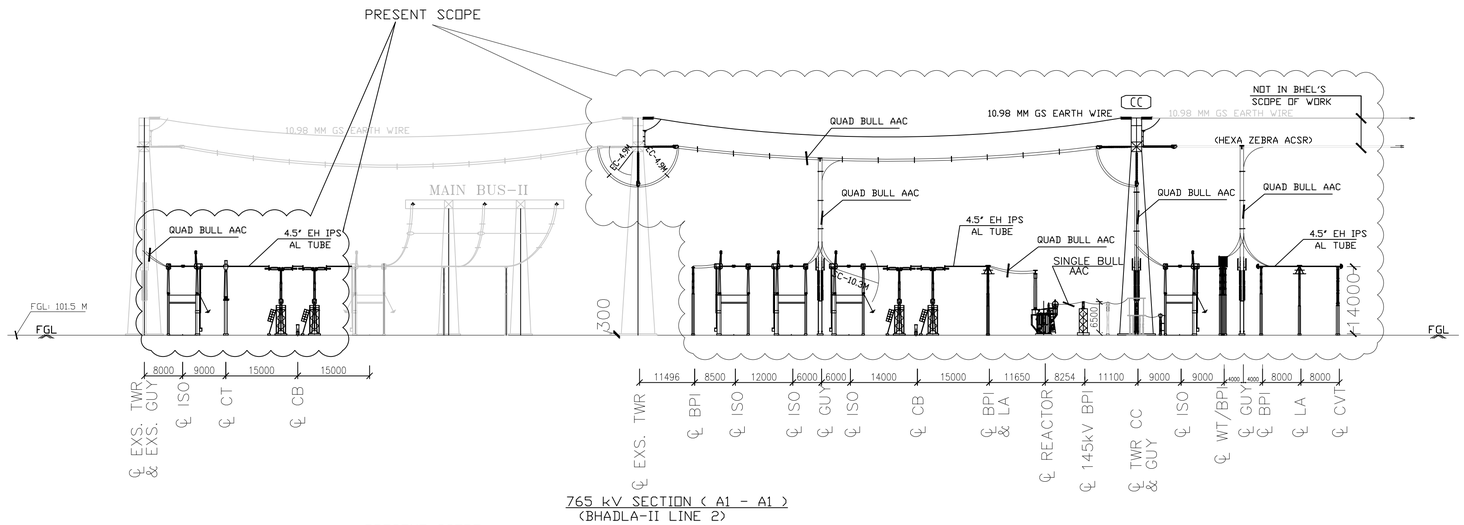
TB-0-409-316-031-F | 01

SHEET No. 01 | NEXT SHEET 02

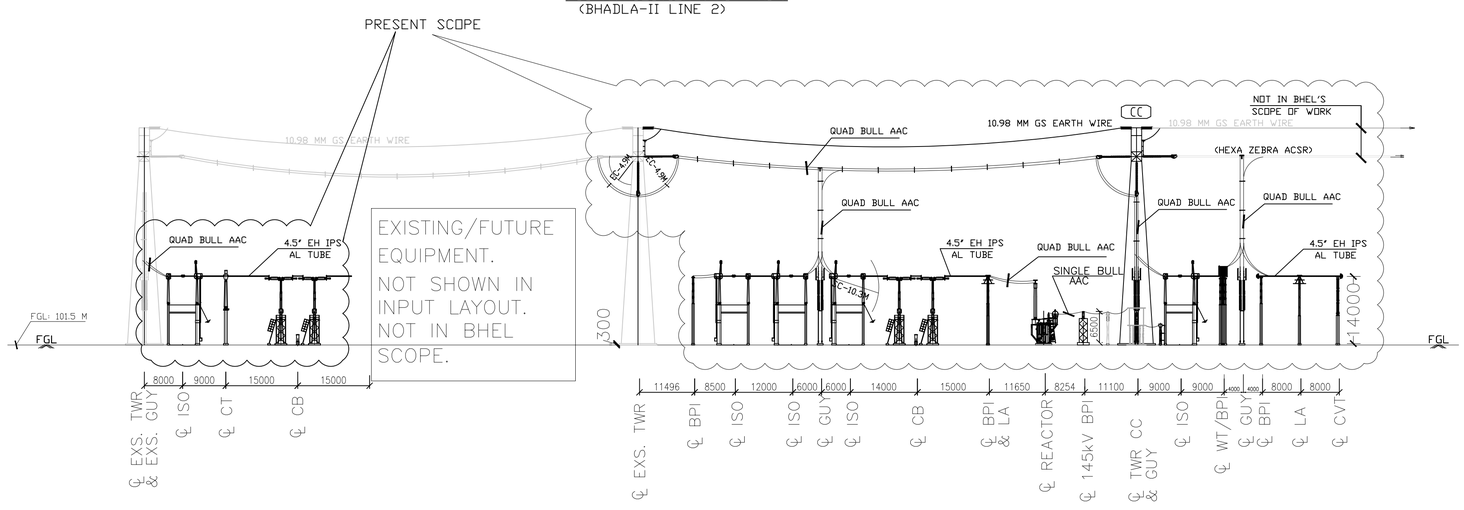
SIGN. & DATE | REF. DRG. No. | COMPUTER DRG. PATH NAME : | INVENTORY No.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No. TB-0-409-316-031-F



765 kV SECTION (A1 - A1)
(BHADLA-II LINE 2)



765 kV SECTION (A2 - A2)
(BHADLA-II LINE 1)

EXISTING/FUTURE - NOT IN BHEL SCOPE

BHEL SCOPE

STATION: FATEHGARH II EXTENSION

REV.	DATE		ZONE
		ALTERED / CHECKED / APPROVED	
01	06-05-2020	ALTERED_NS / CHECKED_SKS / APPROVEDAG	REVISED AS PER POWERGRID'S COMMENTS DATED 21-01-2020 AND MEETING DATED 29-01-2020.

NOA NO.	FTL/765kV/SS02/NDAI/2(I) For Supply of Goods Contract Dated 05-11-2019 & FTL/765kV/SS02/NDAII/2(II) For Supply of Service Contract Dated 05-11-2019
ADDITIONAL INFORMATION W.O.No.	
STATUS OF DRAWING	
DISTRIBUTION OF PRINTS	

प्राइवेट/पॉवरग्रिड लिमिटेड FATEHGARH-II TRANSCO LIMITED
(A 100% WHOLLY OWNED SUBSIDIARY OF POWERGRID)
NAME OF CUSTOMER/PROJECT: SUBSTATION PACKAGE - SS02 for (i) 765kV FATEHGARH-2 (PG) S/S EXTENSION AND (ii) 765kV BHADLA-2 (PG) S/S EXTENSION - TBCB

BHEL — भारत हेवी इलेक्ट्रिकल्स लिमिटेड
ट्रांसमिशन परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता ./SIGN.	दि./DATE
बनाया/DRAWN	NS		31-12-19
जाँचा/CHECKED	SKS		31-12-19
स्वीकृत/APPROVED	AG		31-12-19

विभाग/DEPT.: उलुपात / SCALE
कोड/CODE: कार्ड कोड/CARD CODE
VENDOR

शीर्षक/TITLE: 765 kV LAYOUT PLAN AND SECTION

ड्राईंग सं./DRAWING NO.

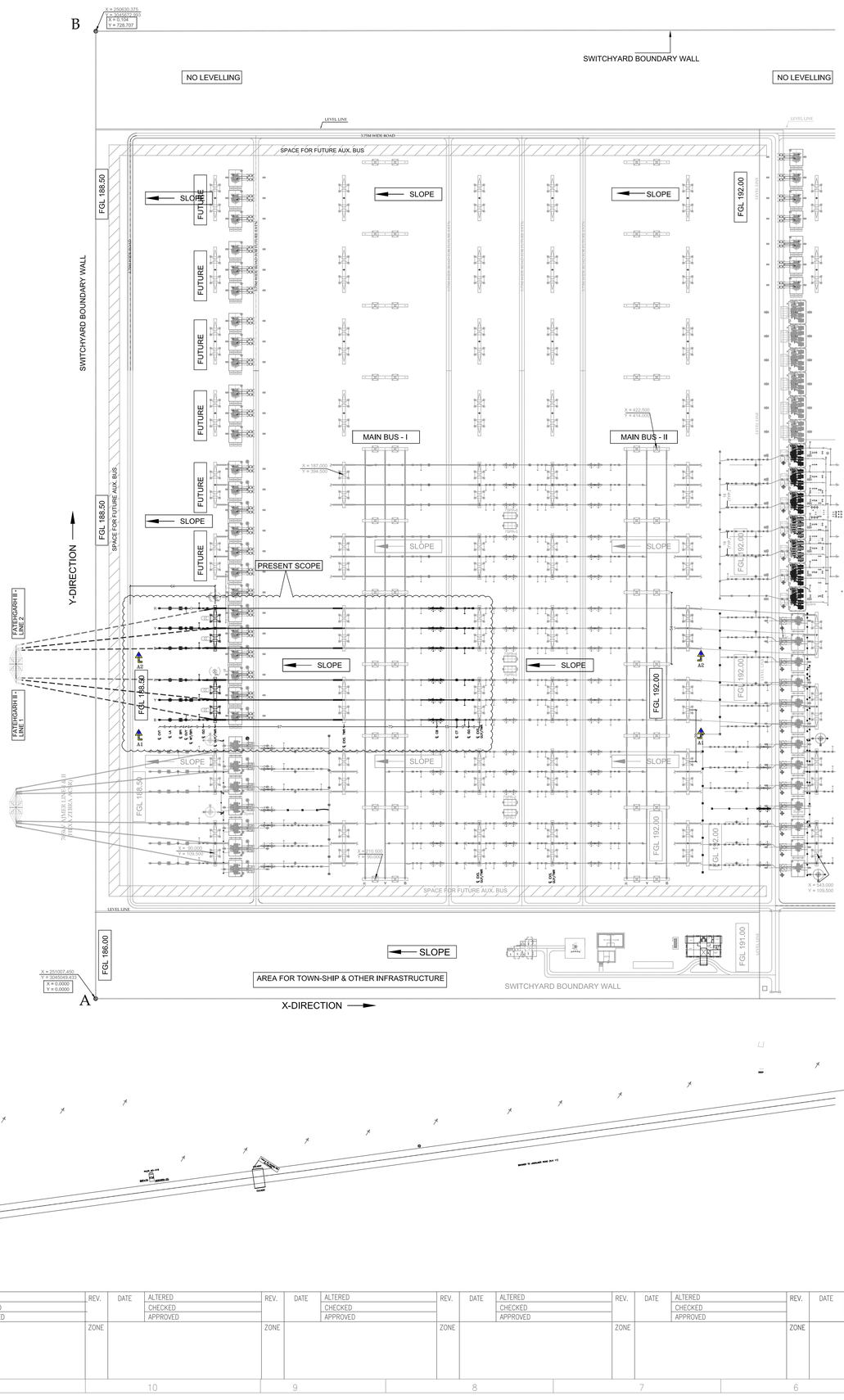
PG DRG NO.	TB-0-409-316-031-F
BHEL DRG NO.	TB-0-409-316-031-F

पृष्ठ सं./SHEET No. 02 | अगला पृष्ठ/NEXT SHEET --

प्रमा:/REV. 01

COMPUTER DRG. PATH NAME :
REF. DRG. No.
SIGN. & DATE
INVENTORY No.

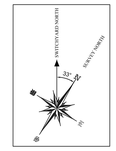
COMPUTER DRG. PATH NAME :



EXISTING 400kV AREA

EXISTING/FUTURE - NOT IN BHEL SCOPE

BHEL SCOPE



STATION: BHADLA II EXTENSION

BILL OF EQUIPMENTS - 765kV:- 01

S.NO.	DESCRIPTION	UNIT	ENGG. QTY.	SUPPLY QTY.	QTY. AS PER BPS	SYMBOL	MAKE
1.0	765kV CIRCUIT BREAKER WITH CR & WITHOUT CSD (3150A, 40KA 1 SEC, 3Ph.)	NOS.	2	4	4		##
2.0	765kV ISOLATOR WITH TWO EARTH SWITCH (3-Ph.) 3150A, 40KA 1 SEC	NOS.	0	2	2		##
3.0	765kV ISOLATOR WITH ONE EARTH SWITCH (3-Ph.) 3150A, 40KA 1 SEC	NOS.	4	8	8		##
4.0	765kV CURRENT TRANSFORMER 3000A, 40KA,1 SEC, 1-Ph.	NOS.	6	12	12		##
5.0	765kV CAPACITIVE VOLTAGE TRNSFORMER 8800PF, 1-Ph.	NOS.	6	6	6		BHEL
6.0	624kV SURGE ARRESTOR, CLASS V	NOS.	6	6	6		##
7.0	765kV, 1 mH LINE TRAP (3150A, 40KA 1 SEC, 1Ph.)	NOS.	4	4	4		##
8.0	800 KV, 1PH. BUS POST INSULATOR – 8KN	NOS.	8	8	18		##
9.0	800 KV, 1PH. GUY INSULATOR	NOS.	12	12	--		BHEL

CONDUCTOR & STRINGING DETAILS -765kV 01

SL.NO.	DESCRIPTION	LEVEL FROM PLINTH	SUB-CONDUCTOR	SUSPENSION/TENSION INSULATOR STRING/PHASE
1.	JACKBUS	(AT 39M HEIGHT)	QUAD AAC BULL CONDUCTOR WITH 450MM SUB-CONDUCTOR SPACING	DOUBLE TENSION 210 kN TWIN POLYMER ROD INSULATOR
2.	DROPPERS/JUMPERING	–	QUAD AAC BULL CONDUCTOR WITH 450MM SUB-CONDUCTOR SPACING	V-SUSPENSION STRING 210kN
3.	EQUIPMENT INTERCONNECTION	(AT 14M HEIGHT)	4.5" IPS AL TUBE (120mm OD)/QUAD AAC BULL CONDUCTOR WITH 450MM SPACING & TWIN AAC BULL FOR CVT AND LA.	
4.	EARTHWIRE	(AT 45M HEIGHT)	7/3.66mm GI WIRE (10.98mm DIA)	

THE TECHNICAL PARAMETERS FOR WHICH THE SYSTEM IS DESIGNED ARE:	
A. SYSTEM OPERATING VOLTAGE	765KV
B. MAX. SYSTEM VOLTAGE (RMS)	800KV
C. LIGHTNING IMPULSE WITHSTAND VOLTAGE (DRY & WET)	±2100KVP
D. SWITCHING IMPULSE WITHSTAND VOLTAGE (DRY & WET)	±1550KVP
E. ONE MIN. POWER FREQUENCY WITHSTAND VOLTAGE (DRY & WET)	830KV (RMS)
F. NOMINAL CREEPAGE DISTANCE - FOR EQUIPMENT	20000MM (25MM/KV)
G. NOMINAL CREEPAGE DISTANCE - FOR INSULATOR STRING	24800MM (31MM/KV)
H. MAXIMUM FAULT LEVEL	40KA/1SEC.
I. CORONA EXTINCTION VOLTAGE	508kV
J. SYSTEM NEUTRAL EARTHING	EFFECTIVELY EARTHED
K. RATED FREQUENCY & NO. OF PHASE	50Hz & 3

01 **NOTES :** –

1. DEAD END TOWER ERECTION AND OUTSOING STRINGING OF LINE CONDUCTOR & SHIELD WIRE ARE NOT IN BHEL SCOPE BUT CONNECTION OF EQUIPMENT TOWARDS LINE SIDE SHALL BE DONE BY BHEL. SUPPLY OF TENSION INSULATOR STRING ON LINE SIDE OF TAKE OFF GANTRY IS IN BHEL SCOPE OF WORK INCLUDING TENSION CLAMP FOR EARTHWIRE.
2. INTER EQUIPMENT DIMENSION ARE PLANNED SO AS TO ACHIEVE REQUIRED PHYSICAL AND ELECTRICAL CLEARANCE. HOWEVER IF ELECTRICAL CLEARANCE ARE NOT AVAILABLE AT SITE AND MODIFICATIONS ARE REQUIRED TO ACHIEVE IT, THE REQUIRED MODIFICATION WILL BE DONE BY BHEL WITHOUT ANY EXTRA COST IMPLICATION TO OWNER.
3. ALL DIMENSIONS ARE IN M UNLESS OTHERWISE SPECIFIED
4. LOCATION OF WT SHOWN IS INDICATIVE ONLY. EXACT LOCATION SHALL BE FINALIZED DURING ERECTION COMMISSIONING STAGE BASED ON LINE PARAMETERS/ LEAST ATTENUATION, FOUNDATION FOR WAVE TRAP SHALL BE CONSTRUCTED FOR ALL THREE PHASES IN 765kV AREA.
5. DETAILS OF BMK, CTJB, CVT JUNCTION BOX & SWITCHYARD PANEL ROOM (SPR) LOCATION SHALL BE SHOWN IN CABLE TRENCH LAYOUT DRAWING.
6. PLINTH HEIGHT OF FOUNDATION WILL BE MIN. 300MM FROM FINISHED GROUND LEVEL (F.G.L).
7. LINE SIDE EQUIPMENT FOUNDATIONS TO BE CONSTRUCTED AFTER CONFIRMATION OF DEAD END TOWER LOCATION FROM POWERGRID SITE. ANY DISCREPANCY MAY BE BROUGHT TO NOTICE OF TBEM.

01 CLEARANCE TABLE AS PER POWERGRID SPECIFICATION:-

Sl.No.	DESCRIPTION	765kV SYSTEM
1	PHASE TO PHASE FOR CONDUCTOR-CONDUCTOR CONFIGURATION FOR ROD-CONDUCTOR CONFIGURATION	7600mm 9400mm
2	PHASE TO EARTH FOR CONDUCTOR-CONDUCTOR STRUCTURE FOR ROD-CONDUCTOR CONFIGURATION	4900mm 6400mm
3	SECTIONAL CLEARANCE	10300mm
4	MIN HEIGHT OF EQPMT BUS CENTRE LINE ABOVE PLINTH LEVEL	+14000mm
6	VERTICAL DISTANCE BETWEEN LOWEST PART OF INSULATOR TO PLINTH	2550mm

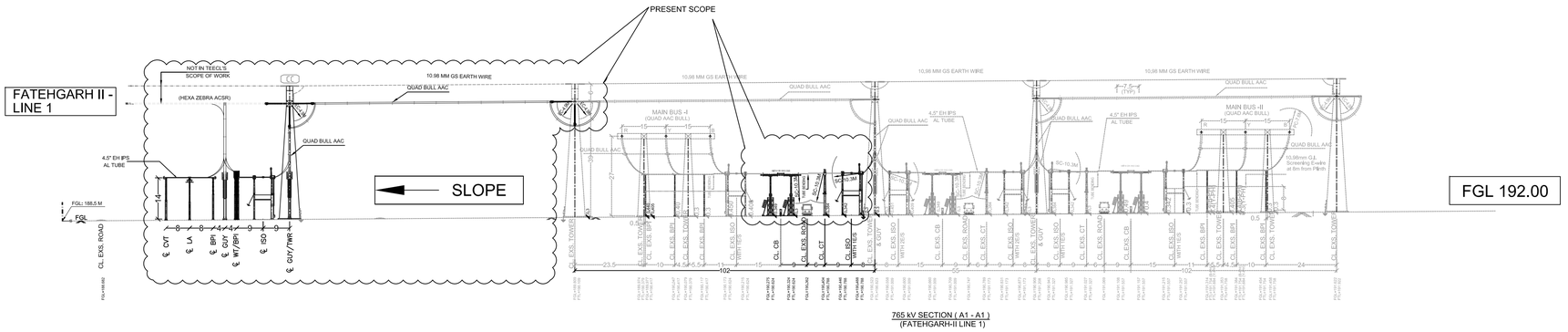
NOA NO.	FTL/765kV/SS02/NOAII/2(I) For Supply of Goods Contract Dated 05-11-2019 & FTL/765kV/SS02/NOAII/2(II) For Supply of Service Contract Dated 05-11-2019		
ADDITIONAL INFORMATION W.O.No.			
STATUS OF DRAWING			
DISTRIBUTION OF PRINTS	NAME OF CUSTOMER/PROJECT: FATEHGARH-II TRANSCO LIMITED (A 100% WHOLLY OWNED SUBSIDIARY OF POWERGRID) SUBSTATION PACKAGE - SS02 for (I) 765kV FATEHGARH-2 (PG) S/S EXTENSION AND (II) 765kV BHADLA-2 (PG) S/S EXTENSION - TBCB		
	BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION		
		बनाया DRAWN	NS / 31-12-19
		जाचा CHECKED	SKS / 31-12-19
		स्वीकृत APPROVED	AG / 31-12-19
		VENDOR	
		शीर्षक/TITLE	765 kV LAYOUT PLAN AND SECTION
		ड्राईग.क्र./DRAWING NO.	
		PG DRG NO.	TB-0-409-316-031-B
		BHEL DRG NO.	TB-0-409-316-031-B
		पुनः/REV.	01
		पृष्ठ क्र./SHEET No.	01
		अगला पृष्ठ /NEXT SHEET	02

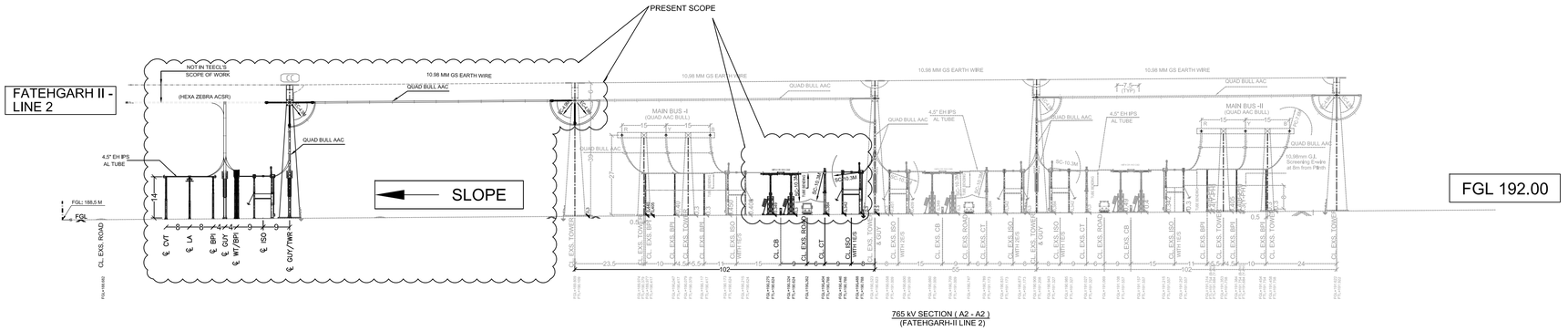
REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE
01	11-03-2020	ALTERED NS / CHECKED SKS / APPROVED AG	REVISED AS PER POWERGRID'S COMMENTS DATED 21-01-2020 AND MEETING DATED 29-01-2020.

REF. DRG. No.

SIGN. & DATE

INVENTORY No.





NOTES:

1. AS EXISTING SWITCHYRAD IS IN SLOPE, THE EXISTING ARRANGEMENT FOR EQUIPMENT/TOWER FOUNDATIONS MAY BE FOLLOWED FOR PRESENT SCOPE ALSO AND PLINTH HEIGHT TO BE ADJUSTED ACCORDINGLY.

NOA NO.	FTL/765kV/SS02/NOAI/2(I) For Supply of Goods Contract Dated 05-11-2019 & FTL/765kV/SS02/NOAII/2(II) For Supply of Service Contract Dated 05-11-2019
ADDITIONAL INFORMATION W.O.No.	
STATUS OF DRAWING	
DISTRIBUTION OF PRINTS	

ग्राहक/परियोजना का नाम NAME OF CUSTOMER/PROJECT: FATEHGARH-II TRANSCO LIMITED (A 100% WHOLLY OWNED SUBSIDIARY OF POWERGRID) SUBSTATION PACKAGE - SS02 for (I) 765kV FATEHGARH-2 (PG) S/S EXTENSION AND (II) 765kV BHADLA-2 (PG) S/S EXTENSION - TBCB

BHEL भारत हेवी इलेक्ट्रिकल्स लिमिटेड ट्रांसमिशन परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता ./SIGN.	दि./DATE
बनाया DRAWN	NS		31-12-19
जांचा CHECKED	SKS		31-12-19
स्वीकृत APPROVED	AG		31-12-19

REV.	DATE	ALTERED / CHECKED / APPROVED
01	11-03-2020	ALTERED NS / CHECKED SKS / APPROVED AG

विभाग DEPT. | कोड CODE | अनुपात / SCALE | कार्ड कोड CARD CODE | VENDOR

ZONE 01: REVISED AS PER POWERGRID'S COMMENTS DATED 21-01-2020 AND MEETING DATED 29-01-2020.

शीर्षक/TITLE: 765 kV LAYOUT PLAN AND SECTION

ड्रॉइंग क्र./DRAWING NO.: PG DRG NO. TB-0-409-316-031-B; BHEL DRG NO. TB-0-409-316-031-B

पुनः/REV. 01

पृष्ठ क्र./SHEET No. 02 अगला पृष्ठ/NEXT SHEET --

COMPUTER DRG. PATH NAME :
REF. DRG. No.
SIGN. & DATE
INVENTORY No.

SECTION-2

Refer POWERGRID Technical Specification: **Technical Specification, Section: LS ENGG / SPEC / LS REV.NO: 07 (32 Sheets).**

Section -LIGHTING SYSTEM (Rev.07)

Major Changes in Technical Specification Lighting System (Rev.07 w.r.t. Rev.06):-

1. For Indoor Lighting, LED fixtures to be supplied as per Quantity specified in Technical Specification.
2. For Outdoor Lighting & GIS Building, LED fixtures have been envisaged in place of Conventional Sodium Vapor Lamps (Quantity to be supplied as per BPS).
3. Firewall mounted Flood Lights have been envisaged for Transformer & Reactors (to be supplied as per BPS).
4. Portable Flood Light Panel for Maintenance purpose has been specified. Typical Drawing is also enclosed (to be supplied as per BPS).
5. Bidder shall be required to submit LM-79 & LM-80 reports for LED Luminaries.
6. Roof top Solar Grid System **with battery** has been replaced by Roof Top Solar Grid System of 50kW, 30kW & 20kW for 765kV, 400kV & 220kV Substation respectively (without Battery) to be integrated in ACDB. (to be supplied as per BPS).
7. Considering maintenance issue of Pole mounted battery, **Solar Panel along with battery** used for Street Lighting System has been deleted and Street Lighting using LED Luminaries is retained.
8. AC Emergency Lighting in GIS building, SPR, DG Area and LT Transformer Area has been specified.
9. Use of Occupancy Sensor has been deleted.
10. Lighting System for Township & Transit Camp included in line with Rev.05.
11. **Stainless steel** Panels/Junction Boxes of thickness 1.5 mm for Outdoor application has been specified.
12. Indoor Lighting Panels Bus Bar has been changed from Copper to Copper/**Aluminum Alloy**.
13. Technical Specification for Receptacle RQ-1 (250A) & RQ-2 (400A), 415V, 3-phase has been included for Oil filtration purpose.
14. All concealed Conduit shall be PVC type and all surface mounted conduit shall be of Galvanized steel.
15. Lighting Steel tubular Poles **painting changed** to hot deep galvanizing with PU (Polyurethane) coating in Suzuki Silver color.
16. Fixtures Model and Vendor names have been deleted and general technical parameters of LED fixtures have been included for Indoor as well as Outdoor Fixtures.
17. Bottom of Outdoor Lighting Panels mounting height shall be 1000mm from FGL.

Note : Above are major changes made in the Model TS, however Bidder is advised to refer Technical Specification in detail for other changes in the specification.

Section -LIGHTING SYSTEM (Rev.07)

1 GENERAL

The scope of work comprises of design, engineering, testing, supply, installation, testing and commissioning of various lighting fixtures complete with lamps, supports and accessories, ceiling fans with electronic regulators, exhaust fans with accessories, lighting panels, Sub-Lighting Panels, lighting poles with distribution boxes, PVC conduits, lighting wires, G.I. earth wire, receptacles, tag block & telephone socket, switchboards, modular switches, junction boxes, pull out boxes, aluminum ladders for maintenance, **solar grid system** complete with accessories.

The following specific areas are included in the scope of lighting as applicable (as per BPS):

i) Indoor Lighting

a) Control Room cum administrative building
b) Firefighting pump house
c) Switchyard panel rooms
d) GIS Building
e) Township & Transit Camp
f) Other Buildings

ii) Outdoor Lighting

a) Switchyard Area including DG Set & LT Transformer area
b) Street Lighting
c) Open Store

2 General Design Criteria

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 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 the lighting fixtures shall be made of impact resistant polystyrene sheet and shall have no yellowing property over a prolonged period Illumination. The type of Lighting Fixture to be used in different areas shall be as per **Annexure-I**.

For Indoor and Outdoor Illumination, detailed drawings showing the lighting layout and electrical distribution diagram shall be prepared by the Contractor and submitted for approval. Conduiting shall be done as per approved Lighting Layout and no separate drawings for the same shall be submitted for approval. The above layout drawings will include disposition and location of lighting fixtures, receptacles, lighting panels etc. While finalizing the detailed layout of lighting fixtures, the position/location and layout of equipment should be taken into account

to have adequate illumination at desired locations. In false Ceiling, surface wiring is permissible but all down run conduit will be concealed in wall below the false Ceiling.

2.1 **Indoor Illumination**

Indoor illumination shall be done by LED Luminaries as per the requirement of false ceiling and non-false ceiling of buildings.

2.2 **Outdoor Illumination**

Outdoor illumination shall be done by LED luminaries as per the requirement. For Outdoor Switchyard area, LED fixtures shall be installed at gantry structures (For 400kV & below voltage level) & available lightning masts (if any). However for 765kV Switchyard, LED fixtures will be installed at 28 meter height on the towers. For other outdoor areas, Street Lighting, lighting poles & nearby buildings (if any) shall be used for installation of LED fixtures. Additional firewall mounted Flood Lights have to be provided for Transformer & Reactors as specified in the BPS. Mounting structure /Accessories for Mounting of LED Lighting Fixtures will be prefabricated and will be hot dip galvanized.

Portable Flood Light Panel (PFLP): Portable Flood Light Panel along with fixture is to be supplied as per BPS for maintenance purpose of the Substation. The detailed drawing for the PFLP shall be as per the drawing attached in the specification (Annexure-IV). Fixture shall be FL-2 type on PFLP.

3 **Grid Interactive Solar PV Power Plant:**

Solar Grid System shall be supplied as specified in BPS. Solar PV Power Plant of PV array Capacity shall be 50kWp for 765kV Substation, 30kWp for 400kV Substation and 20kWp for 220kV & below Substation.

3.1 **General**

Grid Interactive Solar PV Power Plant of PV array shall be provided over Control Room building. This installation shall be a supplement source to Substation ACDB bus, to save on conventional energy supply from the grid during solar energy generation from the plant. The equipment and materials shall include but not limited to the following:

a) PV Modules (Crystalline)
b) Module Mounting Structure and frames
c) Array Terminal Box
d) Grid Interactive Inverters
e) Solar AC Panel
f) Cable & Wires
g) Earthing system

h) Civil works for Foundation of PV Array

All civil works associated with the installation & commissioning of PV Array shall be done by the Contractor including necessary structural work, cost of the same shall be deemed included in the erection work.

The Solar PV Module will be installed over the Control Room Building while the Inverters, Grid interfacing LT Panels etc. will be placed in Substation ACDB Room of Control Room Building. The Contractor shall specify and submit detail GA drawing indicating indoor equipment as well as PV Array. Contractor shall provide necessary supporting documents to the employer including typical solar PV module electrical characteristics including current-voltage (I-V) performance curves and temperature coefficients of power, voltage and current of the proposed PV Module (s).

3.2 Solar PV Modules

Solar PV module shall include but not limited to the following**:**

- PV Module shall be mono or poly crystalline high power silicon cells.
- The solar cells shall have anti-reflective surface coating to help to absorb more light in all weather conditions.
- The PV modules shall comply the relevant standards.
- Each module shall have superior light transmission, tampered & textured glass with antireflective coating. It shall also have tough multi-layered polymer back sheet for environmental protection against moisture & to provide high voltage electrical insulation.
- Solar PV module shall be highly reliable, light weight and shall be designed to have a long service life.
- Major technical parameters for PV module shall be as under:-

Type	Mono or Poly Crystalline silicon
Efficiency	>= 16%
Fill factor	>=70%
Module frame	Non-corrosive and electrolytic ally compatible with the mounting structure material
Array Termination box	Thermo-plastic, IP 65, UV resistant
Module Rated power	The nominal power of a single PV module shall not be less than 300Wp. The rated output of any supplied module shall not vary by more than 3% from average power rating.
Environmental Conditions	It shall perform satisfactorily in relative humidity up to 95% and temperature between 0-85 deg. C.

Applicable standards	IEC 61215 IEC 61730 Part 1 and 2
Salt Mist Corrosion Test	As per IEC 61701

3.3 **Module Mounting Structure and frames**

- Entire system shall be installed by providing necessary steel structures. The array structure and its legs shall be made of hot dip galvanized MS angles or galvanized MS tubular frame. The structure shall be designed for simple mechanical and electrical installation. It shall support PV modules at a given orientation, absorb and transfer the mechanical loads to the ground properly. The minimum thickness of the galvanization shall be as per Section-GTR.
- The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels. The structure shall be designed to allow easy replacement of any module & shall be in line with the site requirement. Array structure shall also have tilt arrangement to adjust the plane of the array for optimum tilt during erection.
- Minimum Ground Clearance of the lowest part of the module structure should be at least 700mm.
- All fasteners for supporting conduits, Nut & Bolts shall be of stainless steel (SS-304 Grade).
- The array structure shall be grounded properly.

3.4 **Array foundation**

Foundation is to be made above the surface and no grouting to be done. If any grouting is done on the concrete foundation, necessary modification shall be done to avoid any seepage to the Ceiling. The base plate arrangement may be made on RCC blocks. Grade of concrete for all RCC blocks shall be 1:1.5:3 mix.

3.5 **Grid Interacting Inverter**

The inverter shall be pure sine wave inverter of high efficiency. Inverters shall have display to show its own parameters along with the parameters of PV array connected to the Inverter. The inverter shall be compatible as On Grid Connected Mode (Synchronization with grid). The inverter shall include but not limited to the following**:**

- The inverter shall be highly efficient based on Maximum Power Point Tracking (MPPT) control providing a fixed DC input voltage to inverter. MPPT must be able to extract maximum energy from Solar array and produce 415 V, 3-ph, 50Hz AC to synchronize with the grid through Substation ACDB panel.
- The Inverter shall not produce Electromagnetic interference (EMI) which may cause malfunctioning of electronic and electrical

instruments including communication equipment, which are located within the facility in which the inverter is housed

- Inverter shall have facility to display basic parameters of the system through LED/LCD display.

Display
- Voltage & Frequency
- Power
- Energy

Indications
- DC Input Line Status
- Inverter under voltage/ over voltage
- Inverter over load

Protections
- Over voltage both at input & output
- Over current both at input & output
- Over/ under grid frequency
- Reverse Polarity Protection
- Reverse current to PV array protection
- Short circuit
- Protection against lightning
- Protection against Surge voltage induced at output due to external source

Major Technical Parameters for Inverter shall be as follows:-

Inverter Capacity	50kW/30kW/20kW
Input DC voltage range	As required for the solar grid
Operation AC voltage	3-phase, 415V±10%
Total Harmonic Distortions on AC side	THD<3%
Operating Frequency range	50Hz ± 3%
Power factor of the inverter	>0.98 at rated power
Operating ambient temperature	-20ºC to +60ºC
Humidity	0 – 95% Rh
Inverter efficiency	>=96%
Inverter weighted (EURO) efficiency	>=95%
Protection degree	As per GTR
Communication interface	IEC 61850 Protocol or through IEC 61850
Safety compliance	IEC 62103, IEC 62109
Display type	LCD / LED

The manufacturer shall facilitate for smooth interfacing of Inverter (Alarm & Analog measured Values) with Substation SAS.

3.6 **Solar AC Panel**

AC Power output of Inverters shall be fed to the Solar AC Panel through suitably rated MCCBs. Output of Solar AC panel shall be connected to Substation ACDB bus through available MCCB in ACDB Panel.

3.7 **Provision for Module Cleaning**

For cleaning of the PV Modules, necessary plumbing & piping work shall be done by tapping from the existing pipeline available at the roof top so that water is easily available near the PV modules.

4 **LIGHTING SYSTEM DESCRIPTION**

The lighting system shall comprise of the following:

4.1 **AC Normal Lighting System**

All the Lighting fixtures connected to the AC Normal Lighting system in different areas will be fed from the 415 V main lighting distribution board through Lighting Panel & Sub-lighting panels (SLP).

4.2 **AC Emergency Lighting System**

The lighting panels of this system will be connected to the 415 V Emergency lighting distribution board (ELDB) which is fed from diesel generator during the emergency. This system will be provided in Control Room building, GIS Building, Switchyard Panel Room, Firefighting pump house, Switchyard Area including DG Set & LT Transformer Area. AC Emergency lighting load will be connected to this system which will be normally 'ON'. Approximate 25 % of lighting fixtures (distributed over all above areas) shall be connected on AC emergency lighting system.

4.3 **D.C. Emergency lighting System**

DC emergency LED lighting fixtures of 8W DC Input Down Lighter shall be operated on the 220/110V DC system (as per available Station DC Supply) and will be provided in the strategic locations in Control Room Building, Fire Fighting Pump House and GIS Building .

The supply to the DC lighting panels shall be automatically switched ON in case of loss of Normal & Emergency AC supply at station or when under voltage occurs in the AC MLDB. 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.

Exit Lightings Signage are to be provided in the all rooms of Control Room Building, Fire Fighting pump house & GIS Building including

Corridors & Staircase so that the operating personnel can safely find their way even during emergency of total AC failure.

5 LIGHTING SYSTEM DESCRIPTION- TOWHSHIP & TRANSIT CAMP

The scope of work comprises of design, engineering, testing, supply, installation, testing and commissioning of 415V, 400Amp, Main Township Distribution board/Energy meter Boards/Flat DBs etc. as per single line diagram (C/ENGG/TS/STD/ILLU/TOWNSHIP/01), Power and Control cables, various lighting fixtures complete with lamps, supports and accessories, ceiling fans complete with electronic regulators, exhaust fans for toilets and pantry & accessories, lighting panels, lighting poles complete with distribution boxes, galvanized rigid steel/PVC conduits, lighting wires, G.I. Earthwire, receptacles, tag block & telephone socket, bells, boxes for telephone/television & Air-conditioners points, switchboards, switches, junction boxes, pull out boxes complete with accessories as outlined in electrical drawings enclosed with tender documents for various type of quarters, parking, pump house, recreation centre and transit camp associated with township.

The township lighting system shall comprise of the following:

5.1 EXTERNAL ELECTRIFICATION WORKS

The entire External Electrification work including connection to various quarters, recreation centers & transit camp associated with township including street lighting of township shall be in the scope of the contractor. 415V, 400A Main Township distribution board shall be fed from 415V, 1000A Main switchboard (being supplied under LT switchgear package) located in ACDB/DCDB Room of main Switchyard through 2-3 ½ x300 sq.mm XLPE insulated power cable from each source. **Supply of Main Township DB & associated 3 ½ x300 sq.mm XLPE cable along with its interconnection, installation etc. shall be as per BPS.**

Further typical distribution from 415V Main Township DB is indicated in the drawings. The entire external electrification work comprising of feeder pillars, Cables and associated glands and lugs, steel tubular poles, street lights, MS junction boxes, GI pipes for cable protection, danger plates, Hume pipes, fire extinguishers, cable route markers etc. as required shall be in the scope of the contractor. The exact location of quarters, recreation center, transit camp, streets etc. shall be intimated to successful bidder during detailed engineering.

5.2 INTERNAL ELECTRIFICATION WORKS

The bidder shall quote for each type of quarters, recreation center and transit camp separately as per BPS, including entire scope pertaining to lighting system, earthing and lightning protection.

The scope shall broadly consist of entire concealed conduit work, wiring for lights/power/fans/telephones/cables & air-conditioners, supply and fixing of metal boxes, plates, switches, sockets, call bells, buzzers,

exhaust fans, ceiling fans, MCBs, MCCBs, light fittings, energy meters boards & flat DBs etc. as per the requirements of various quarters, recreation centers and transit camps.

In addition to above complete earthing (through separate earth pit) and lightning protection for each type of quarters, recreation center and transit camp shall be provided as per standard guidelines given in relevant Indian standards and code of practices. The complete drawing for earthing and lightning protection shall be submitted to owner for approval. The loop earthing inside the buildings shall be carried out with minimum 1Cx1.5 sq.mm PVC stranded Copper wire. All materials required or earthing and lightning protection of township buildings shall be in the scope of contractor.

Any item not specifically outlined in the layouts and specifications enclosed herein shall necessarily be included by the contractor as per applicable buildings codes, statutory electricity rules and code of practices for the completion of scope.

6 DESCRIPTION OF ITEMS

The Contractor shall supply and install the following equipment and accessories in accordance with the specification and applicable standards:

6.1 LED LUMINAIRES

LED Luminaries shall be used for the lighting of all the indoor and outdoor areas. In false ceiling area, LED luminaries shall be recessed mounting type & in non-false ceiling area, the LED luminaries shall be surface mounting type.

Suitable heat sink with proper thermal management shall be provided in the luminaries. All LED Luminaries shall be POWERGRID approved make. The marking on luminaries & safety requirements of luminaries shall be as per IS standards.

Necessary Care shall be taken so that there is no water stagnation anywhere in the Luminaries. The entire housing shall be dust and water proof protection as per IS 12063.

Parameters of outdoor & indoor Lighting fixtures are detailed in **Annexure-II**.

6.2 LIGHTING PANELS

6.2.1 CONSTRUCTIONAL FEATURES OF LIGHTINNG PANELS

i) The Lighting panels shall conform to IS-8623.

ii) All Outdoor Lighting Panels shall be **Stainless sheet steel** of Grade 304 and shall be dust, weather and vermin proof. Panels shall be of

thickness not less than 1.5 mm smoothly finished, leveled and free from flaws. Stiffeners shall be provided wherever necessary.

iii) The panels shall be of front single door hinged construction, suitable for either floor mounting on channels, sills or on walls/columns by suitable M.S. brackets. Indoor Lighting panels shall be modular flush mounted and wall embedded of slim depth.

iv) All panels shall have a dead front assembly provided with hinged door(s) and with suitable locking arrangement.

v) All Outdoor panel's removable covers and doors shall be gasketed all around with neoprene/EPDM gaskets/ puff arrangement.

vi) The outdoor panels shall be suitable for cable/conduit entry from the bottom. Suitable removable cable gland-plate shall be provided in the bottom of panels. For indoor lighting panels the provision of cable/conduit entry shall be from both top and bottom side with suitable removable gland plate. The thickness of the gland plate shall be 3 mm. Necessary number of double compression brass type cable gland shall be supplied, fitted on to these gland plates.

vii) The panels shall be so constructed as to permit free access to connection of terminals and easy replacement of parts.

viii) Each panel shall have a caution notice fixed on it.

ix) Each panel will be provided with laminated as built circuit diagram suitably pasted in the panel.

x) Main Bus Bars

Bus bars shall be of **Copper/aluminum alloy** conforming to IS: 5082 and shall have adequate cross-section to carry the rated continuous current and withstand short circuit currents. Maximum operating temperature of the bus bars shall not exceed 85 deg. C. The bus bars shall be able to withstand a fault level of 9 kA for 1 sec. for AC panels and 4 kA for 1 sec. for DC panels.

xi) All Outdoor Lighting Panels shall be erected such that a minimum height of 1000mm is maintained between FGL & bottom of the Lighting Panel. Size of Outdoor Lighting panels shall be such that cables are properly terminated and wires are dressed with provision of loops.

6.2.2 CONFIGURATION OF INDOOR AND OUTDOOR LIGHTING PANELS (AS PER BPS).

Type of Panel	Description	Detail Of Feeders
ACP 1	Indoor AC	**Bus Bars:** 415V, 63A, 3 phase 4

	Lighting panel	wire bus bars with Colored LED indication lamps with fuse for each phase. **Incomer:** One no. 415V, 63A TPN MCB with 300mA 63A Four Pole RCCB. **Outgoings:** 12 nos. 230V, 16A Single Pole MCB and 1 no. 5/15A Switch with Socket. **Mounting:** The indoor ACP shall be of slim depth suitable for embedding in the wall and will be flush mounted.
ACP 2	Outdoor-Switchyard AC Lighting panel	**Bus Bars:** 415V, 63A, 3 phase 4 wire bus bars with Colored LED indication lamps with fuse for each phase. **Incomer:** One no. 415V, 63A TPN MCB & Contactor with suitable Photo-sensitive automatic switching system. **Outgoings:** 6 nos., 230V, 20A Single Pole MCB and 3 Nos. 230V, 32A TPN MCB and 1 no. 5/15A Switch with Socket. **Mounting:** Suitable for Outdoor applications**.**
ACP 3	Outdoor - Street AC Lighting Panel	**Bus Bars:** 415V, 63A, 3 phase 4 wire bus bars with Colored LED indication lamps with fuse for each phase. **Incomer:** One no. 415V, 63A TPN MCB & Contactor with suitable Photo- sensitive automatic switching system. **Outgoings:** 3 nos. 32A TPN MCB and 1 no. 5/15A Switch with Socket. **Mounting:** Suitable for Outdoor applications**.**

DCP	Indoor DC Lighting panel	**Bus Bars:** 220/110V DC (as applicable) 32A two wire Bus Bar. **Incomers:** 220/110V DC (as applicable) with one 32A DP Contactor (for AC fail Logic) backed up by 32A double pole MCB with DC test push button. **Outgoings:** 6 nos.16 A Double Pole MCB **Mounting:** The indoor DCP shall be of slim depth suitable for embedding in the wall and will be flush mounted
SLP	Outdoor AC Sub-lighting panel	**Incomers:** 415V, 32A TPN MCB **Outgoings:** 8 nos. terminal blocks suitable for cable upto 16 sq. mm cable. **Mounting:** Suitable for Outdoor applications with Loop in and Loop out facility.
Sub-DB	Indoor AC Sub Distribution Box	**Incomers:** 415V, 32A TPN MCB. **Outgoings:** 6 nos. 230V, 16A Single Phase feeder with Single Pole MCB. **Mounting:** The Sub-Distribution Box shall be of slim depth suitable for embedding in the wall and will be flush mounted/surface mounted as per site requirement.

6.2.3 AUXLIARY ITEMS FOR LIGHTING PANELS

(i) TERMINAL BLOCKS

Each terminal shall be suitable for termination of suitable size of Cable/Wire Conductors without any damage to the conductors or any looseness of connections.

(ii) RESIDUAL CURRENT CIRCUIT BREAKERSS (RCCB)

For indoor panels (ACP 1), 63A, 4pole 300 mA RCCB conforming IS 12640 will be provided along with incomer.

(iii) **MINIATURE CIRCUIT BREAKER (MCB)**

a) The miniature circuit breakers shall be suitable for manual closing, opening, automatic tripping under overload and short circuit. The MCBs shall also be trip free. MCB of Type C tripping characteristics as per IS 8828 will be used for Illumination purposes.

b) The MCBs and MLDB panel MCCBs together shall be rated for full fault level. In case the MCB rating is less than the specified fault level the Contactor shall co-ordinate these breaker characteristics with the backup MCCB in such a way that if fault current is higher than breaker rating, the MCCB should blow earlier than the MCB. If the fault current is less than MCB breaking capacity, MCB shall operate first and not the incomer MCCB.

c) The MCBs shall be suitable for housing in the lighting panels and shall be suitable for connection with stranded copper/Al wire connection at both the incoming and outgoing side by copper/Al lugs or for bus bar connection on the incoming side.

d) The terminals of the MCBs and the 'open/trip' and 'close' conditions shall be clearly and indelibly marked.

(iv) **CONTACTORS**

Contactors shall be of the full voltage, direct-on line air break, single throw, electro-magnetic type. They shall be provided with at least 2'NC' and 2'NO' auxiliary contacts. 3-Phase Contactor shall be provided with the three elements, positive acting, ambient temperature compensated time lagged, hand reset type thermal overload relay with adjustable settings to suit the rated current. Hand reset button shall be flush with the front of the cabinet and suitable for resetting with starter compartment door closed. The Contactor shall check the adequacy of the Contactors rating, wires with respect to lighting load.

(v) **PUSH BUTTONS**

All push buttons shall be of push to actuate type having 2 'NO' and 2 'NC' self-reset contacts. They shall be provided with integral escutcheon plates engraved with their functions. Push buttons shall be of reputed make.

(vi) **LABELS**

a) Designation labels shall be provided on the front of lighting Panels. The panel designation labels shall be of 3 mm thick plastic plate. The letter shall be black engraved on white back ground.

b) All incoming and outgoing circuits shall be provided with labels.

Labels shall be made of non-rusting metal or 3 ply lamicoid. Labels shall have white letters on black or dark blue background.

(vii) **EARTHING TERMINALS**

Outdoor Panels shall be provided with two separate and distinct earthing terminals suitable to receive the earthing conductors of size 50x6 G.S. Flat.

6.3 EARTHING & LIGHTNING PROTECTION FOR CONTROL ROOM BUILDING, GIS BUILDING , TRANSIT CAMP & TOWNSHIP

Earthing and lightning protection system installation shall be in strict accordance with the latest editions of Indian Electricity Rules, relevant Indian Standards and Codes of practice and Regulations existing in the locality where the system is installed.

a) Code of practice for Earthing IS: 3043
b) Code of practice for the protection of Building and allied structures against lightning IS : 2309.
c) Indian Electricity Rules 1956 with latest amendments.

Lighting Fixtures & Miscellaneous Items For Township Lighting:-
Please refer Annexure-I

6.4 POWER AND CONTROL CABLES:-

Power and Control cables required under township lighting shall conform to standard technical specification, Section-Power and Control cables.

6.5 RECEPTACLES (AS PER BPS).

All receptacles shall be of heavy duty type, suitable for fixing on wall/column and complete with individual switch. The outdoor Receptacles shall have IP 55 protection. The receptacles shall be of following types:

Type RO : 20A, 240V, 3 pin type (third pin grounded) plug and socket with body earthing arrangement with Single Pole MCB, metal clad with gasket having cable gland entry suitable for 2Cx6 sq.mm. PVC/aluminum armoured cable and a spring loaded cover suitable for installation in moist outdoor location. Receptacles shall be housed in a box made out of 1.5 mm thick Stainless Steel of Grade 304 with hinged doors with suitable locking arrangements. Door shall be lined with good quality gasketing.

Type RP - 63A, 3ph, 415V AC receptacles shall be provided for welding purposes in GIS Halls and near major equipments in switchyard.63A, 415V, 3 phase, 4 pin interlocked plug and socket with

body earthing arrangement with TPN MCB. Receptacles shall be housed in a box made out of 1.5 mm thick Stainless Steel of Grade 304, with hinged door with suitable locking arrangement The receptacle shall be suitable for 3.5C x 35/3.5Cx70 sq.mm and suitable for installation in moist outdoor location. Aluminum conductor cable entry and shall also be suitable for loop-in and loop out connection of cables of similar size. . Door shall be lined with good quality gasketing.

Type RQ-1 (250A)/ Type RQ-2(400A):- 250A/400A Receptacle shall be provided for oil filtration purpose near alternate Transformer/Reactor. 250A/400A, 415V, 3 phase, 4 pin, Switch Box with body earthing arrangement with TPN MCB, suitable for outdoor application. The enclosure shall be made out of 1.5 mm thick Stainless Steel of Grade 304, with hinged door with suitable arrangement and having cable gland entry suitable for 3.5C X 300 sq.mm XLPE armoured cable. The bus bar shall have adequate cross-section to carry the rated continuous current and withstand short circuit currents. The receptacle shall be suitable for loop-in and loop out connection of cables of similar size. Door shall be lined with good quality gasketing.

6.6 LIGHTING ACCESSORIES

Various accessories mentioned below shall be supplied as per site requirement and cost of the same shall be deemed to be included in overall Lighting System cost.

(i) JUNCTION BOXES

a) The Indoor junction boxes shall be provided with 4 way knockouts suitable for two numbers 10 sq. mm. wire/ Cable. These junction boxes shall be concealed type for indoor lighting.

b) The outdoor junction boxes shall be complete with conduit knockouts/threaded nuts and provided with terminal strips. The junction boxes shall be suitable for termination of Cable glands of required size. The junction boxes shall be provided with 4 way knockouts suitable for street lighting/switchyard lighting terminals suitable for 2 numbers 4C x 16 Sq.mm Al. cable or as per requirement. All Outdoor Junction boxes shall be of Stainless Steel of thickness 1.5mm of grade 304. Outdoor Junction Boxes shall be suitable for mounting on columns, structures etc for Outdoor Lighting. The outdoor Junction shall have IP 55 protection.

c) The junction boxes shall have the following indelible markings
   (i) Circuit Nos. on the top.
   (ii) Circuit Nos. with ferrules (inside) as per drawings.
   (iii) DANGER sign in case of 415 volt junction box.

(ii) SWITCH AND SWITCHBOARD

a) All Switch board/boxes and electronic fan regulators located in office/building areas shall be modular flush mounted type.

b) Switch boards/boxes shall have conduit knock outs on all the sides.

c) The exact number of Switches including regulator for fans and layout of the same in the switchboard shall be suitable as per the requirement during installation.

d) The maximum number of luminaries controlled by one no. 6 Amp Switch shall be 8 nos. However each Switchboard shall have minimum 2 Nos. of 6A Switches to control the Luminaries. For DC fixtures there will be no switch and the same shall be directly controlled from DCP.

e) The Luminaries shall be wired in such a fashion that luminaries on each phase are evenly distributed all over the room.

f) 6/16A, 240V AC modular flush mounted socket with switch outlet shall be provided in indoor areas like offices, cabins, Security Room, Control Room, Switchyard Panel Room etc.

g) 25A, 240V AC modular flush mounted socket with switch shall be provided at strategic locations in GIS Halls, ACDB/Switchgear room etc.

(iii) **CONDUITS & CONDUIT ACCESSORIES**

a) The conduits shall be Rigid PVC conduits of 20/25 /32 mm diameter for Lighting, Telephone wiring & LAN Cabling and shall be ISI marked.

b) Flexible conduits wherever required shall be PVC type.

c) All conduits accessories shall be ISI marked.

d) Galvanized Steel Conduits for Surface Conductor (e.g. GIS Hall).

(iv) **PULL OUT BOXES**

a) The pull out boxes shall be concealed type for indoor lighting and suitable for mounting on column, structures etc., for outdoor lighting.

b) The pull out boxes shall be circular of minimum 16 SWG sheet steel and shall have cover with good quality gasket lining.

c) The pull out boxes shall be completed with conduit knock outs/threaded hubs and provided at approximately 3 meters intervals in a conduit run.

(v) **CEILING, WALL MOUNTED & EXAUST FANS AND REGULATORS**

a) The Contactor shall supply and install 1400 mm sweep ceiling fans complete with electronic regulator and board for mounting switch, suspension rod, canopy and accessories. The electronic regulator for Ceiling fans will be housed in common switchboard for lighting and shall be of similar make and model as that of modular switches. The wall mounted fans shall be of 400 mm sweep. Exhaust fans shall be of 300mm size.

b) Winding of the fans shall have Class-E insulating material. Winding shall be of copper wire.

(vi) **LIGHTING WIRES**

a) Wiring from Lighting/Sub-Lighting Panels to junction boxes / Switchboards/ fixtures etc. is covered under Lighting Wires. The wiring used for lighting shall be standard products.

b) The wires shall be of 630V grade (Phase to ground), PVC insulated products.

c) The conductor sizes for wires used for point wiring shall be 1.5 sq.mm, 2.5 sq.mm, 4 sq.mm and 6 sq.mm stranded copper wire as required.

d) The wires used for connection of a lighting fixture from a nearest junction box or for loop-in loop-out connection between two fixtures shall be single core copper stranded conductor, 630V grade (Phase to ground) flexible PVC insulated cords, unsheathed, conforming to IS:694 with nominal conductor cross sectional areas of 2.5 sq. mm.

e) The wires shall be colour coded as follows:

Red for R - Phase
Yellow for Y - Phase
Blue for B - Phase
Black for Neutral
White for DC (Positive)
Grey for DC (Negative)
Green for Earth

6.7 **LIGHTING POLES (AS PER BPS).**

(i) The Contactor shall supply, store and install the following types of galvanized steel tubular lighting poles required for street lighting and decorative lighting, as per the attached drawing of poles.

(i) Type L1 Street Lighting Pole of 6 meter - for SL-L1 type fixture
(ii) Type D1 Post top lantern pole of 4 meter - for Sl-D1 type fixture

(ii) “L1” type poles shall be used for street lighting. “D1” type (Decorative

post top lantern) poles and Bollards shall be installed In front of control room building, Fire Fighting Buildings as finalized during detailed engineering.

(iii) Lighting poles shall be complete with fixing brackets. Cable termination box will be built inside the pole itself as per drawing enclosed.

(iv) Poles and its Cable termination box shall be hot dip galvanized and PU (Polyurethane) coated in Suzuki silver color and inside with bituminous paint.

(v) Terminal strips provided in street - lighting poles shall be suitable for terminating up to 2 nos. 4C x 16 sq. mm aluminum cables.

(vi) Wiring from junction box at the bottom of the pole to the fixture at the top of the pole shall be done through 2.5 sq. mm Copper wire laid inside the tubular pole.

(vii) Distance of center of pole from street edge should be approximately 1000 to 1200 mm or as per site conditions.

(viii) Earthing of the poles should be connected to the switchyard main earth mat wherever it is available, else, the same should be earthed through 3M long, 20 mm dia, earth electrode.

6.8 LADDER(AS PER BPS).

Following ladders shall be supplied as per BPS for maintenance purpose of illumination system:

(i) A type Aluminum ladder of 3 Mtr vertical height.
(ii) Cartwheel mounted aluminum ladder Vertical Extendable from 5.1m to 11m.

7 TYPE TEST REQUIREMENT:

a) Lighting Panels, Receptacles, Junction Boxes etc. shall conform to following degree of protection:

- Installed outdoor: IP- 55
- Installed indoor in air conditioned area: IP-31
- Installed in covered area: IP-52
- Installed indoor in non-air conditioned area where possibility of entry of water is limited: IP-41.

b) Lighting fixtures LED type shall conform to type test requirements of LM-79, LM-80 and TTC.

8 LIGHTING SYSTEM INSTALLATION WORKS

Section -LIGHTING SYSTEM (Rev.07)

8.1 General

In accordance with the specified installation instructions as shown on manufacturer's drawings or as directed by Employer, Contractor shall unload, erect, install, test and put into commercial use all the electrical equipment included in the contract. Equipment shall be installed in a neat, workmanship manner so that it is level, Plumb Square and properly aligned and oriented. Tolerances shall be as established in manufacturers drawing or as stipulated by Purchaser.

All apparatus, connections and cabling shall be designed so as to minimize risk of fire or any damage which will be caused in the event of fire. All Lighting accessories mentioned in Clause 6.7 shall be supplied and erected as a part of Lighting System Installation works. Cost of Erection, Foundation & Civil Works of the above accessories and Lighting Poles are to be included in the Cost of the erection of Lighting system, no extra payment shall be made on account of the same.

Further, lighting control in GIS Hall has to be done in staggered way for the minimum basic illumination. Further separate switchboard shall be provided to have enhanced lighting for each bay.

8.2 Conduit System

(i) Contractor shall supply, store and install conduits required for the lighting installation as specified. All accessories/fittings required for making the installation complete, including but not limited to pull out boxes (as specified in specification ordinary and inspection tees and elbow, check nuts, male and female bushings (brass or galvanized steel), caps, square headed make plugs, nipples, gland sealing fittings, pull boxes, conduits terminal boxes, glands, gaskets and box covers, saddle terminal boxes, and all steel supporting work shall be supplied by the Contractor. In case of false ceiling surface conduiting is permissible however all down run conduits will be concealed in wall below the false ceiling. The conduit fittings shall be of the same material as conduits. Separate Conduit should be laid for Communication purpose .The contractor shall also supply & install 20 mm PVC conduit and accessories for telephone wiring and LAN Cabling wherever feasible, telephone and LAN cabling can be laid in the same conduit.

(ii) In case of false Ceiling surface conduiting (GI Pipe) is permissible under the ceiling.

(iii) All unarmored cables/wires shall run within the conduits from lighting panels to lighting fixtures, receptacles. etc.

(iv) Size of conduit shall be suitably selected by the contactor.

(v) Conduit support shall be provided at an interval of 750 mm for horizontal runs and 1000 mm for vertical runs.

(vi) Conduit supports shall be clamped-on spacer plates or brackets by saddles or U-bolts. The spacer plates or brackets in turn, shall be securely fixed to the building steel by welding and to concrete or brick work by grouting or by nylon raw plugs. Wooden plug inserted in the masonry or concrete for conduit support is not acceptable.

(vii) For directly embedding in soil, the conduits shall be coated with an asphalt-base compound. Concrete pier or anchor shall be provided wherever necessary to support the conduit rigidly and to hold it in place.

(viii) For long conduit run, pull boxes shall be provided at suitable intervals to facilitate wiring.

(ix) Conduit shall be securely fastened to junction boxes or cabinets, each with a lock nut inside and outside the box.

(x) Conduits joints and connections shall be made through water-tight and rust proof by application of a thread compound which insulates the joints. White lead is suitable for application on embedded conduit and red lead for exposed conduit.

(xi) The entire GI conduit system (if used) shall be embedded, electrically continuous and thoroughly grounded. Where slip joints are used, suitable bounding shall be provided around the joint to ensure a continuous ground circuit.

(xii) Conduits and fittings shall be properly protected during construction period against mechanical injury. Conduit ends shall be plugged or capped to prevent entry of foreign material.

8.3 **Wiring**

i) The scope also includes wiring from nearest Lighting/Sub-Lighting Panel to the Controlling Switch/MCB/Lighting Fixtures.

ii) Wiring shall be generally carried out by PVC insulated wires in conduits. All wires in a conduit shall be drawn simultaneously. No subsequent drawing of wires is permissible.

iii) Wires shall not be pulled through more than two equivalent 90 deg. bends in a single conduit run. Where required, suitable junction boxes shall be used.

iv) Wiring shall be spliced only at junction boxes.

v) For lighting fixtures, connection shall be teed off through suitable

round conduit or junction box, so that the connection can be attended without taking down the fixture.

vi) Maximum two wires can be terminated to each way of terminal connections.

vii) AC and DC wiring should run through the separate conduits. Similarly Communication & LAN cables shall run in separate conduit than that of AC & DC Conduits.

8.4 **Lighting Panels**

i) The lighting panels shall be erected at the locations to be finalized during detailed engineering.

ii) Suitable foundations/supporting structures for all outdoor type lighting panels shall be provided by the Contractor.

iii) The Sub lighting Panel shall be provided where independent switch of fixtures are required.

8.5 **General Requirements for Cabling Work**

i) Each cable run shall be tagged with number that appears in the cable schedules. Cables shall be tagged at their entrance and/or exit from any piece of equipment, junction or pull box, floor opening etc.

ii) The tag shall be made up of aluminum with the number punched on it and securely attached to the cable by not less than two turns of G.I. wire. Cable tags shall be rectangular in shape for power cables and circular shape for control cables.

iii) Location of cables laid directly under ground shall be indicated clearly by cable marker made of galvanized iron plate embedded in concrete block.

iv) The location of underground cable joints if any shall be clearly indicated with cable marker with an additional inscription "cable joint".

v) The marker, which is a concrete block, shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change of direction. It shall also be located on both sides of the road or drain crossing.

vi) Road crossing of cables through suitable size of GI pipe/Hume pipe as required at site.

8.6 **Foundation & civil works**

i) Foundation for street lighting poles and panels shall be done by the

Contractor.

ii) All final adjustment of foundation levels, chipping and dressing of foundation surfaces, setting and grouting of anchor bolts, sills, inserts and fastening devices shall be carried out by the Contractor including minor modification of civil works as may be required for erection.

iii) Any Cutting of masonry/concrete work, which is necessary shall be done by the Contractor at his own cost and shall be made good to match the original work.

ANNEXURE-I

BILL OF QUANTITY

Sr. No	Locations	Type & No of Lighting Fixture	With Anti Glare Film over the Fixture	Type of Fans
01.	**Control Room cum Administrative Building-Single Storey (As applicable)**			
(i)	Control Room	RSQ-I: 10 Nos.	Yes	--
(ii)	Station- In Charge Room	RSQ-I: 4 Nos. and RC-I : 4 Nos.	Yes	--
(iii)	Administrative Area	RSQ-I: 12 Nos. and RC-I : 9 Nos.	Yes	Pedestal Fans
(iv)	Conference Room	RSQ-I: 9 Nos. and RC-I : 4 Nos.	Yes	Wall Mounted Fans
(v)	Electrical Room/Telecommunication Room	RSQ-I: 4 Nos. and RC-I : 2 Nos.	Yes	Wall Mounted Fans
(vi)	ACDB/DCDB Room	SL-I: 16 Nos.	Yes	Ceiling Fan
(vii)	Battery & Battery Charger Room	RL-I: 6 Nos.	Yes	--
(viii)	Corridor & Reception	SC/RC-I: 8 Nos. and SL/RL-I: 2Nos.	Yes	Ceiling Fan
(ix)	Toilets	SC-I: 2 Nos.(in each Toilet)	No	Exhaust Fans
(x)	Pantry	SL-I: 2 Nos. and SC-I: 1 No.	Yes	Exhaust Fans
(xi)	Periphery of the Building	BL: 10Nos.	No	--
02.	**Control Room cum Administrative Building- Double Storey (As applicable)**			
(i)	Control Room	RSQ-I: 12 Nos.	Yes	--
(ii)	Station- In Charge Room	RSQ-I: 4 Nos. and RC-I : 2 Nos.	Yes	--
(iii)	Administrative Area	RSQ-I: 16 Nos. and RC-I : 12 Nos.	Yes	Pedestal Fans
(iv)	Conference Room	RSQ-I: 9 Nos. and RC-I : 5 Nos.	Yes	Wall Mounted Fans
(v)	Electronic Test Lab/Telecommunication Room	RSQ-I: 4 Nos.	Yes	Wall Mounted Fans
(vi)	ACDB Room	SL-I: 16 Nos.	Yes	Ceiling Fan
(vii)	DCDB Room	SL-I: 9 Nos.	Yes	Ceiling Fan
(viii)	Battery & Battery Charger Room	RL-I: 6 Nos.	Yes	--
(ix)	Store	SL-I: 6 Nos.	No	--
(x)	Lobby/ Waiting Area	SSQ-I: 5 Nos. and RC-I : 4 Nos.	Yes	Ceiling Fan
(xi)	Toilet	SC-I: 2 Nos. (in each Toilet)	No	Exhaust Fans
(xii)	Pantry	SL-I: 2 Nos. and SC-I: 1 No.	Yes	Exhaust Fans
(xiii)	Corridors	SC/RC-I: 36 Nos. and SL/RL-I: 6 Nos.	No	--
(xiv)	Periphery of the Building	BL: 15 Nos.	No	--
03.	**GIS Building**			
(i)	765kV, 400kV & 220kV GIS Hall	IHB: As per BPS	No	--
(ii)	AHU Room	SL-1: : As per BPS	Yes	--
(iii)	C&R Room	RSQ-I: : As per BPS	Yes	--
04.	**Fire Fighting Pump House**			
(i)	FFPH Building	SL-1: 9 Nos.	Yes	Wall Mounted Fan
(ii)	Periphery of the Building	BL: 4 Nos.	No	--
05.	**Switchyard Panel Room (SPR) (9 meter)**	SSQ-I: 10 Nos.	Yes	--
06.	**Switchyard Panel Room (SPR) (6 meter)**	SSQ-I: 8 Nos.	Yes	--
07.	**Switchyard and Outdoor Substation Area**	FL-1 & FL-2: As per BPS	No	--
08.	**Street lighting roads**	SL-LI & SL-DI:As per BPS	No	--

Section -LIGHTING SYSTEM (Rev.07)

TOWNSHIP & TRANSIT CAMP ILLUMINATION (As Applicable)

ANNEXURE-I

Sr. No	Locations	Type & No of Lighting Fixture	Anti-Glare Film Requirement	Type of Fans
01.	**Township Quarters**			
(i)	Bed Room	SL-I :1 Nos. and SC: 2 Nos.	Yes	Ceiling Fan
(ii)	Drawing Room	SSQ-I: 2Nos. and SC 2 Nos.	Yes	Ceiling Fan
(iii)	Dining Room	SSQ-I: 2 Nos.	Yes	Ceiling Fan
(iv)	Kitchen	SL-I: 1 Nos. and SC: 1 Nos.	Yes	Exhaust Fan
(v)	Lobby	SSQ-I and SC 2 Nos.	Yes	--
(vi)	Toilet	SC-I: 1 Nos.	No	Exhaust Fan
(vii)	Servant Room	SL-I: 1 Nos.	Yes	Ceiling Fan
(viii)	Car Parking	BL-I: 1 Nos.	No	--
(ix)	Stair	SC-I: 4 Nos.	No	--
(x)	Terrace/Balcony	BL-I : 1 Nos.	No	--
02.	**Transit Camp**			
(i)	VIP Lounge	SSQ-I:2 Nos. and SC: 2 Nos.	Yes	Ceiling Fan
(ii)	Dining Room	SSQ-I: 2 Nos. and SC: 2 Nos	Yes	Ceiling Fan
(iii)	Drawing Room	SSQ-I: 1 Nos. and 2 Nos.	Yes	Ceiling Fan
(iv)	Dormitory	SL-I : 4 Nos.	Yes	Ceiling Fan
(v)	Bed Room	SL-I :1 Nos. and SC: 2 Nos.	Yes	Ceiling Fan
(vi)	Store	SL-1: 2 Nos.	No	Exhaust Fan
(vii)	Corridors	SC-I: 2 Nos.	No	--
(viii)	Terrace/Balcony	BL-I : 1 Nos.	No	--
(ix)	Care Taker Room	SL-I: 1 Nos.	Yes	Ceiling Fan
(x)	Kitchen	SL-I: 1 Nos.	Yes	Exhaust Fan
(xi)	Stair	SC-I: 4 Nos.	No	--
(xii)	Toilet	SC-I: 1 Nos.	No	Exhaust Fan
(xiii)	Other Rooms	SC-I: 2 Nos.	No	--

ANNEXURE-II

Details of Lighting Fixture

(a) Indoor Application

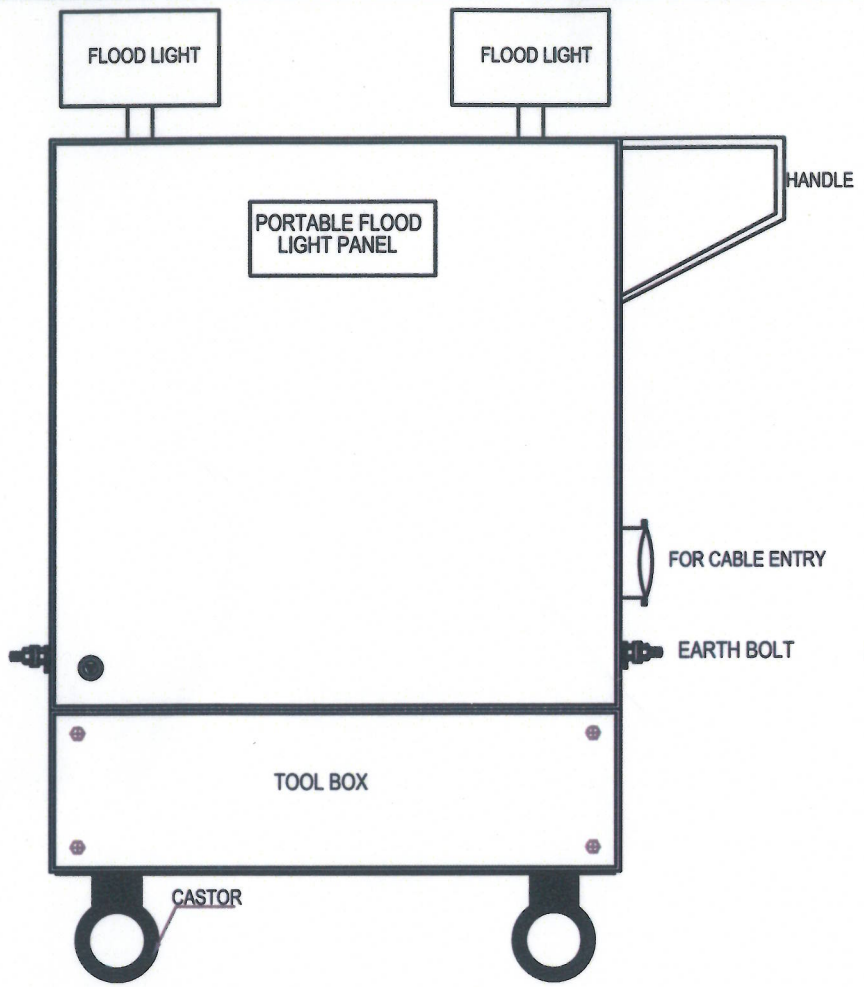
Sr. No	Technical Specification	SL-1 (Surface Mounted Linear LED Tube with Box)	RL-I (Recessed Mounted 4 x 1 Feet LED Panel)	SC-I (Surface Mounted Circular LED Downlight Luminaire)	Type RC-I (Recessed Mounted Circular LED Downlight Luminaire)	Type SSQ-1 (Surface Mounted 2X2 LED Luminaire)	Type RSQ-1 (Recessed Mounted 2x2 LED Luminaire)	Type IHB (LED Indoor High Bay)
1	System Wattage	≤ 2 X 20 W	≤ 40 W	≤ 15 W	≤ 15 W	≤ 40 W	≤40 W	≤150W
2	System Lumen Output	≥ 3600	≥ 3600	≥ 1200	≥ 1200	≥ 3400	≥ 3400	≥14000
3	System efficacy (Lumens/Watt)	≥ 100	≥ 100	≥ 80	≥ 80	≥ 85	≥ 85	≥ 100
4	Housing	CRCA Housing	CRCA Housing	Pressure Die Cast Housing	Pressure Die Cast Housing	CRCA Housing	CRCA Housing	Pressure Die Cast Aluminum Housing
5	Ingress Protection	IP20	IP-20	IP20	IP-20	IP-20	IP-20	IP-65
6	Surge Protector	2kV	2kV	2kV	2kV	2kV	2kV	4kV (Internal) & 10kV (External)
7	Mounting	Surface Mounted	False Ceiling	Surface Mounted	False Ceiling	Surface Mounted	False Ceiling	Hanging Type under Shed
8	THD	<10%	<10%	<10%	<10%	<10%	<10%	<10%
9	CRI	>80	>80	>80	>80	>80	>80	>70
10	CCT	5700k±300k	5700k±300k	5700k±300k	5700k±300k	5700k±300k	5700k±300k	5700k±300k
11	Power Factor	>0.95	>0.95	>0.95	>0.95	>0.95	>0.95	>0.95
12	Ik Protection	NA	NA	NA	NA	NA	NA	IK-05
13	Operating Humidity	90% RH	90% RH	90% RH	90% RH	90% RH	90% RH	90% RH
14	Burning Hours	50,000	50,000	50,000	50,000	50,000	50,000	50,000
15	Operating Temperature	-5℃ to 45℃						
16	Lumen Maintenance	70% at the End of Burning Hours						

Section -LIGHTING SYSTEM

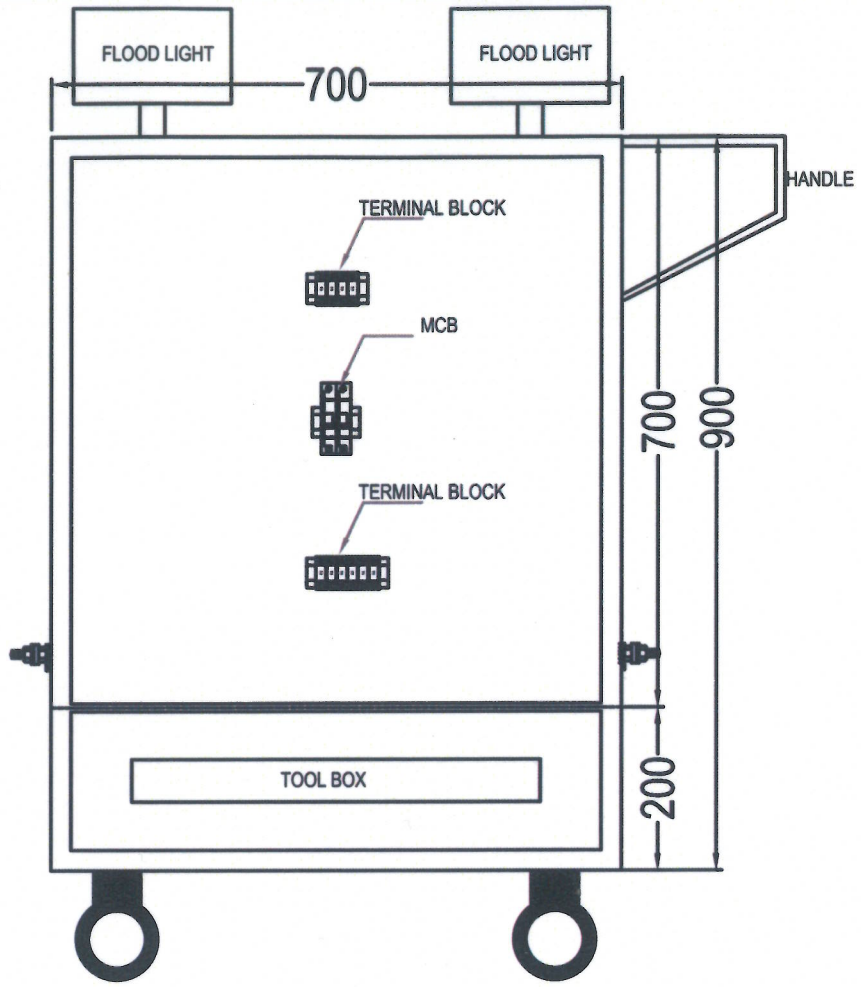
Details of Lighting Fixture

(b) Outdoor Application

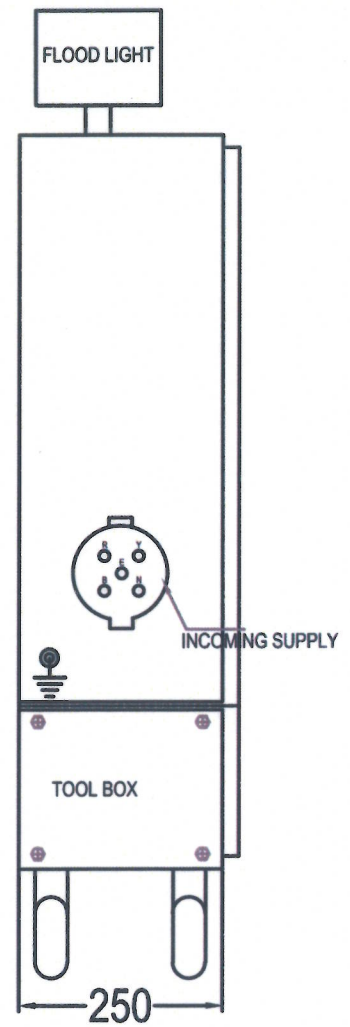
Sr.No	Technical Specification	BL (Surface Mounted Bulk Head)	Type SL-L1 (LED Street Light Luminaire)	Type SL-D1 (Pole Mounted LED Post Top Luminaire)	Type FL-1 (LED Flood Light Luminaries)	Type FL-2 (LED Flood Light Luminaries)
1	System Wattage	≤ 10W	≤45W	≤ 30W	≤150W	≤250W
2	System Lumen Output	≥ 800	≥4000	≥ 2600	≥ 14000	≥ 23000
3	System efficacy (Lumens/Watt)	≥ 80	≥ 100	≥ 90	≥ 100	≥ 100
4	Housing	Pressure Die Cast Housing and with Polycarbonate diffuser	Pressure Die Cast	Die Cast Aluminum	Pressure Die Cast Housing	Pressure Die Cast Housing
5	Ingress Protection	IP-65	IP-65	IP-65	IP-65	IP-65
6	Surge Protector(Internal)	3kV	3kV	3kV	3kV	3kV
7	Surge Protector(External)	10kV	10kV	10kV	10kV	10kV
8	Mounting	Wall Mounting	Pole Mounting for 40mm max O.D	Suitable for 60mm max O.D	On Lattice Structure	On Lattice Structure
9	THD	<20%	<10%	<10%	<10%	<10%
10	CRI	>70	>70	>70	>70	>70
11	CCT	5700k±300k	5700k±300k	5700k±300k	5700k±300k	5700k±300k
12	Power Factor	>0.90	>0.95	>0.95	>0.95	>0.95
13	Ik Protection	IK-09	IK-05	IK-05	IK-05	IK-05
14	Operating Humidity	90% RH	90% RH	90% RH	90% RH	90% RH
15	Burning Hours	50,000	50,000	50,000	50,000	50,000
16	Operating Temperature	-5℃ to 45℃				
17	Lumen Maintenance	70% at the End of Burning Hours				



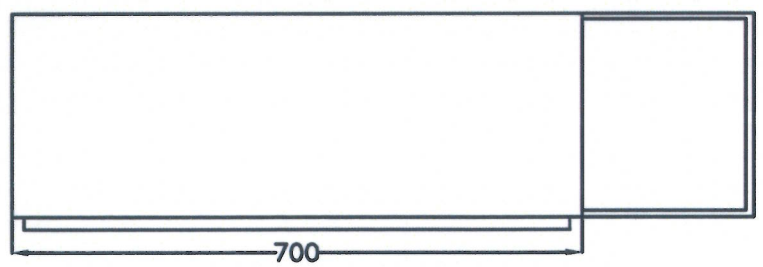
FRONT VIEW WITH DOOR



INTERNAL FRONT VIEW



SIDE VIEW



TOP VIEW

GENERAL NOTES

1	PANEL NAME	PORTABLE FLOOD LIGHT PANEL
2	TYPE OF PANEL	SINGLE FRONT FIXED TYPE
3	PANEL DIMENSION	SIZE: 700W X 900H X 250D MM
4	PANEL BODY	STAINLESS STEEL SS-304
5	IP CLASS OF PANEL	IP-55

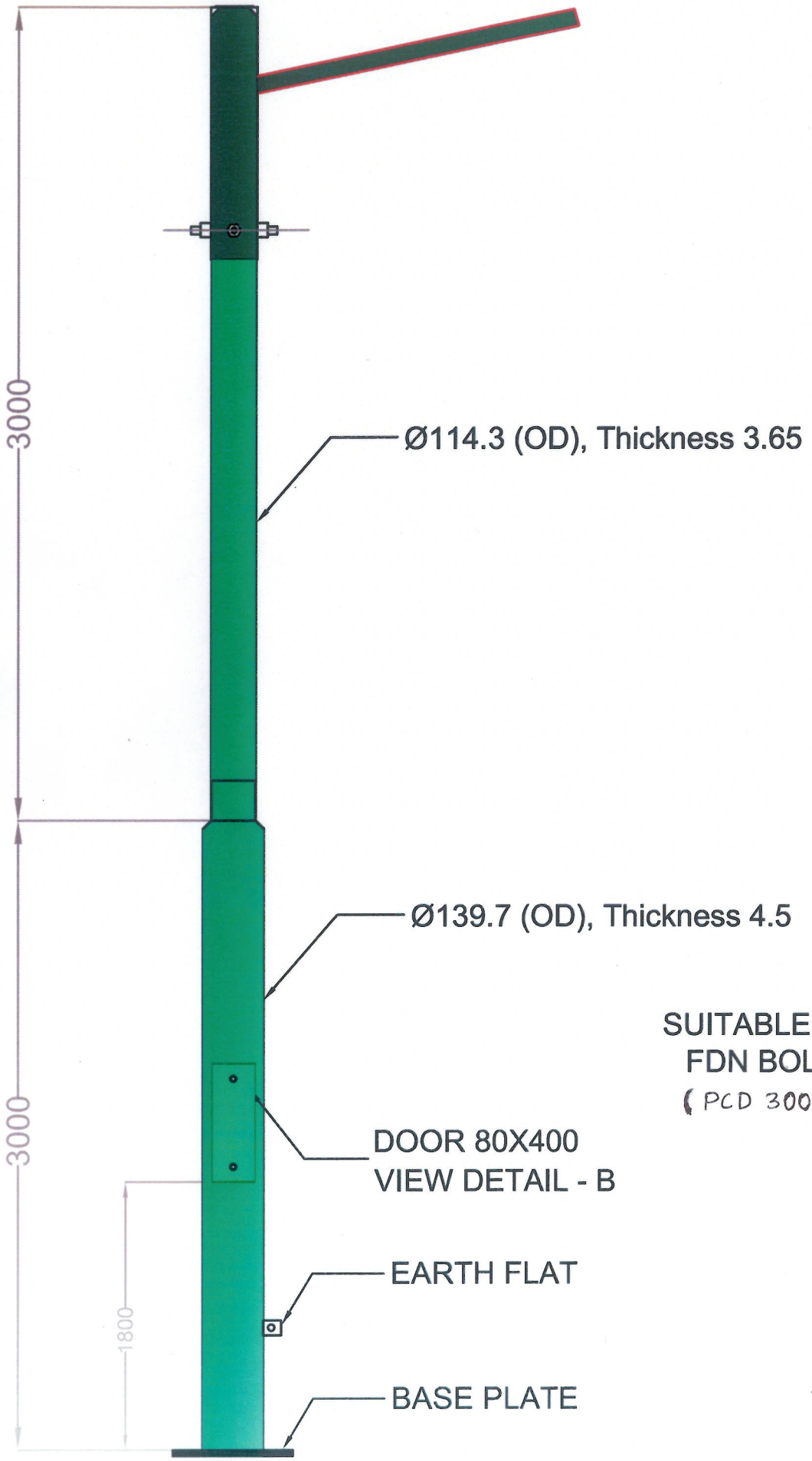
PORTABLE CORD OF 25 METER WITH PLUG TO BE PROVIDED ALONGWITH THE PORTABLE FLOOD LIGHT PANEL

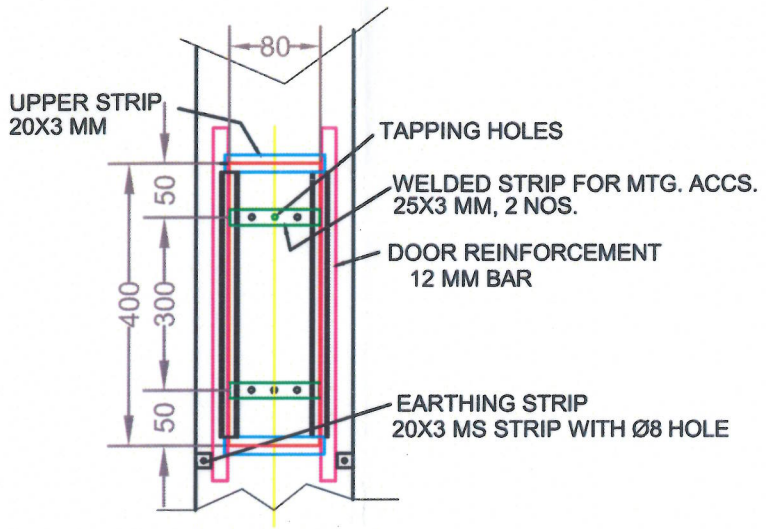
OWNER:-
POWERGRID CORPORATION OF INDIA LTD

PROJECT:- STANDARD DRAWING

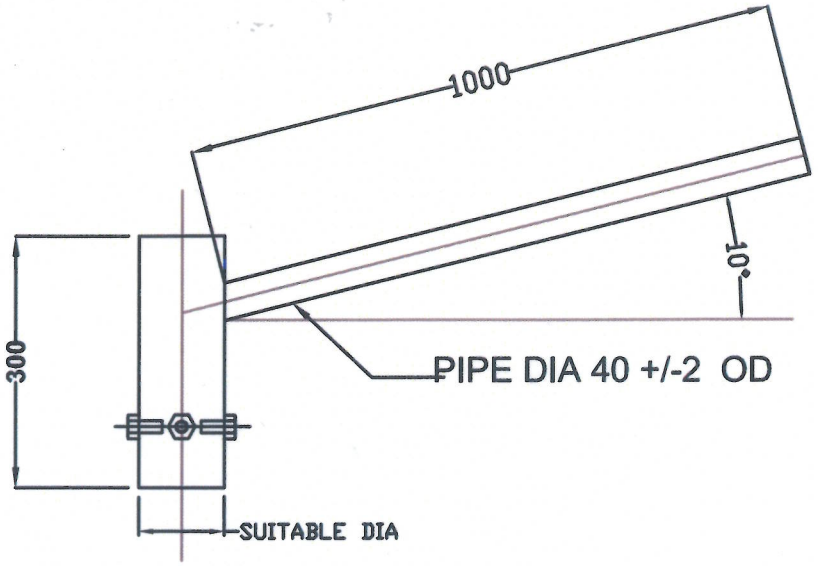
TITLE:- TYPICAL DRAWING FOR PORTABLE FLOOD LIGHT PANEL

DRAWN BY :-	DRAWING NO: -C/ENGG/GA/PFL.	SHEET NO.	SCALE
CHECKED BY :-	APPROVEDBY :-	1 OF 1	N.T.S.

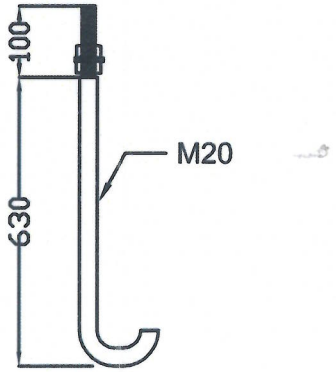




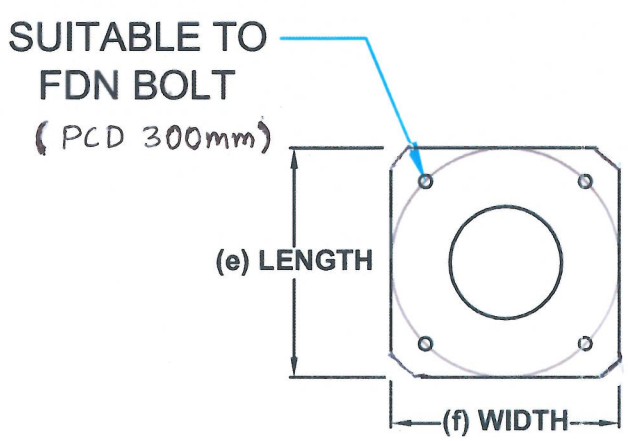
DETAIL - B
(AFTER REMOVE DOOR COVER)



SINGLE ARM BRACKET



FOUNDATION BOLTS J-TYPE
WITH HARDWARE

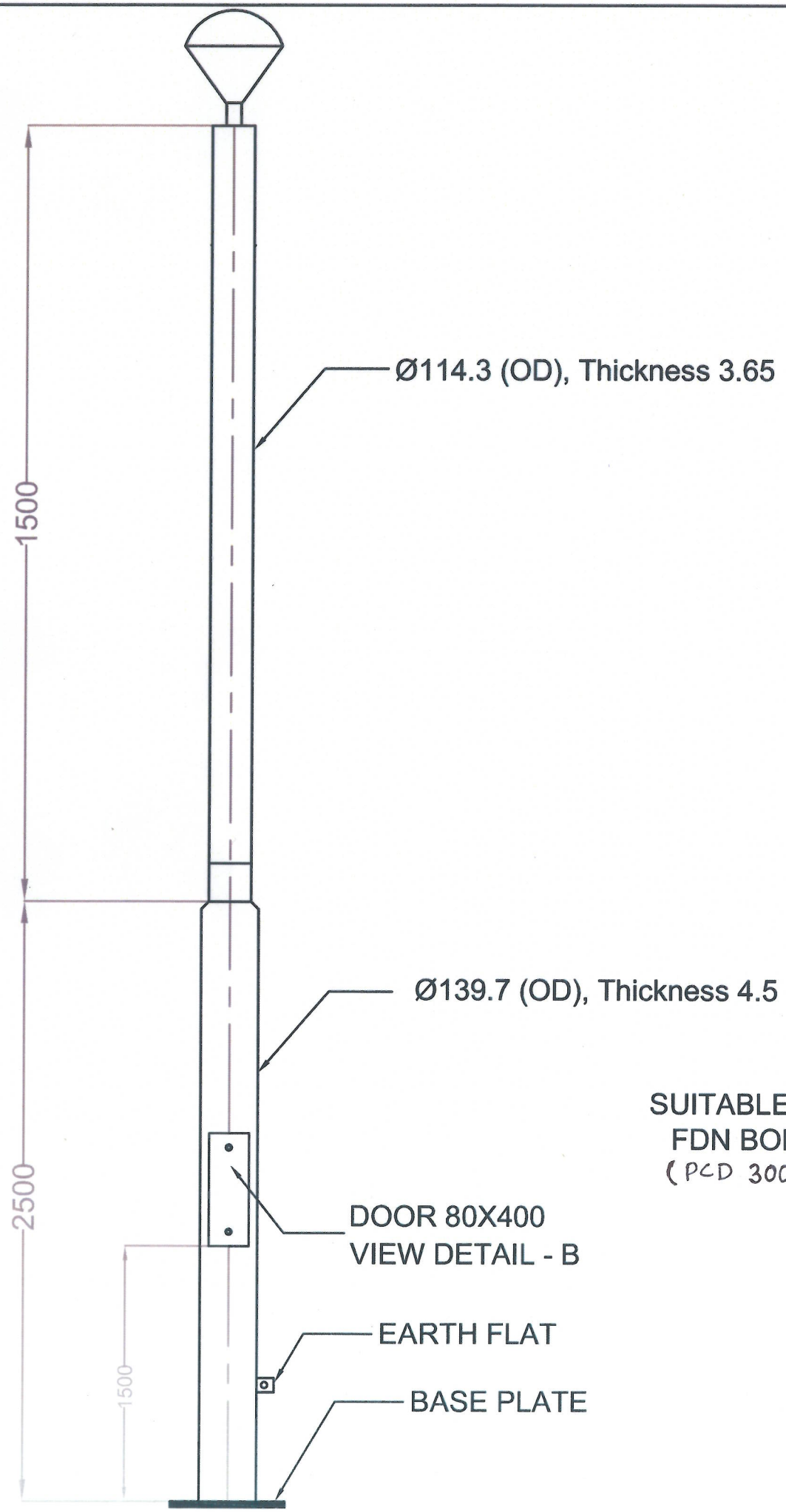


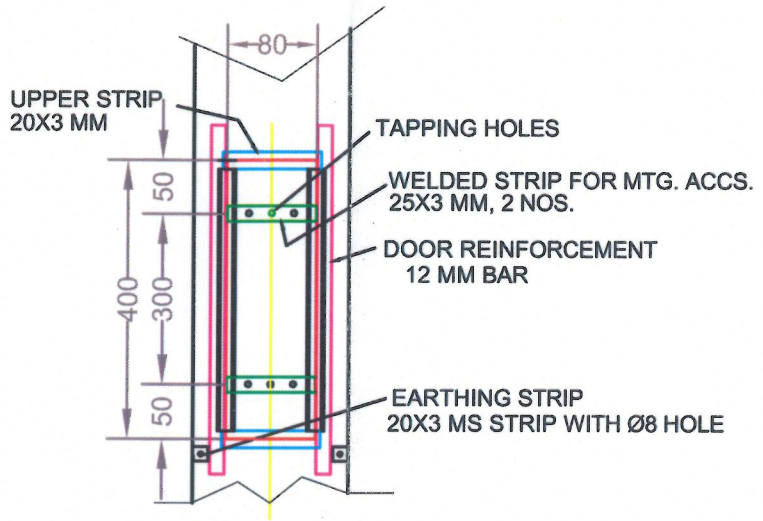
BASE PLATE 300 x 300 x 12mm
BOTTOM VIEW

NOTES:

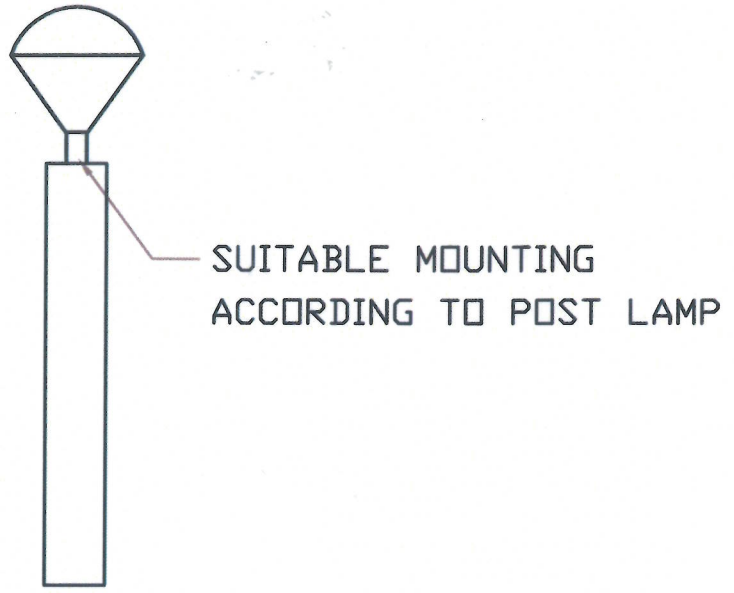
1. ALL DIMENSIONS ARE IN MM.
2. STEEL PIPES AS PER IS: 1161. & MS PLATES AS PER IS 2062.
3. TOLERANCES AS PER IS 1161 - 1979 & AS PER IS 2713.
4. POLE SHALL BE HOT DIP GALVANISED INSIDE & OUTSIDE & PU PAINTED IN APPROVED SHADE ON OUTSIDE OF POLE.

OWNER:- POWERGRID CORPORATION OF INDIA LIMITED			
PROJECT:- STANDARD DRAWINGS			
TITLE:- GA DRAWING FOR 6 METER STEEL TUBULAR POLE-SL-L1			
DRAWN BY:	DRG. NO:C/ENGG/GA/POLE/SL-L1		
CHECKED BY:-	APPROVED BY:-	1 OF 3	NTS

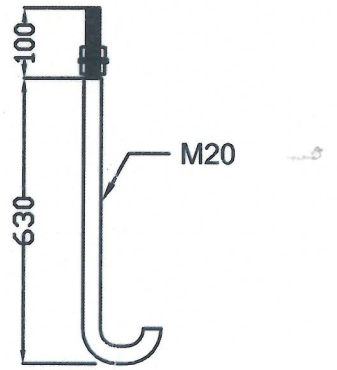




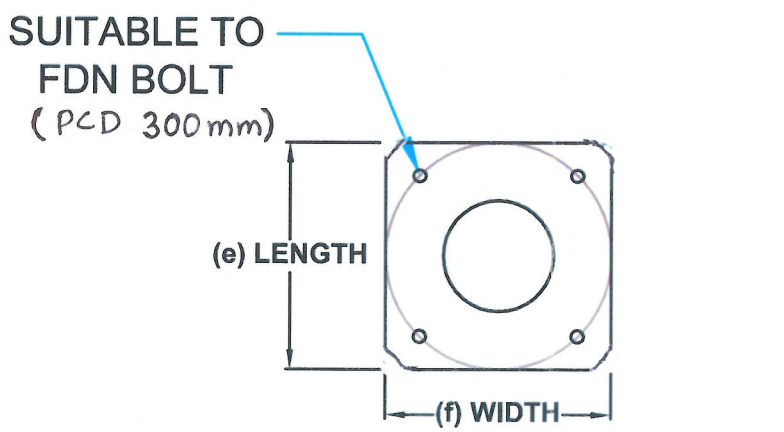
DETAIL - B
(AFTER REMOVE DOOR COVER)



DETAIL - A
POST TOP LAMP



FOUNDATION BOLTS J-TYPE
WITH HARDWARE

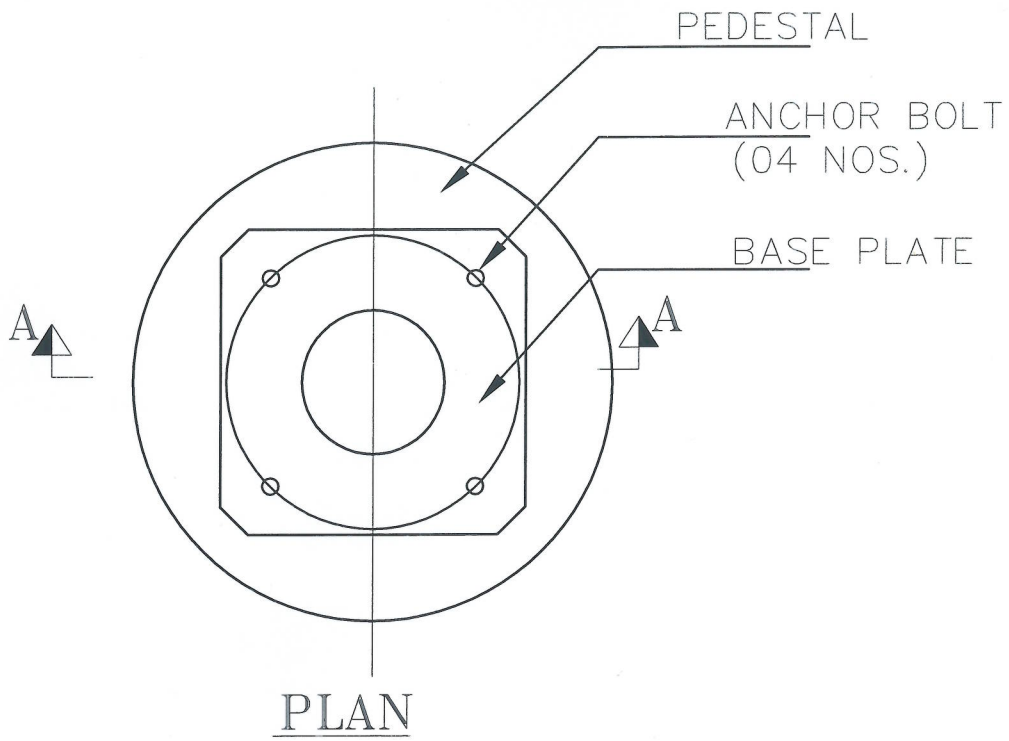


BASE PLATE 300 x 300 x 12mm
BOTTOM VIEW

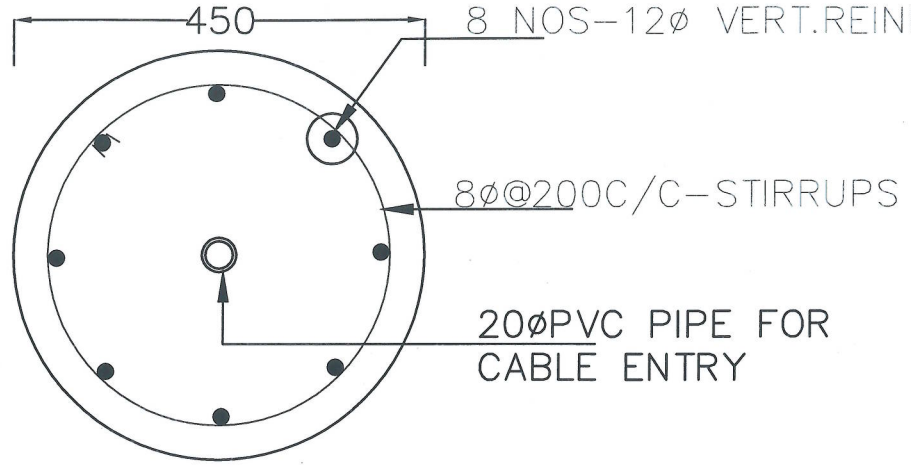
NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. STEEL PIPES AS PER IS: 1161. & MS PLATES AS PER IS 2062.
3. TOLERANCES AS PER IS 1161 - 1979 & AS PER IS 2713.
4. POLE SHALL BE HOT DIP GALVANISED INSIDE & OUTSIDE & PU PAINTED IN APPROVED SHADE ON OUTSIDE OF POLE.

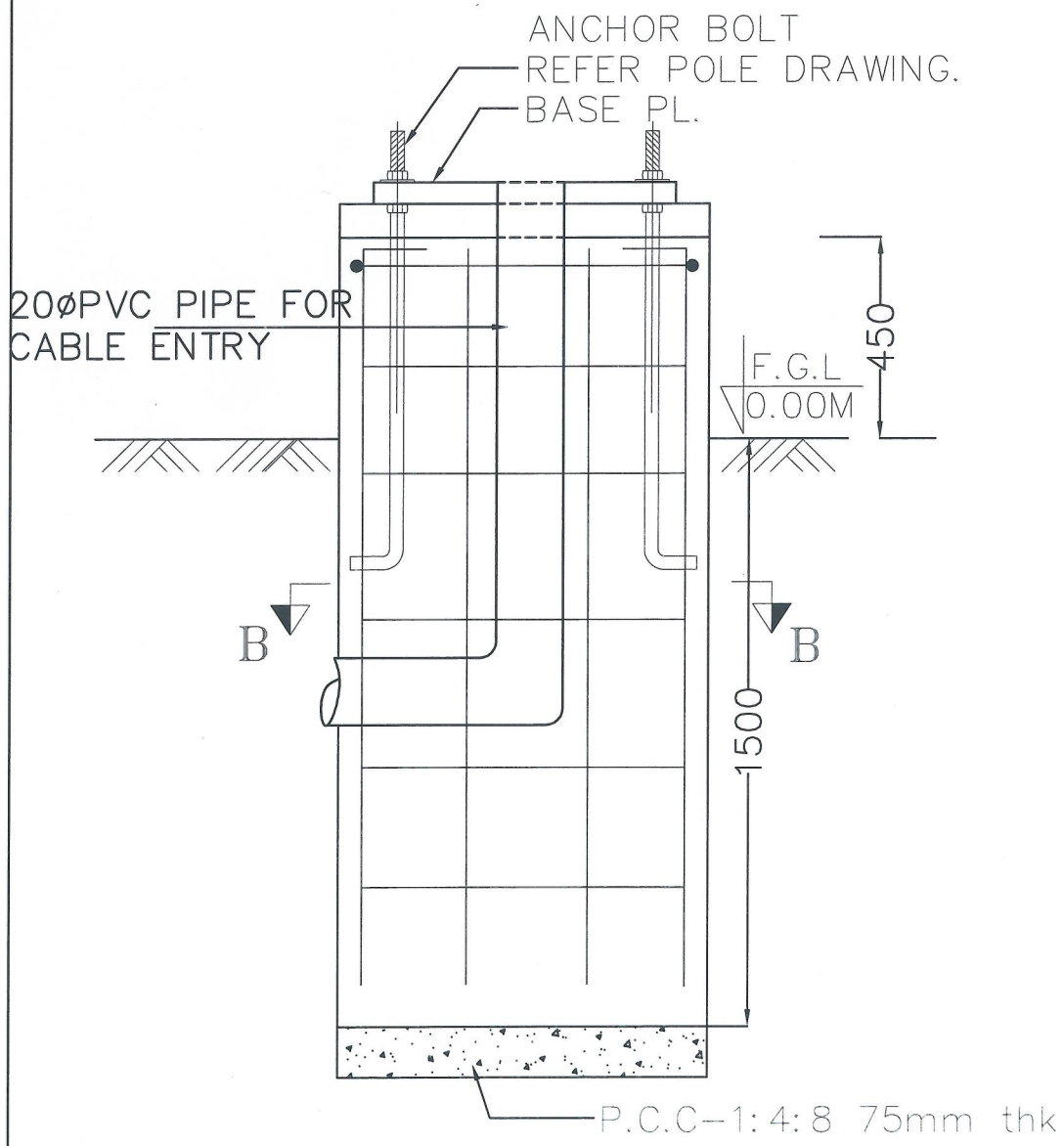
OWNER:- POWERGRID CORPORATION OF INDIA LIMITED			
PROJECT:- STANDARD DRAWINGS			
TITLE:- GA DRAWING FOR 4 METER POST LAMP -SL-D1			
DRAWN BY:	DRG. NO:C/ENGG/GA/POLE/SL-D1		
CHECKED BY:-	APPROVED BY:-	2 OF 3	NTS



PLAN



SECTION:B-B



SECTION:A-A

(A) GENERAL NOTES:

ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METRES
ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED. THE DRAWINGS SHALL NOT BE SCALED.
ALL STRUCTURAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ARCHITECTURAL
DISCREPANCY IN DRAWINGS IF ANY SHALL BE BROUGHT TO THE NOTICE OF THE DESIGN OFFICE PRIOR TO CONSTRUCTION.
EXCUTION OF R.C.C. WORKS/STRUCTURAL STEEL WORK AS PER OUR DRAWINGS SHALL BE THE RESPONSIBILITY OF SITE ENGINEER.

(B) SPECIFICATION NOTES FOR R.C.C WORK:

(GRADE OF CONCRETE)

CONCRETE FOR ALL WORKS AS PER BPS.

(REINFORCING STEEL)

ALL REINFORCING STEEL EXCEPT M.S LUGS FOR INSERT PLATES SHALL BE HIGH YIELD STRENGTH DEFORMED BARS CONFORMING TO GRADE Fe 415. OR Fe 500 AS

LUGS FOR INSERT PLATES SHALL BE PLAIN M.S BARS CONFORMING TO GRADE 1 OF IS:432 (PART-1) 1966.IF FLATS OR ANGLES ARE USED AS LUGS,THEY SHALL CONFORM TO

(CLEAR COVER TO MAIN REINFORCEMENT)

UNLESS SHOWN OTHERWISE MIN.CLEAR COVER TO MAIN REINFORCEMENT SHALL BE AS FOLLOWS

BOTTOM	40mm.
TOP,SIDES	40mm.

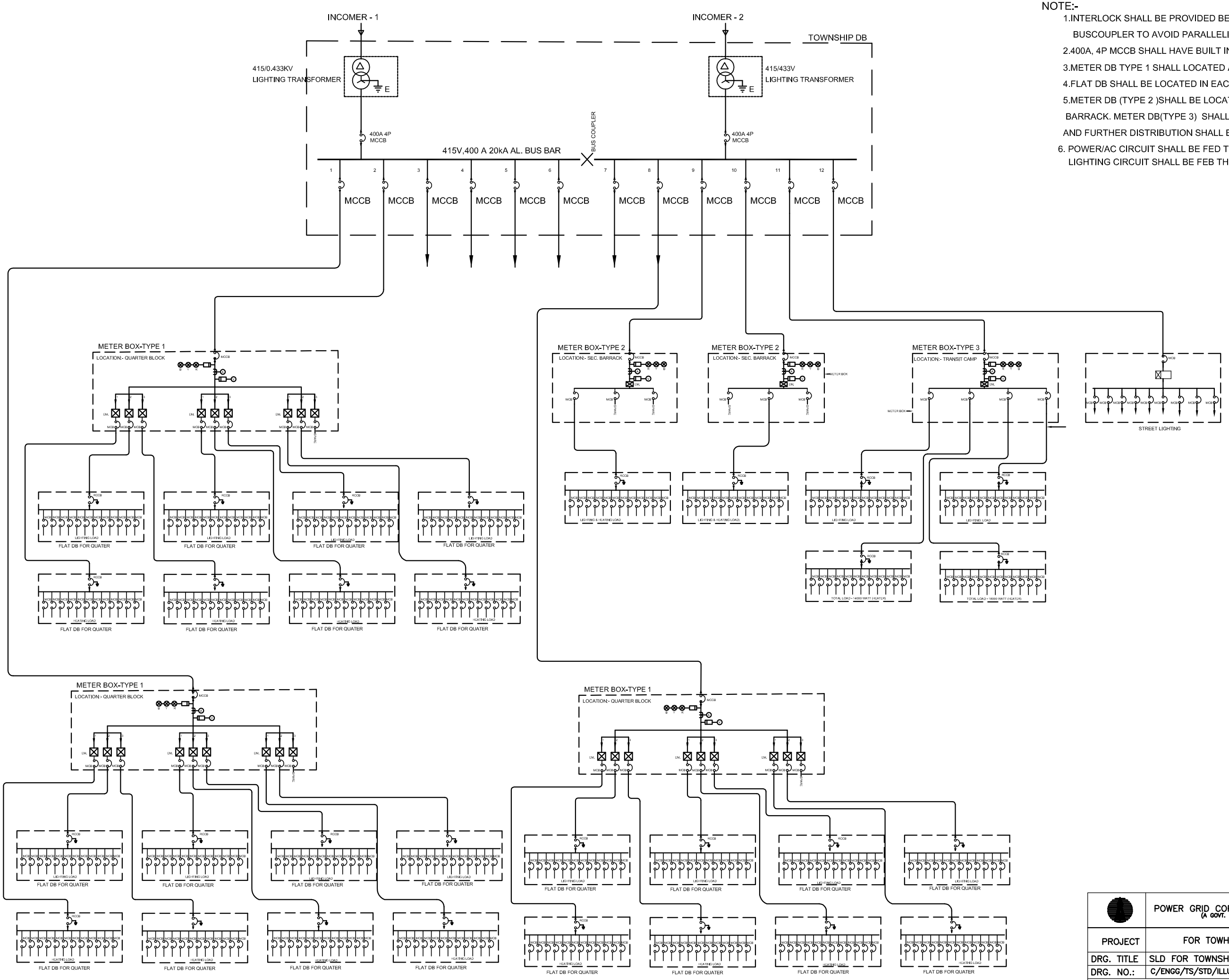
(LAP LENGTH OR DEVELOPMENT LENGTH FOR DEFORMED BARS SHALL BE AS FOLLOWS)

-45xDIA OF BAR.

NOT MORE THAN 50% BARS SHALL BE SPLICED AT A SECTION.
(LOCATION OF SPLICE SHALL BE DECIDED IN CONSULTATION WITH SITE ENGINEER & PRIOR APPROVAL OF DESIGN OFFICE).

IMP NOTE :THIS DRAWING IS NOT APPLICABLE FOR MARSHY LANDS

OWNER:- POWERGRID CORPORATION OF INDIA LIMITED			
PROJECT:- STANDARD DRAWINGS			
TITLE:- FOUNDATION DRAWING FOR POLE			
DRAWN BY:	DRG. NO:C/ENGG/FDN/POLE		
CHECKED BY:-	APPROVED BY:-	3 OF 3	NTS



NOTE:-

1. INTERLOCK SHALL BE PROVIDED BETWEEN INCOMER-1 & 2. BUSCOUPLER TO AVOID PARALLELING OF SUPPLIES IN TOWNSHIP DB.
2. 400A, 4P MCCB SHALL HAVE BUILT IN OL/SC PROTECTION.
3. METER DB TYPE 1 SHALL LOCATED AT G.F OF EACH TYPE OF BUILDING.
4. FLAT DB SHALL BE LOCATED IN EACH FLAT.
5. METER DB (TYPE 2)SHALL BE LOCATED AT EACH THE SECURITY BARRACK. METER DB(TYPE 3) SHALL BE LOCATED AT TRANSIT CAMP AND FURTHER DISTRIBUTION SHALL BE DONE THROUGH THE FLAT DBs.
6. POWER/AC CIRCUIT SHALL BE FED THROUGH DOUBLE POLE MCB WHILE LIGHTING CIRCUIT SHALL BE FEB THROUGH SINGLE POLE MCB.

SCHEDULE OF SYMBOL

SR. NO.	SYMBOL	DESCRIPTION
1.		MCCB
2.		RCCB
3.		MCB
4.		TIMER
5.	A	AMMETER
6.	V	VOLTMETER
7.		ENERGY METER
8.		FUSE
9.	E	TRANSFORMER

	POWER GRID CORPORATION OF INDIA LTD. (A GOVT. OF INDIA ENTERPRISE)
PROJECT	FOR TOWHSHIP ILLUMINATION
DRG. TITLE	SLD FOR TOWNSHIP (TYPICAL)
DRG. NO.:	C/ENGG/TS/STD/ILLU/TOWNSHIP/01
	SCALE: NTS | SHEET: 01 OF 01

SECTION-3
GENERAL TECHNICAL REQUIREMENTS-SECTION 3
Site Information

S.No.	Particular	Details
a)	Owner	Fatehgarh-II Transco Limited- a 100% wholly owned subsidiary of Power Grid Corporation of India Limited
b)	Customer	Fatehgarh-II Transco Limited- a 100% wholly owned subsidiary of Power Grid Corporation of India Limited
c)	Project Title	Substation Package - SS02 for (i) 765kV Fatehgarh-2 (PG) S/S Extension and (ii) 765kV Bhadla-2 (PG) S/s Extension under Transmission System Associated With LTA applications from Rajasthan SEZ Part-B (Rajasthan SEZ Part-B Project) through Tariff Based Competitive Bidding (TBCB) Route
d)	Location	Fatehgarh-2, Rajasthan Bhadla-2, Rajasthan
e)	Transport Facilities	Road/Train Nearest Rail Head For Fatehgarh-2: Fatehgarh Nearest Rail Head For Bhadla-2: Nokha
	SITE CONDITIONS	
a)	Max. ambient air temp.	50°C
b)	Min. ambient air temp.	0°C
c)	Max. design ambient temp.	50°C
d)	Design reference temp.	50°C
e)	Average Humidity	Max. 100%
f)	Special corrosion conditions	No
g)	Solar Radiation	1.2kW/sqmtr
h)	Atmospheric UV radiation	High
i)	Altitude above sea level	Less than 1000 meter above mean sea level (MSL)
j)	Pollution Severity	High Pollution level
k)	Seismic Zone	As per IS 1893 but not less than 0.3g horizontal
WIND DATA		
	Wind velocity	As per IS-875
	Average No. of thunderstorm days per annum	As per IS
	Main Electrical Parameters:	
	Fault Levels:	765kV: 40kA for 1 sec
	Creepage Distance	25mm/kV for All Equipment i.e BPI/Bushings, CB, Isolator, CT, CVT, LA, WT, NCT etc. 31mm/kV for string insulators

GENERAL TECHNICAL REQUIREMENTS-SECTION 3

INDEX

GENERAL TECHNICAL REQUIREMENTS-SECTION 3

1.0 FOREWORD

The provisions under this section are intended to supplement requirements for the materials, equipments and services covered under other sections of tender documents and are not exclusive.

The Supplier shall note that the standards mentioned herein are not mutually exclusive or complete in themselves, but are intended to complement each other, with minimum repetition, to define the requirements of the Specification. In the event of a conflict between requirements of any two clauses of the Specification/ documents or requirements of different codes/ standards specified, the more stringent requirement as per the interpretation of the owner shall apply, unless confirmed otherwise by the owner in writing based on a written request from the Supplier.

In case of conflicting requirements between this document (General Technical Requirement Section 3) and equipment specification (Section 1 & Section 2), equipment specification shall prevail.

When specific requirements stipulated in the Specification exceed or change those required by the applicable standards, the stipulations of the Specification shall take precedence.

Unless specifically agreed to by the Purchaser prior to Award of Contract, the Work shall be in accordance with the standards indicated and the requirements of the Specification. The Supplier shall be held responsible for any deviation.

In case of conflict between the various standards, the decision of owner shall be binding & final.

2.0 GENERAL REQUIREMENT

The following words and expressions shall have the meanings hereby assigned to them throughout this document

"Employer/Owner" means Power Grid Corporation of India Ltd.

“Purchaser” means Bharat Heavy Electricals Limited

"Supplier/Manufacturer/Bidder" means the person or persons, firm or company assigned to execute the works as defined by the scope of supply, described here.

"Specification" refers to this document.

The supplier should be approved by Power Grid. If not, it is the responsibility of the vendor to be assessed and approved by Power Grid, before placement of order by BHEL. Any cost involved in vendor assessment/approval must be borne by the vendor himself.

2.1 The Supplier/Manufacturer shall furnish catalogues, engineering data, technical information, design documents, drawings etc., fully in conformity with the technical specification during detailed engineering.

2.2 It is recognised that the Bidder may have standardised on the use of certain components, materials, processes or procedures different from those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to Employer.

2.3 Wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition.

2.4 Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components which are minor in nature and incidental to the requirement but not specifically stated in the specification, which are necessary for commissioning and satisfactory operation of the switchyard/ substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment provided, shall be inter-changeable with one another.

2.5 Deleted.

2.6 Deleted.

3.0 STANDARDS

3.1 The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

3.2 The equipment to be furnished under this specification shall conform to latest issue with all amendments (as on the originally scheduled date of bid opening) of standard specified under Annexure-C of this section, unless specifically mentioned in the specification.

3.3 The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to compliment each other.

3.4 The Bidder shall also note that list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC.

3.5 When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.6 Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards specified under Annexure-C/individual sections for various equipments shall also, be accepted, however the salient points of difference shall be clearly brought out during detailed engineering along with English language version of such standard. The equipment conforming to standards other than specified under Annexure-C/ individual sections for various equipments shall be subject to Employer's approval.

4.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

4.1 The 800kV system is being designed to limit the switching surge over voltage of 1.9 p.u. and the power frequency over voltage of 1.4 p.u. The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, restrike etc under such over voltage conditions.

4.2 All equipments shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.

4.3 All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature

variation, ice & snow, (wherever applicable) short circuit etc for the equipment.

4.4 The bidder shall design terminal connectors of the equipment taking into account various forces that are required to withstand.

4.5 The equipment shall also comply to the following:

a) To facilitate erection of equipment, all items to be assembled at site shall be "match marked".

b) All piping, if any between equipment control cabinet/operating mechanism to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.

4.6 **System Parameter**

765kV, 400kV & 220kV System

SL No	Description of parameters	765kV System
1.	System operating voltage	765kV
2.	Maximum operating voltage of the system (rms)	800kV
3.	Rated frequency	50HZ
4.	No. of phase	3
5.	Rated Insulation levels	
i)	Full wave impulse withstand voltage (1.2/50 microsec.)	2100kVp
ii)	Switching impulse withstand voltage (250/2500 micro sec.) dry and wet	1550kVp
iii)	One minute power frequency dry withstand voltage (rms)	830kV
SL No	**Description of parameters**	**765kV System**
iv)	One minute power frequency dry and wet withstand voltage (rms)	-
6.	Corona extinction voltage	508 kV
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz	2500 µV at 508 kV rms
8.	Minimum creepage distance - for Equipment other than Insulator string	20000 mm

	Minimum creepage distance - for Insulator String	24800 mm
9	Min. clearances	
i.	Phase to phase	**7600mm** (for conductor conductor configuration) **9400mm** (for rod-conductor configuration)
ii.	Phase to earth	**4900mm** (for conductor structure) **6400mm** (for rod- structure)
iii.	Sectional clearances	10300 mm
10.	Rated short circuit current for 1 sec. duration	40kA
11.	System neutral earthing	Effectively earthed

Notes:

1. The above parameters are applicable for installations up to an altitude of 1000m above mean sea level. For altitude exceeding 1000m, necessary altitude correction factor shall be applicable as per relevant IEC.

2. The insulation and RIV levels of the equipments shall be as per values given in the Technical Specification of respective equipment.

3. Corona and radio interference voltage test and seismic withstand test procedures for equipments shall be in line with the procedure given at **Annexure-A** and **Annexure-B** respectively.

5.0 ENGINEERING DATA AND DRAWINGS

5.1 Deleted.

5.2 The Bidder shall submit 4 (four) sets of drawings/ design documents /data / detailed bill of quantity and 1 (one) set of test reports for the approval of the Employer. The bidder shall also submit the softcopy of the above documents in addition to hardcopy.

5.3 Drawings

5.3.1 All drawings submitted by the Bidder shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, dimensions, internal & the external connections, fixing arrangement required and any other information specifically requested in the specifications.

5.3.2 Drawings submitted by the Bidder shall be clearly marked with the name of the Employer, the unit designation, the specifications title, the specification number and the name of the Project. POWERGRID has standardized a large number of drawings/documents of various make including type test reports which can be used for all projects having similar requirements and in such cases no project specific approval (except for list of applicable drawings along with type test reports) is required. However, distribution copies of standard drawings/documents shall be submitted as per provision of the contract. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in SI units.

5.3.3 The review of these data by the Employer will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. This review by the Employer may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the Employer shall not be considered by the Bidder, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

5.5 All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Bidder's risk. The Bidder may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Bidder's drawing or work by the Employer shall not relieve the bidder of any of his responsibilities and liabilities under the Contract.

5.6 All engineering data submitted by the Bidder after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

5.7 Approval Procedure

The following schedule shall be followed generally for approval and for providing final documentation.

i) Approval/comments/ by Employer on initial submission	As per schedule
ii) Resubmission (whenever required)	As per contract
iii) Approval or comments	As per contract
iv) Furnishing of distribution copies (2 hard copies to each substation and one scanned copy (pdf format)	2 weeks from the date of approval
v) Furnishing of distribution copies of test reports (a) Type test reports (one scanned softcopy in pdf format to each substation plus one for corporate centre & one hardcopy per substation)	2 weeks from the date of final approval
(b) Routine Test Reports (one copy for each substation)	-do-

vi) Furnishing of instruction/ operation manuals (2 copies per substation and one softcopy (pdf format) for corporate centre & per substation) — On completion of Engineering

(vii) As built drawings (two sets of hardcopy per substation & one softcopy (pdf format) for corporate centre & per substation) — On completion of entire works

NOTE :

(1) The bidder may please note that all resubmissions must incorporate all comments given in the earlier submission by the Employer or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.

(2) All drawings should be submitted in softcopy form, however substation design drawings like SLD, GA, all layouts etc. shall also be submitted in AutoCAD Version. SLD, GA & layout drawings shall be submitted for the entire substation in case of substation extension also.

(3) The instruction Manuals shall contain full details of drawings of all equipment being supplied under this contract, their exploded diagrams with complete instructions for storage, handling, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.

(4) If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Bidder to the Employer.

(5) The Bidder shall furnish to the Employer catalogues of spare parts.

(6) All As-built drawings/documents shall be certified by site indicating the changes before final submission.

6.0 MATERIAL/ WORKMANSHIP

6.1 General Requirement

6.1.1 Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended.

6.1.2 In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard, the Employer shall decide upon the question of similarity. When required by the specification or when required by the Employer the Bidder shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it is to be understood that the cost as well as the time delay associated with the rejection shall be borne by the Bidder.

6.1.3 The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfil their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Employer.

6.1.4 Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

6.1.5 Deleted.

6.1.6 The Bidder shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Bidder shall apply all operational lubricants to the equipment installed by him.

6.1.7 All oil, grease and other consumables used in the Works/Equipment shall be purchased in India unless the Bidder has any special requirement for the specific application of a

type of oil or grease not available in India. If such is the case, he shall declare in the proposal, where such oil or grease is available. He shall help Employer in establishing equivalent Indian make and Indian Bidder. The same shall be applicable to other consumables too.

6.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

6.2.1 Space Heaters

6.2.1.1 The heaters shall be suitable for continuous operation at 240V as supply voltage. On-off switch and fuse shall be provided.

6.2.1.2 One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

6.2.2 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

6.2.3 Ventilation opening

Wherever ventilation is provided, the compartments shall have ventilation openings with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust.

6.2.4 Degree of Protection

The enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall comply with following degree of protection as detailed here

under:
a) Installed out door: IP- 55
b) Installed indoor in air conditioned area: IP-31
c) Installed in covered area: IP-52
d) Installed indoor in non-air conditioned area where possibility of entry of water is limited: IP-41.
e) For LT Switchgear (AC & DC distribution Boards): IP-52

The degree of protection shall be in accordance with IS:13947 (Part-I)/IEC-60947 (Part-I)/IS 12063/IEC-60529. Type test report for IP-55 or higher degree of protection test, shall be submitted for approval.

6.3 RATING PLATES, NAME PLATES AND LABELS

6.3.1 Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Employer. The rating plate of each equipment shall be according to IEC requirement.

6.3.2 All such nameplates, instruction plates, rating plates of transformers, reactors, CB, CT, CVT, SA, Isolators, C & R panels and PLCC equipments shall be bilingual with Hindi inscription first followed by English. Alternatively two separate plates one with Hindi and the other with English inscriptions may be provided.

6.4 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into operation, shall be furnished by the Bidder unless specifically excluded under the exclusions in these specifications and documents.

7.0 DESIGN IMPROVEMENTS / COORDINATION

7.1 Deleted.

7.2 Deleted.

7.3 The Bidder shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

7.4 The Bidder has to coordinate designs and terminations with the agencies (if any) who are Consultants/Bidder for the Employer. The names of agencies shall be intimated to the successful bidders.

7.5 The Bidder will be called upon to attend design co-ordination meetings with the Engineer, other Bidder's and the Consultants of the Employer (if any) during the period of Contract. The Bidder shall attend such meetings at his own cost at POWERGRID Corporate Centre, Gurgaon (Haryana) or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

8.0 QUALITY ASSURANCE PROGRAMME

8.1 To ensure that the equipment and services under the scope of this Contract, whether manufactured or performed within the Bidder's Works or at his Sub-Bidder's premises or at the Employer's site or at any other place of Work as applicable, are in accordance with the specifications, the Bidder shall ensure suitable quality assurance programme to control such activities at all points necessary. A quality assurance programme of the Bidder shall be in line with ISO requirements & shall generally cover the following:

a) The organisation structure for the management and implementation of the proposed quality assurance programme.

b) System for Document and Data Control.

c) Qualification and Experience data of Bidder's key personnel.

d) The procedure for purchases of materials, parts, components and selection of sub-Bidder's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.

e) System for shop manufacturing and site erection controls including process controls, fabrication and assembly control.

f) System for Control of non-conforming products including deviation dispositioning, if any and system for corrective and preventive actions based on the feedback received from the Customers and also internally documented system for Customer complaints.

g) Inspection and test procedure both for manufacture and field activities.

h) System for Control of calibration of testing and measuring equipment and the indication of calibration status on the instruments.

i) System for indication and appraisal of inspection status.

j)System of Internal Quality Audits, Management review and initiation of corrective and Preventive actions based on the above.

k) System for authorising release of manufactured product to the Employer.

l) System for maintenance of records.

m) System for handling, storage and delivery.

n) A quality plan detailing out the specific quality control measures and procedure adopted for controlling the quality characteristics relevant to each item of equipment furnished and /or service rendered.

o) System for various field activities i.e. unloading, receipt at site, proper storage, erection, testing and commissioning of various equipment and maintenance of records. In this regard, the Employer has already prepared Standard Field Quality Plan for transmission line/substation equipments as applicable, Civil/erection Works which is required to be followed for associated works.

The Employer or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Bidder/his vendor's quality management and control activities.

8.2 Quality Assurance Documents

The Bidder shall ensure availability of the following Quality Assurance Documents:

i) All Non-Destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication, and reports including radiography interpretation reports.

ii) Welder and welding operator qualification certificates.

iii) Welder's identification list, welding operator's qualification procedure and welding identification symbols.

iv) Raw Material test reports on components as specified by the specification and in the quality plan.

v) The Manufacturing Quality Plan (MQP) indicating Customer Inspection Points (CIPs) at various stages of manufacturing and methods used to verify that the inspection and testing points in the quality plan were performed satisfactorily.

vi) Factory test results for testing required as per applicable quality plan/technical specifications/GTP/Drawings etc.

vii) Stress relief time temperature charts/oil impregnation time temperature charts, wherever applicable.

8.3 INSPECTION, TESTING & INSPECTION CERTIFICATE

8.3.1 Bidder shall procure bought out items from sub-vendors as per the list in "Compendium of Vendors" available on POWERGRID web-site www.powergridindia.com after ensuring compliance to the requirements/conditions mentioned therein. Bidder shall explore first the possibilities of procuring the bought out items from POWERGRID approved existing vendors. In case of their unavailability / non-response, Bidder may approach POWERGRID for additional sub-vendor approval. In that case, the assessment report of proposed sub vendor by Bidder along with the enclosures as per Annexure-F shall be submitted within 60 days of the award. The proposal shall be reviewed and approval will be accorded based on the verification of the document submitted and/or after the physical assessment of the works as the case may be. The physical assessment conducted by POWERGRID, if required, shall be on chargeable basis. Charges shall be as per the POWERGRID norms prevailing at that time, which shall be intimated by POWERGRID separately. If proposal for sub-vendor is submitted after 60 days, the Bidder's proposal normally will not be considered for current LOA. However, POWERGRID may process the case for developing more vendors for referred items, if found relevant. In all cases, It is the responsibility of the Bidder that Project activities do not suffer on account of delay in approval/non approval of a new sub-vendor.

The responsibility and the basis of inspection for various items & equipment is placed at Annexure-G along with the requirement of MQP (Manufacturing Quality Plan), ITP(Inspection & Test Plan), FAT(Factory Acceptance Test) which should be valid &

POWERGRID approved and Level of inspection envisaged against each item.

Bidder shall ensure that order for items where MQP/ITP/FAT is required will be placed only on vendors having valid MQP/ITP/FAT and where the supplier's MQP/ITP/FAT is either not valid or has not been approved by POWERGRID, MQP shall be generally submitted as per POWERGRID format before placing order.

Items not covered under MQP/ITP/FAT shall be offered for inspection as per POWERGRID LOA/technical Specifications/POWERGRID approved data sheets/POWERGRID approved drawings and relevant Indian/International standards. Inspection Levels: For implementation of projects in a time bound manner and to avoid any delay in deputation of POWERGRID or its authorized representative, involvement of POWERGRID for inspection of various items / equipment will be based on the level below:

Level –I: Bidder to raise all inspection calls and review the report of tests carried out by the manufacturer, on his own, as per applicable standards/ POWERGRID specification, and submit to concerned POWERGRID inspection office/Inspection Engineer. CIP/MICC will be issued by POWERGRID based on review of test reports/certificates of manufacturers.

Level – II: Bidder to raise all inspection calls and carry out the inspection on behalf of POWERGRID on the proposed date of inspection as per applicable standards/specification. However, in case POWERGRID wishes to associate itself during inspection, the same would be intimated to Bidder and CIP/MICC will be issued by POWERGRID. Else, Bidder would submit their test reports/certificates to POWERGRID. CIP/MICC will be issued by POWERGRID based on review of test reports/certificates.

Level - III: Bidder to raise inspection calls for both, stage (as applicable) & final inspection and carry out the stage inspections (if applicable) on behalf of POWERGRID on the proposed date of inspection as per applicable standards/specification. However, in case POWERGRID wishes to associate itself during stage inspection, the same would be intimated to Bidder and CIP will be issued by POWERGRID. Else, Bidder would submit the test reports / certificates of stage inspection after their own review and CIP will be issued by POWERGRID based on review of test reports / certificates. Final inspection will be carried out by POWERGRID and CIP/MICC will be issued by POWERGRID.

Level – IV: Bidder to raise inspection calls for both, stage (as applicable) & final inspections. POWERGRID will carry out the inspection for both stage & final inspection as per applicable standards/specification and CIP/MICC will be issued by POWERGRID.

8.3.2 Bidder shall ensure that to implement the above inspection levels, particularly for the quality control and inspection at sub-vendor's works, they would depute sufficient qualified & experienced manpower in their Quality Control and Inspection department. Further, to assure quality of construction, Bidder shall have a separate workforce having appropriate qualification & experience and deploy suitable tools and plant for maintaining quality requirement during construction in line with applicable Field Quality Plan (FQP).

8.3.3 The Employer, his duly authorised representative and/or outside inspection agency acting on behalf of the Employer shall have at all reasonable times access to the Bidder's premises or Works and shall have the power at all reasonable times to ensure that proper Quality Management practices / norms are adhered to, inspect and examine the materials & workmanship of the Works, to carry out Quality/Surveillance Audit during manufacture or erection and if part of the Works is being manufactured or assembled at other premises or works. The Bidder shall obtain for the Employer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Bidder's own premises or works. The item/equipment, if found unsatisfactory with respect to workmanship or material is liable to be rejected. The observations for improvements during product/ process inspection by POWERGRID shall be recorded in Quality Improvement Register (available & maintained at works) for review & timely compliance of observations.

8.3.4 Bidder shall submit inspection calls over internet through POWERGRID website. The required vendor code and password to enable raising inspection call will be furnished to the main Bidder within 30 days of award of contract on submission of documents by Bidder. After raising the inspection calls, Bidder shall then proceed as per the message of that particular call which is available on the message board.

8.3.5 The Employer reserves the right to witness any or all type, acceptance and routine tests specified for which the Bidder shall give the Employer/Inspector Twenty one (21) days written notice of any material being ready for testing for each stage of testing as identified in the approved quality plan as customer inspection point(CIP) for indigenous inspections. All inspection calls for overseas material shall be given at least forty five (45) days in advance. Such tests shall be to the Bidder's account except for the expenses of the Inspection Engineer. The Employer/inspector, unless witnessing of the tests is waived by Employer, will attend such tests within Twenty one (21) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Bidder may proceed with the test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector three copies of tests, duly certified. Bidder shall ensure, before giving notice for type test, that all drawings and quality plans have been got approved. The equipment shall be dispatched to site only after approval of Routine and Acceptance test results and Issuance of

Dispatch Clearance in writing by the Employer. CIP/Material Inspection clearance certificate (MICC) shall be issued by the Employer after inspection of the equipment or review of test reports as applicable. Employer may waive off the presence of Employer's inspecting engineer. In that case test will be carried out as per approved QP and test certificate will be furnished by the supplier for approval. CIP/MICC will be issued only after review and approval of the test reports.

8.3.6 Bidder shall generally offer material for inspection as per supply bar chart approved by POWERGRID and not before 30 days from schedule indicated in the bar chart. In case Bidder offers material(s) for inspection prior to 30 days from the scheduled date with necessary approval of POWERGRID, POWERGRID shall inspect the material and issue CIP only. However, in such an exceptional case, MICC shall be issued only as per provision of original / revised approved supply schedule.

8.3.7 Bidder shall minimize the number of inspection calls by offering optimum quantities in each inspection call at the respective manufacturer's works.

8.3.8 Bidder shall inspect the material themselves and only after they are fully convinced about the Quality, they shall offer the material for POWERGRID inspection and shall also ensure that relevant portion of LOA/NOA, approved drawing and data sheets along with applicable Quality Plans are available at the works of Bidder or their Sub-vendor before the material is offered for inspection.

8.3.9 Bidder shall ensure that material which has been cleared for dispatch after inspection will be dispatched within 30 days in case of domestic supplies and within 60 days in case of Off-shore supplies from the date of issuance of CIP. Material which is not dispatched within stipulated time as above will be reoffered for POWERGRID inspection or specific approval of POWERGRID QA&I shall be obtained for delayed dispatch.

8.3.10 The Employer or IE shall give notice in writing to the Bidder, of any objection either to conformance to any drawings or to any equipment and workmanship which in his opinion is not in accordance with the Contract. The Bidder shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Employer/Inspection Engineer giving reasons therein, that no modifications are necessary to comply with the Contract.

8.3.11 All Test Reports and documents to be submitted in English during final inspection of equipment by POWERGRID or as and when required for submission.

8.3.12 When the factory tests have been completed at the Bidder's or Sub-Bidder's works, the

Employer/Inspection Engineer (IE) shall issue a certificate to this effect within fifteen (15) days after completion of tests & submission of documents by Bidder/manufacturer but if the tests are not witnessed by the Employer/IE, the certificate shall be issued within fifteen (15) days of receipt of the Bidder's Test certificate by the Employer/IE. Bidder shall, on completion of all tests, submit test reports within Ten (10) days to POWERGRID IE. Failure of the Employer/IE to issue such a certificate shall not prevent the Bidder from proceeding with the Works. The completion of these tests or the issue of the certificate shall not bind the Employer to accept the equipment should, it, on further tests after erection, be found not to comply with the Contract.

8.3.13 In all cases, where the Contract provides for tests whether at the premises or works of the Bidder or of any Sub- Bidder, the Bidder, except where otherwise specified, shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Employer/Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Employer/Inspection Engineer or to his authorised representative to accomplish testing.

8.3.14 The inspection and acceptance by Employer and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Bidder in respect of the agreed quality assurance programme forming a part of the Contract, or if such equipment is found to be defective at a later stage.

8.3.15 The Employer will have the right of having at his own expenses any other test(s) of reasonable nature carried out at Bidder's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

8.3.16 The Employer reserves the right for getting any additional field tests conducted on the completely assembled equipment at site to satisfy that material complies with specifications.

8.3.17 Rework/ Re-engineering, if any, on any item/equipment shall be carried out only after mutual discussions and in accordance with mutually agreed procedure. Bidder shall submit Joint Inspection Report of equipments under Re-Work/Re-Engineering alongwith procedure for the same to POWERGRID for approval, before taking up the Re-Work/Re-Engineering, failing which POWERGRID reserves the right to reject the equipment.

8.3.18 Bidder may establish a field test Laboratory to execute Civil Construction testing requirements at site with the condition that all testing equipment shall be calibrated

from POWERGRID approved accredited Testing laboratories, with calibration certificates kept available at site and all testing personnel employed in the Field Testing Laboratories to be qualified and experienced Engineers or testing to be carried out at POWERGRID approved Third Party Laboratories.

8.3.19 Bidder shall ensure that all possible steps are taken to avoid damages to the equipment during transport, storage and erection.

8.3.20 Bidder shall implement additional stringent quality checks and preparation during installation of GIS at site (if applicable) as per POWERGRID approved guidelines/Technical specifications.

8.3.21 Bidder shall ensure commissioning of all CSDs along with Circuit Breakers wherever applicable.

8.3.22 For EHV transformers/reactors:

Insulation oil shall be as per POWERGRID Technical specifications and same grade shall be used for impregnation of the active part & testing at the works of Transformer/Reactor Manufacturer and as well as for filling the Transformer/Reactors at site. Bidder to ensure that windings for Transformer/Reactors are made in air conditioned environment. Core-coil assembly shall be performed in positive pressurized dust controlled environment. Dust measurements shall be monitored regularly at Transformer / Reactor Manufacturer works. Bidder shall ensure that respective civil foundations & Fire walls for Transformer/Reactors units to be commissioned, shall be made ready at concerned sites before receipt of Transformer/Reactors units. All the requisite material for Neutral & Delta Bus formation required for charging of complete bank of 765KV class 1-ph Transformer/Reactor units shall be made available at the concerned sites before receipt of the Transformer/Reactor units at site.

8.3.23 The Employer reserves the right to increase or decrease their involvement in inspections at Bidder's Works or at his Sub-Bidder's premises or at the Employer's site or at any other place of Work based on performance of Bidder/sub-Bidder.

9.0 TYPE TESTING & CLEARANCE CERTIFICATE

9.1 All equipment being supplied shall conform to type tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective sections.

9.2 The reports for all type tests as per technical specification shall be furnished by the Bidder alongwith equipment / material drawings. However, type test reports of similar equipments/ material already accepted in POWERGRID shall be applicable for all projects with similar requirement. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by POWERGRID or representative authorized by POWERGRID or Utility or representative of accredited test lab.

Unless otherwise specified elsewhere, the type test reports submitted shall be of the tests conducted on or after 05-Nov-2009. In case the test reports are of the test conducted earlier than 05-Nov-2009, the bidder shall repeat these test(s) at no extra cost to the BHEL/Employer.

Further, in the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification or any/all type tests not carried out, same shall be carried out without any additional cost implication to the BHEL/Employer.

The Bidder shall intimate the Employer the detailed program about the type tests atleast two (2) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.

9.3 The Employer intends to repeat those type tests which are indicated in the price schedule and the same shall be payable as per provision of contract. The price of conducting type tests shall be included in Bid price and break up of these shall be given in the relevant schedule of Bid Proposal Sheets. These Type test charges would be considered in bid evaluation. In case Bidder does not indicate charges for any of the type tests or does not mention the name of any test in the price schedules, it will be presumed that the particular test has been offered free of charge. Further, in case any Bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected. The Employer reserves the right to waive the repeating of type tests partly or fully and in case of waival, test charges for the same shall not be payable.

9.4 The Employer reserves the right to witness any or all the type tests. The Employer shall bear all expenses for deputation of Employer's representative(s) for witnessing the type tests.

9.5 The list of makes of various items, for which Type test reports are not required to be submitted are specified in Compendium of Vendors (COV).

10.0 Deleted.

11.0 PACKAGING & PROTECTION

11.1 All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the Employer, the Bidder shall also submit packing details/associated drawing for any equipment/material under his scope of supply, to facilitate the Employer to repack any equipment/material at a later date, in case the need arises. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Bidder. Employer takes no responsibility of the availability of the wagons.

11.2 All coated surfaces shall be protected against abrasion, impact, discolouration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

12.0 FINISHING OF METAL SURFACES

12.1 All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. All steel conductors including those used for earthing/grounding (above ground level) shall also be galvanized according to IS: 2629.

12.2 HOT DIP GALVANISING

12.2.1 The minimum weight of the zinc coating shall be 610 gm/sq.m and minimum average thickness of coating shall be 86 microns for all items having thickness 6mm and above. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq.m minimum.

12.2.2 The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of

coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

12.2.3 After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate or alternate approved treatment shall be provided to avoid formation of white rust after hot dip galvanization.

12.2.4 The galvanized steel shall be subjected to four numbers of one minute dips in copper sulphate solution as per IS-2633.

12.2.5 Sharp edges with radii less than 2.5 mm shall be able to withstand four immersions of the Standard Preece test. All other coatings shall withstand six immersions. The following galvanizing tests should essentially be performed as per relevant Indian Standards.
- Coating thickness
- Uniformity of zinc
- Adhesion test
- Mass of zinc coating

12.2.6 Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of touch-up zinc rich paint at site shall be allowed with approval of Engineer Incharge.

12.3 PAINTING

12.3.1 All sheet steel work shall be degreased, pickled, phosphated in accordance with the IS-6005 “Code of practice for phosphating iron and sheet”. All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swaf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

12.3.2 After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be “flash dried” while the second coat shall be stoved.

12.3.3 After application of the primer, two coats of finishing synthetic enamel paint shall be

applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.

12.3.4 The exterior and interior colour of the paint in case of new substations shall preferably be RAL 7032 for all equipment, marshalling boxes, junction boxes, control cabinets, panels etc. unless specifically mentioned under respective sections of the equipments. Glossy white colour inside the equipments /boards /panels/junction boxes is also acceptable. The exterior colour for panels shall be matching with the existing panels in case of extension of a substation. Each coat of primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments.

12.3.5 In case the bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures, like electrostatic painting etc., the procedure shall be submitted during detailed engineering for Employer's review & approval.

12.3.6 The colour scheme as given below shall be followed for Fire Protection and Air Conditioning systems

S.No.	PIPE LINE	Base colour	Band colour
Fire Protection System			
1	Hydrant and Emulsifier system pipeline	FIRE RED	-
2	Emulsifier system detection line – water	FIRE RED	Sea Green
3	Emulsifier system detection line –Air	FIRE RED	Sky Blue
4	Pylon support pipes	FIRE RED	-
Air Conditioning Plant			
5	Refrigerant gas pipeline – at compressor suction	Canary Yellow	-
6	Refrigerant gas pipeline – at compressor discharge	Canary Yellow	Red
7	Refrigerant liquid pipeline	Dark Admiralty Green	-
8	Chilled water pipeline	Sea Green	-
9	Condenser water pipeline	Sea Green	Dark Blue

The direction of flow shall be marked by → (arrow) in black colour.

Base Colour Direction of flow Band Colour

12.3.7 For aluminium casted surfaces, the surface shall be with smooth finish. Further, in case of aluminium enclosures, the surface shall be coated with powder (coating thickness of 60 microns) after surface preparation for painting. For stainless steel surfaces, no painting is envisaged.

13.0 Deleted

14.0 TOOLS

14.1 Deleted

14.2 SPECIAL TOOLS AND TACKLES

The bidder shall supply all special tools and tackles required for Operation and maintenance of equipment. The special tools and tackles shall only cover items which are specifically required for the equipment offered and are proprietary in nature. The list of special tools and tackles, if any, shall be finalized during detail engineering and the same shall be supplied without any additional cost implication to the Employer.

14.3 Deleted

15.0 AUXILIARY SUPPLY

15.1 The auxiliary power for station supply, including the equipment drive, cooling system of any equipment, air-conditioning, lighting etc shall be designed for the specified Parameters as under. The DC supply for the instrumentation and PLCC system shall also conform the parameters as indicated in the following table:

Normal Voltage	Variation in Voltage	Frequency in HZ	Phase/Wire	Neutral connection
415V	±10%	50 ± 5%	3/4 Wire	Solidly Earthed.
240V	±10%	50 ± 5%	1/2 Wire	Solidly Earthed.
220V	190V to 240V	DC	Isolated 2 wire System	-
110V	95V to 120V	DC	Isolated 2 wire System	-
48V	--	DC	2 wire system (+) earthed	-

Combined variation of voltage and frequency shall be limited to + 10%.

16.0 SUPPORT STRUCTURE

16.1 The equipment support structures shall be suitable for equipment connections at the first level i.e 14.0 meter, 8.0 meter, 5.9 meter and 4.6 meter from plinth level for 765kV, 400kV, 220kV and 132kV substations respectively. All equipment support structures shall be supplied alongwith brackets, angles, stools etc. for attaching the operating mechanism, control cabinets & marshalling box (wherever applicable) etc.

16.2 The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or supporting insulators to the bottom of the equipment base, where it rests on the foundation pad shall be 2.55 metres.

17.0 Deleted

18.0 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

18.1 All types of boxes, cabinets etc. shall generally conform to & be tested in accordance with IS-5039/IS-8623, IEC-60439, as applicable, and the clauses given below:

18.2 Control cabinets, junction boxes, Marshalling boxes & terminal boxes shall be made of stainless steel of atleast 1.5 mm thick or aluminum enclosure of atleast 1.6 mm thick and shall be dust, water and vermin proof. Stainless steel used shall be of grade SS304 or better. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminium enclosed box the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

18.3 A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes / Control cabinets to prevent ingress of rain water.

18.4 Cabinet/boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere.

18.5 All doors, removable covers and plates shall be gasketed all around with suitably profiled EPDM/Neoprene/PU gaskets. The gasket shall be tested in accordance with approved quality plan, IS:11149 and IS:3400. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

Further, the gasketing arrangement shall be such that gaskets are pasted in slots (in door fabrication/gasket itself) in order to prevent ingression of dust and moisture inside the panels so that no internal rusting occurs in panels during the operation of the equipment.

18.6 All boxes/cabinets shall be designed for the entry of cables by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate above the base of the marshalling kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland plate. Gland plate shall have provision for some future glands to be provided later, if required. The Nickel plated glands shall be dust proof, screw on & double compression type and made of brass. The gland shall have provision for securing armour of the cable separately and shall be provided with earthing tag. The glands shall conform to BS:6121.

18.7 A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.

18.8 LED based illumination of minimum 9 watts shall be provided. The switching of the fittings shall be controlled by the door switch.

For junction boxes of smaller sizes such as lighting junction box, manual operated earth switch mechanism box etc., plug socket, heater and illumination is not required to be provided.

18.9 All control switches shall be of MCB/rotary switch type and Toggle/piano switches shall not be accepted.

18.10 Earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire shall be terminated on to the earthing pad and secured by the use of self etching washer. Earthing of hinged door shall be done by using a separate earth wire.

18.11 The bay marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/feruling by pasting the same on the inside of the door.

18.12 The following routine tests alongwith the routine tests as per IS:5039 shall also be conducted:

i) Check for wiring
ii) Visual and dimension check

18.13 The enclosure of bay marshalling kiosk, junction box, terminal box and control cabinets shall conform to IP-55 as per IS:13947 including application of 2KV rms for 1 (one) minute, insulation resistance and functional test after IP-55 test.

19.0 DELETED

20.0 TERMINAL BLOCKS AND WIRING

20.1 Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All interphase and external connections to equipment or to control cubicles will be made through terminal blocks.

20.2 Terminal blocks shall be 650V grade and have continuous rating to carry the maximum expected current on the terminals and non-breakable type. These shall be of moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But the terminal blocks shall be non-disconnecting stud type except for the secondary junction boxes of Current Transformer and Voltage Transformer.

20.3 Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

20.4 The terminal shall be such that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally.

20.5 The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable.

20.6 The terminal blocks shall be of extensible design, multilayer terminal arrangement is not allowed in any junction box (Common MB, Individual MB, JB etc.). There should be sufficient space at both sides of terminals so that ferrule number of wires / TB numbers are clearly visible during wire removal or insertion.

20.7 The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

20.8 The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barriers shall be provided between the

terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

20.9 Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.
a) All circuits except Minimum of two of 2.5 sq mm CT/PT circuits copper flexible.
b) All CT/PT circuits Minimum of 4 nos. of 2.5 sq mm copper flexible.

20.10 The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live.

20.11 Atleast 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

20.12 There shall be a minimum clearance of 250 mm between the First/bottom row of terminal block and the associated cable gland plate for outdoor ground mounted marshalling box and the clearance between two rows of terminal blocks shall be a minimum of 150 mm.

20.13 The Bidder shall furnish all wire, conduits and terminals for the necessary interphase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets. For equipments rated for 400 kV and above the wiring required in these items shall be run in metallic ducts or shielded cables in order to avoid surge over-voltages either transferred through the equipment or due to transients induced from the EHV circuits.

20.14 All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The Bidder shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

21.0 LAMPS & SOCKETS

21.1 Lamps & Sockets

All lamps shall use a socket base as per IS-1258, except in the case of signal lamps. All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

21.2 Hand Lamp:

A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each

cubicle with ON-OFF Switch for connection of hand lamps.

21.3 Switches and Fuses:

21.3.1 Each panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with miniature circuit breaker / switch fuse units. Selection of the main and Sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

21.3.2 All fuses shall be of HRC cartridge type conforming to IS: 9228 mounted on plug-in type fuse bases. Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

22.0 Deleted

23.0 Deleted

ANNEXURE-C

LIST OF GENERAL STANDARDS AND CODES

CODES	TITLE
--	India Electricity Rules
--	Indian Electricity Act
--	Indian Electricity (Supply) Act
--	Indian Factories Act
IS-5	Colors for Ready Mixed Paints and Enamels
IS-335	New Insulating Oils
IS-617	Aluminium and Aluminium Alloy Ingots and Castings for General Engineering Purposes
IS-1448 (P1 to P 145)	Methods of Test for Petroleum and its Products
IS-2071 (P1 to P3)	Methods of High Voltage Testing
IS-12063	Classification of degrees of protection provided by enclosures of electrical equipment
IS-2165 ; P1:1997, P2:1983	Insulation Coordination
IS-3043	Code of Practice for Earthing
IS-6103	Method of Test for Specific Resistance (Resistivity) of Electrical Insulating Liquids
IS-6104	Method of Test for Interfacial Tension of Oil against Water by the Ring Method
IS-6262	Method of test for Power factor & Dielectric Constant of Electrical Insulating Liquids
IS-6792	Method for determination of electric strength of insulating oils
IS-5578	Guide for marking of insulated conductors
IS-11353	Guide for uniform system of marking & identification of conductors & apparatus terminals.
IS-8263	Methods for Radio Interference Test on High voltage Insulators
IS-9224 (Part 1,2&4)	Low Voltage Fuses
IEC-60060 (Part 1 to P4)	High Voltage Test Techniques
IEC 60068	Environmental Test
IEC-60117	Graphical Symbols
IEC-60156	Method for the Determination of the Electrical Strength of Insulation Oils
IEC-60270	Partial Discharge Measurements
IEC-60376	Specification and Acceptance of New Sulphur Hexafloride
IEC-60437	Radio Interference Test on High Voltage Insulators
IEC-60507	Artificial Pollution Tests on High Voltage Insulators to be used on AC Systems
IEC-62271-1	Common Specification for High Voltage Switchgear & Control gear Standards
IEC-60815	Guide for the Selection of Insulators in respect of Polluted Conditions

CODES	TITLE
IEC-60865 (P1 & P2)	Short Circuit Current - Calculation of effects
ANSI-C.1/NFPA.70	National Electrical Code
ANSI-C37.90A	Guide for Surge Withstand Capability (SWC) Tests
ANSI-C63.21, C63.3	Specification for Electromagnetic Noise and Field Strength Instrumentation 10 KHz to 1 GHZ
C36.4ANSI-C68.1	Techniquest for Dielectric Tests
ANSI-C76.1/EEE21	Standard General Requirements and Test Procedure for Outdoor Apparatus Bushings
ANSI-SI-4	Specification for Sound Level Meters
ANSI-Y32-2/C337.2	Drawing Symbols
ANSI-Z55.11	Gray Finishes for Industrial Apparatus and Equipment No. 61 Light Gray
NEMA-107T	Methods of Measurements of RIV of High Voltage Apparatus
NEMA-ICS-II	General Standards for Industrial Control and Systems Part ICSI-109
CISPR-1	Specification for CISPR Radio Interference Measuring Apparatus for the frequency range 0.15 MHz to 30 MHz
CSA-Z299.1-1978h	Quality Assurance Program Requirements
CSA-Z299.2-1979h	Quality Control Program Requirements
CSA-Z299.3-1979h	Quality Verification Program Requirements
CSA-Z299.4-1979h	Inspection Program Requirements
TRANSFORMERS AND REACTORS	
IS:10028 (Part 2 & 3)	Code of practice for selection, installation & maintenance of Transformers (P1:1993), (P2:1991), (P3:1991)
IS-2026 (P1 to P4)	Power Transformers
IS-3347 (part 1 to Part 8)	Dimensions for Porcelain transformer Bushings for use in lightly polluted atmospheres
IS-3639	Fittings and Accessories for Power Transformers
IS-6600	Guide for Loading of oil immersed Transformers
IEC-60076 (Part 1 to 5)	Power Transformers
IEC-60214	On-Load Tap-Changers
IEC-60289	Reactors
IEC- 60354	Loading Guide for Oil - Immersed power transformers
IEC-60076-10	Determination of Transformer and Reactor Sound Levels
ANSI-C571280	General requirements for Distribution, Power and Regulating Transformers
ANSI-C571290	Test Code for Distribution, Power and Regulation Transformers
ANSI-C5716	Terminology & Test Code for Current Limiting Reactors
ANSI-C5721	Requirements, Terminology and Test Code for Shunt Reactors Rated Over 500 KVA
ANSI-C5792	Guide for Loading Oil-Immersed Power Transformers upto and including 100 MVA with 55 deg C or 65 deg C Winding Rise

CODES	TITLE
IS:3156- (P1 to P4)	Voltage Transformers
IS-4379	Identification of the Contents of Industrial Gas Cylinders
IEC-61869 (Part-1)	Instrument transformers - Part 1: General requirements
IEC-61869 (Part-2)	Instrument transformers - Part 2: Additional requirements for current transformers
IEC-61869 (Part-3)	Instrument transformers - Part 3: Additional requirements for inductive voltage transformers
IEC-61869 (Part-4)	Instrument transformers - Part 4: Additional requirements for combined transformers
IEC-61869 (Part-5)	Instrument transformers - Part 5: Additional requirements for capacitor voltage transformers
IEC-61869 (Part-6)	Instrument transformers - Part 6: Additional general requirements for low-power instrument transformers
IEC-61869 (Part-9)	Instrument transformers - Part 9: Digital interface for instrument transformers
IEC-61869 (Part-102)	Instrument transformers - Part 102: Ferroresonance oscillations in substations with inductive voltage transformers
IEC-61869 (Part-103)	Instrument transformers - The use of instrument transformers for power quality measurement
BUSHING	
IS-2099	Bushings for Alternating Voltages above 1000V
IEC-60137	Insulated Bushings for Alternating Voltages above 1000V
SURGE ARRESTERS	
IS-3070 (PART2)	Lightning arresters for alternating current systems : Metal oxide lightning arrestors without gaps
IEC-60099-4	Metal oxide surge arrestors without gaps
IEC-60099-5	Selection and application recommendation
ANSI-C62.1	IEE Standards for S A for AC Power Circuits
NEMA-LA 1	Surge Arresters
CUBICLES AND PANELS & OTHER RELATED EQUIPMENTS	
IS-722, IS-1248	Electrical relays for power system
IS-3231, 3231 (P-3)	Protection
IS:5039	Distributed pillars for Voltages not Exceeding 1000 Volts
IEC-60068.2.2	Basic environmental testing procedures Part 2: Test B: Dry heat
IEC-60529	Degree of Protection provided by enclosures
IEC-60947-4-1	Low voltage switchgear and control gear
IEC-61095	Electromechanical Contactors for household and similar purposes
IEC-60439 (P1 & 2)	Low Voltage Switchgear and control gear assemblies
ANSI-C37.20	Switchgear Assemblies, including metal enclosed bus
ANSI-C37.50	Test Procedures for Low Voltage Alternating Current Power

CODES	TITLE
	Circuit Breakers
ANSI-C39	Electric Measuring instrument
ANSI-C83	Components for Electric Equipment
IS: 8623: (Part I to 3)	Specification for Switchgear & Control Assemblies
NEMA-AB	Moulded Case Circuit and Systems
NEMA-CS	Industrial Controls and Systems
NEMA-PB-1	Panel Boards
NEMA-SG-5	Low voltage Power Circuit breakers
NEMA-SG-3	Power Switchgear Assemblies
NEMA-SG-6	Power switching Equipment
NEMA-5E-3	Motor Control Centers
1248 (P1 to P9)	Direct acting indicating analogue electrical measuring instruments & their accessories
Disconnecting switches	
IEC-62271-102	High-voltage switchgear and control gear - Part 102: Alternating current disconnectors and earthing switches
IEC-60265 (Part 1 & 2)	High Voltage switches
ANSI-C37.32	Schedule of preferred Ratings, Manufacturing Specifications and Application Guide for high voltage Air Switches, Bus supports and switch accessories
ANSI-C37.34	Test Code for high voltage air switches
NEMA-SG6	Power switching equipment
PLCC and line traps	
IS-8792	Line traps for AC power system
IS-8793	Methods of tests for line traps
IS-8997	Coupling devices for PLC systems
IS-8998	Methods of test for coupling devices for PLC systems
IEC-60353	Line traps for A.C. power systems
IEC-60481	Coupling Devices for power line carrier systems
IEC-60495	Single sideboard power line carrier terminals
IEC-60683	Planning of (single Side-Band) power line carrier systems
CIGRE	Teleprotection report by Committee 34 & 35
CIGRE	Guide on power line carrier 1979
CCIR	International Radio Consultative Committee
CCITT	International Telegraph & Telephone Consultative Committee
EIA	Electric Industries Association
Protection and control equipment	
IEC-60051: (P1 to P9)	Recommendations for Direct Acting indicating analogue electrical measuring instruments and their accessories
IEC-60255 (Part 1 to 23)	Electrical relays
IEC-60297 (P1 to P4)	Dimensions of mechanical structures of the 482.6mm (19 inches)

CODES	TITLE
	series
IEC-60359	Expression of the performance of electrical & electronic measuring equipment
IEC-60387	Symbols for Alternating-Current Electricity meters
IEC-60447	Man machine interface (MMI) - Actuating principles
IEC-60521	Class 0.5, 1 and 2 alternating current watt hour metres
IEC-60547	Modular plug-in Unit and standard 19-inch rack mounting unit based on NIM Standard (for electronic nuclear instruments)
ANSI-81	Screw threads
ANSI-B18	Bolts and Nuts
ANSI-C37.1	Relays, Station Controls etc
ANSI-C37.2	Manual and automatic station control, supervisory and associated telemetering equipment
ANSI-C37.2	Relays and relay systems associated with electric power apparatus
ANSI-C39.1	Requirements for electrical analog indicating instruments
MOTORS	
IS-325	Three phase induction motors
IS-4691	Degree of protection provided by enclosure for rotating electrical machinery
IEC-60034 (P1 to P19:)	Rotating electrical machines
IEC-Document 2	Three phase induction motors
(Central Office) NEMA-MGI	Motors and Generators
Electronic equipment and components	
MIL-21B, MIL-833 & MIL-2750	Environmental testing
EC-60068 (P1 to P5)	Printed boards
IEC-60326 (P1 to P2)	Material and workmanship standards
IS-1363 (P1 to P3)	Hexagon head bolts, screws and nuts of product grade C
IS-1364 (P1 to P5)	Hexagon head bolts, screws and nuts of products grades A and B
IS-3138	Hexagonal Bolts and Nuts (M42 to M150)
ISO-898	Fasteners: Bolts, screws and studs
ASTM	Specification and tests for materials
Clamps & connectors	
IS-5561	Electric power connectors
NEMA-CC1	Electric Power connectors for sub station
NEMA-CC 3	Connectors for Use between aluminium or aluminum-Copper Overhead Conductors
Bus hardware and insulators	
IS: 2121	Fittings for Aluminum and steel cored Al conductors for overhead

CODES	TITLE
IS:1248	Indicating Instruments
IS:2208	HRC Fuses
IS:13947 (Part-3)	Air break switches, air break disconnectors & fuse combination units for voltage not exceeding 1000V AC or 1200V DC
IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control gear
IS:6005	Code of practice for phosphating of Iron and Steel
IS:3231	Electrical relays for power system protection
IS:3842	Electrical relay for AC Systems
IS:5	Colours for ready mix paint
IEEE-484	Recommended Design for installation design and installation of large lead storage batteries for generating stations and substations
IEEE-485	Sizing large lead storage batteries for generating stations and substations
Wires and cables	
ASTMD-2863	Measuring the minimum oxygen concentration to support candle like combustion of plastics (oxygen index)
IS-694	PVC insulated cables for working voltages upto and including 1100 Volts
IS-1255	Code of practice for installation and maintenance of power cables, upto and including 33 kV rating
IS-1554 (P1 and P2)	PVC insulated (heavy duty) electric cables (part 1) for working voltage upto and including 1100 V Part (2) for working voltage from 3.3 kV upto and including 11kV
IS:1753	Aluminium conductor for insulated cables
IS:2982	Copper Conductor in insulated cables
IS-3961 (P1 to P5)	Recommended current ratings for cables
IS-3975	Mild steel wires, formed wires and tapes for armouring of cables
IS-5831	PVC insulating and sheath of electric cables
IS-6380	Elastometric insulating and sheath of electric cables
IS-7098	Cross linked polyethylene insulated PVC sheathed cables for working voltage upto and including 1100 volts
IS-7098	Cross-linked polyethyle insulated PVC sheathed cables for working voltage from 3.3kV upto and including 33 kV
IS-8130	Conductors for insulated electrical cables and flexible cords
IS-1753	Aluminum Conductors for insulated cables
IS-10418	Specification for drums for electric cables
IEC-60096 (part 0 to p4)	Radio Frequency cables
IEC-60183	Guide to the Selection of High Voltage Cables
IEC-60189 (P1 to P7)	Low frequency cables and wires with PVC insulation and PVC sheath

CODES	TITLE
IEC-60227 (P1 to P7)	Polyvinyl Chloride insulated cables of rated voltages up to and including 450/750V
IEC-60228	Conductors of insulated cables
IEC-60230	Impulse tests on cables and their accessories
IEC-60287 (P1 to P3)	Calculation of the continuous current rating of cables (100% load factor)
IEC-60304	Standard colours for insulation for low-frequency cables and wires
IEC-60331	Fire resisting characteristics of Electric cables
IEC-60332 (P1 to P3)	Tests on electric cables under fire conditions
IEC-60502	Extruded solid dielectric insulated power cables for rated voltages from 1 kV upto to 30 kV
IEC-754 (P1 and P2)	Tests on gases evolved during combustion of electric cables
AIR conditioning and ventilation	
IS-659	Safety code for air conditioning
IS-660	Safety code for Mechanical Refrigeration
ARI:520	Standard for Positive Displacement Refrigeration Compressor and Condensing Units
IS:4503	Shell and tube type heat exchanger
ASHRAE-24	Method of testing for rating of liquid coolers
ANSI-B-31.5	Refrigeration Piping
IS:2062	Steel for general structural purposes
IS:655	Specification for Metal Air Dust
IS:277	Specification for Galvanised Steel Sheets
IS-737	Specification for Wrought Aluminium and Aluminium Sheet & Strip
IS-1079	Hot rolled cast steel sheet & strip
IS-3588	Specification for Electrical Axial Flow Fans
IS-2312	Propeller Type AC Ventilation Fans
BS-848	Methods of Performance Test for Fans
BS-6540 Part-I	Air Filters used in Air Conditioning and General Ventilation
BS-3928	Sodium Flame Test for Air Filters (Other than for Air Supply to I.C. Engines and Compressors)
US-PED-2098	Method of cold DOP & hot DOP test
MIL-STD-282	DOP smoke penetration method
ASHRAE-52	Air cleaning device used in general ventilation for removing particle matter
IS:3069	Glossary of Terms, Symbols and Units Relating to Thermal Insulation Materials
IS:4671	Expanded Polystyrene for Thermal Insulation Purposes
IS:8183	Bonded Mineral Wool
IS:3346	Evaluation of Thermal Conductivity properties by means of

CODES	TITLE
	guarded hot plate method
ASTM-C-591-69	Standard specification for rigid preformed cellular urethane thermal insulation
IS:4894	Centrifugal Fans
BS:848	Method of Performance Test for Centrifugal Fans
IS:325	Induction motors, three-phase
IS:4722	Rotating electrical machines
IS:1231	Three phase foot mounted Induction motors, dimensions of
IS:2233	Designations of types of construction and mounting arrangements of rotating electrical machines
IS:2254	Vertical shaft motors for pumps, dimensions of
IS:7816	Guide for testing insulation resistance of rotating machines
IS:4029	Guide for testing three phase induction motors
IS: 4729	Rotating electrical machines, vibration of, Measurement and evaluation of
IS:4691	Degree of protection provided by enclosures for rotating electrical machinery
IS:7572	Guide for testing single-phase ac motors
IS:2148	Flame proof enclosure for electrical apparatus
BS:4999(Part-51)	Noise levels
Galvanizing	
IS-209	Zinc Ingot
IS-2629	Recommended Practice for Hot-Dip galvanizing on iron and steel
IS-2633	Methods for testing uniformity of coating of zinc coated articles
ASTM-A-123	Specification for zinc (Hot Galavanizing) Coatings, on products Fabricated from rolled, pressed and forged steel shapes, plates, bars and strips
ASTM-A-121-77	Zinc-coated (Galvanized) steel barbed wire
Painting	
IS-6005	Code of practice for phosphating of iron and steel
ANSI-Z551	Gray finishes for industrial apparatus and equipment
SSPEC	Steel structure painting council
Fire protection system	
--	Fire protection manual issued by tariff advisory committee (TAC) of India
HORIZONTAL CENTRIFUGAL PUMPS	
IS:1520	Horizontal centrifugal pumps for clear, cold and fresh water
IS:9137	Code for acceptance test for centrifugal & axial pumps
IS:5120	Technical requirement – Rotodynamic special purpose pumps
API-610	Centrifugal pumps for general services Hydraulic Institutes Standards

CODES	TITLE
NFPA-13	Standard for the installation of sprinkler system
NFPA-15	Standard for water spray fixed system for the fire protection
NFPA-12A	Standard for Halong 1301 Fire Extinguishing System
NFPA-72E	Standard on Automatic Fire Detectors
--	Fire Protection Manual by TAC (Latest Edition)
NFPA-12	Standard on Carbon dioxide extinguisher systems
IS:3034	Fire of industrial building
--	Electrical generating and distributing stations code of practice
IS:2878	CO2 (Carbon dioxide) Type Extinguisher
IS:2171	DC (Dry Chemical Powder) type
IS:940	Pressurised Water Type
D.G. SET	
IS:10002	Specification for performance requirements for constant speed compression ignition (diesel engine) for general purposes
IS:10000	Method of tests for internal combustion engines
IS:4722	Rotating electrical machines-specification
IS:12063	Degree of protection provided by enclosures
IS:12065	Permissible limit of noise levels for rotating electrical machines
--	Indian Explosive Act 1932
Steel structures	
IS-228 (1992)	Method of Chemical Analysis of pig iron, cast iron and plain carbon and low alloy steels.
IS-802 (P1 to 3)	Code of practice for use of structural steel in overhead transmission line towers
IS-806	Code of practice for use of steel tubes in general building construction
IS-808	Dimensions for hot rolled steel beam, column channel and angle sections
IS-814	Covered electrodes for manual arc welding of carbon of carbon manganese steel
IS-816	Code of Practice for use of metal arc welding for general construction in Mild steel
IS-817	Code of practice for training and testing of metal arc welders. Part 1 : Manual Metal arc welding
IS-875 (P1 to P4)	Code of practice for design loads (other than earthquake) for buildings and structures
IS-1161	Steel tubes for structural purposes
IS-1182	Recommended practice for radiographic examination of fusion welded butt joints in steel plates
IS-1363 (P1 to P3)	Hexagonal head bolts, screws & nuts of products grade C
IS-1364	Hexagon head bolts, screws and nuts of product grades A and B
IS-1367 (P1 to P18)	Technical supply condition for threaded steel fasteners

CODES	TITLE
IS-1599	Methods for bend test
IS-1608	Method for tensile testing of steel products
IS-1893	Criteria for earthquake resistant design of structures
IS-1978	Line Pipe
IS-2062	Steel for general structural purposes
IS-2595	Code of practice for Radiographic testing
IS-3063	Single coil rectangular section spring washers for bolts, nuts and screws
IS-3664	Code of practice for ultrasonic pulse echo testing by contact and immersion methods
IS-7205	Safety code for erection of structural steel work
IS-9595	Recommendations for metal arc welding of carbon and carbon manganese steels
ANSI-B18.2.1	Inch series square and Hexagonal bolts and screws
ANSI-B18.2.2	Square and hexagonal nuts
ANSI-G8.14	Round head bolts
ASTM-A6	Specification for General Requirements for rolled steel plates, shapes, sheet piling and bars of structural use
ASTM-A36	Specifications of structural steel
ASTM-A47	Specification for malleable iron castings
ASTM-A143	Practice for safeguarding against embilement of Hot Galvanized structural steel products and procedure for detaching embrilement
ASTM-A242	Specification for high strength low alloy structural steel
ASTM-A283	Specification for low and intermediate tensile strength carbon steel plates of structural quality
ASTM-A394	Specification for Galvanized steel transmission tower bolts and nuts
ASTM-441	Specification for High strength low alloy structural manganese vanadium steel
ASTM-A572	Specification for High strength low alloy colombium-Vanadium steel of structural quality
AWS D1-0	Code for welding in building construction welding inspection
AWS D1-1	Structural welding code
AISC	American institute of steel construction
NEMA-CG1	Manufactured graphite electrodes
Piping and pressure vessels	
IS-1239 (Part 1 and 2)	Mild steel tubes, tubulars and other wrought steel fittings
IS -3589	Seamless Electrically welded steel pipes for water, gas and sewage
IS-6392	Steel pipe flanges
ASME	Boiler and pressure vessel code

CODES	TITLE
CPWD	Latest CPWD specifications
ACSR MOOSE CONDUCTOR	
IS:6745 BS:443-1969	Methods for Determination of Mass of zinc coating on zinc coated Iron and Steel Articles
IS:8263	Methods for Radio Interference
IEC:437-1973 NEMA:107-1964 CISPR	Test on High Voltage Insulators
IS:209, BS:3436-1961	Zinc Ingot
IS:398 Part - V IEC:209-1966	Aluminum Conductors for Overhead Transmission Purposes
BS:215(Part-II), IEC:209-1966	Aluminium Conductors galvanized steel reinforced extra high voltage (400 kV and above)
IS:1778, BS:1559-1949	Reels and Drums for Bare Conductors
IS:1521, ISO/R89-1959	Method for Tensile Testing of steel wire
IS:2629	Recommended practice for Hot dip Galvanising on Iron and Steel
IS:2633	Method for Testing Uniformity of coating of zinc Coated Articles
IS:4826/ ASTMA-472-729	Hot dip galvanised coatings on round steel wires
GALVANISED STEEL EARTHWIRE	
IS:1521, ISO/R:89-1959	Method for Tensile Testing of Steel Wire
IS:1778	Reels and Drums for Bare Conductors
IS:2629	Recommended practice for Hot Dip Galvanising on Iron and Steel
IS:2633	Methods for testing Uniformity of Coating of Zinc Coated Articles
IS:4826/ ASTM: A 475-72a BS:443-1969	Hot dip Galvanised Coatings on Round Steel Wires
IS:6745/ BS:443-1969	Method for Determination of mass of Zinc Coating on Zinc coated Iron and Steel Articles.
IS:209/ BS:3463-1961	Zinc ingot
IS:398 (Pt. I to P5:1992)/ BS:215 (Part-II	Aluminum Conductors for overhead transmission purposes
Lighting Fixtures and Accessories	
IS:1913	General and safety requirements for electric lighting fittings
IS:3528	Water proof electric lighting fittings
IS:4012	Dust proof electric lighting fittings
IS:4013	Dust tight proof electric lighting fittings
IS:10322	Industrial lighting fittings with metal reflectors
IS:10322	Industrial lighting fittings with plastic reflectors
IS:2206	Well glass lighting fittings for use under ground in mines (non-

CODES	TITLE
	flameproof type)
IS:10322	Specification for flood light
IS:10322	Specification for decorative lighting outfits
IS:10322	Luminaries for street lighting
IS:2418	Tubular fluorescent lamps
IS:9900	High pressure mercury vapour lamps
IS:1258	Specification for Bayonet lamp fluorescent lamp
IS:3323	Bi-pin lamp holder tubular fluorescent lamps
IS:1534	Ballasts for use in fluorescent lighting fittings. (Part-I)
IS:1569	Capacitors for use in fluorescent lighting fittings
IS:2215	Starters for fluorescent lamps
IS:3324	Holders for starters for tubular fluorescent lamps
IS:418	GLS lamps
IS:3553	Water tight electric fittings
IS:2713	Tubular steel poles
IS:280	MS wire for general engg. Purposes
Conduits, Accessories and Junction Boxes	
IS:9537	Rigid steel conduits for electrical wiring
IS:3480	Flexible steel conduits for electrical wiring
IS:2667	Fittings for rigid steel conduits for electrical wiring
IS:3837	Accessories for rigid steel conduits for electrical wiring
IS:4649	Adaptors for flexible steel conduits
IS:5133	Steel and Cast Iron Boxes
IS:2629	Hot dip galvanising of Iron & Steel
Lighting Panels	
IS:13947	LV Switchgear and Control gear(Part 1 to 5)
IS:8828	Circuit breakers for over current protection for house hold and similar installations
IS:5	Ready mix paints
IS:2551	Danger notice plates
IS:2705	Current transformers
IS:9224	HRC Cartridge fuse links for voltage above 650V(Part-2)
IS:5082	Wrought aluminium and Al. alloys, bars, rods, tubes and sections for electrical purposes
IS:8623	Factory built Assemblies of Switchgear and Control Gear for voltages upto and including 1000V AC and 1200V DC
IS:1248	Direct Acting electrical indicating instruments
Electrical Installation	
IS:1293	3 pin plug
IS:371	Two to three ceiling roses

CODES	TITLE
IS:3854	Switches for domestic and similar purposes
IS:5216	Guide for safety procedures and practices in electrical work
IS:732	Code of practice for electrical wiring installation (system voltage not exceeding 650 Volts.)
IS:3043	Code of practice for earthing
IS:3646	Code of practice of interior illumination part II & III
IS:1944	Code of practice for lighting of public through fares
IS:5571	Guide for selection of electrical equipment for hazardous areas
IS:800	Code of practice for use of structural steel in general building construction
IS:2633	Methods of Testing uniformity of coating on zinc coated articles
IS:6005	Code of practice for phosphating iron and steel
	INDIAN ELECTRICITY ACT
	INDIAN ELECTRICITY RULES
LT SWITCHGEAR	
IS:8623 (Part-I)	Specification for low voltage switchgear and control gear assemblies
IS:13947 (Part-I)	Specification for low voltage switchgear and control gear, Part 1 General Rules
IS:13947 (part-2)	Specification for low voltage switchgear and control gear, Part 2 circuit breakers
IS:13947 (part-3)	Specification for low voltage switchgear and control gear. Part 3 Switches, Disconnectors, Switch-disconnectors and fuse combination units
IS:13947 (part-4)	Specification for low voltage switchgear and control gear. Part 4 Contactors and motors starters
IS:13947 (part-5)	Specification for low voltage switchgear and control gear. Part 5 Control-circuit devices and switching elements
IS:13947 (part-6)	Specification for low voltage switchgear and control gear. Part 6 Multiple function switching devices
IS:13947 (part-7)	Specification for low voltage switchgear and control gear. Part 7 Ancillary equipments
IS:12063	Degree of protection provided by enclosures
IS:2705	Current Transformers
IS:3156	Voltage Transformers
IS:3231	Electrical relays for power system protection
IS:1248	Electrical indicating instruments
IS:722	AC Electricity meters
IS:5578	Guide for Marking of insulated conductors of apparatus terminals
IS:13703 (part 1)	Low voltage fuses for voltage not exceeding 1000V AC or 1500V DC Part 1 General Requirements
IS:13703 (part 2)	Low voltage fuses for voltage not exceeding 1000V AC or 1500V DC Part 2 Fuses for use of authorized persons

CODES	TITLE
IS:6005	Code of practice of phosphating iron and steel
IS:5082	Wrought Aluminum and Aluminum alloys for electrical purposes
IS:2633	Hot dip galvanising

Annexure-G

MQP & INSPECTION LEVEL REQUIREMENT

Sl. No.	Item / Equipment	Requirement of MQP/ITP/FAT	Inspection Level
1 A	Transformer /Reactor	Yes	IV
1 B	Circuit Breakers	Yes	IV
2	Current transformer	Yes	IV
3	Capacitive voltage transformers/Potential transformer	Yes	IV
4	Isolators	Yes	IV
5	Lightening Arrestors	Yes	III
6	Line Trap	Yes	III
7	Control & Relay Panels	Yes	III
8	Power Cables	Yes	III
9	Control Cables	Yes	III
10	LT Switchgear & ACDB/DCDB/MLDB/ELDB/ Lighting Panels	Yes	III
11	Fire protection system		
11-A	Panels, Deluge valve, Hydro pneumatic tank.	No	III
11-B	Strainers, extinguishers, MS/GI pipes, Pumps, motors, air compressor, and other valves, Diesel Engines	No	II
11-C	Others	No	I
12	Insulator (Disc, Long Rod, Solid Core)	Yes	IV
13	Conductor	Yes	IV
14	Clamps & Connecters (including equipment connectors)	Yes	III
15	Junction Box / Lighting Switch Boards / Bay MB/Telecom Equipment Cabinet	No	II
16	Cable lugs	No	I
17	Lighting Fixtures ,Lamps & fans	No	I
18	Switches	No	I
19	Conduits	No	I
20	Lighting Poles	No	II
21	MS/GI /PVC Pipes for cable trenches and lighting	No	I
22	Hume Pipes	No	I
23	Galvanized Cable trays	No	II
24	MS/ GI Flat and earthing material	No	II
25	MS Round for Earthmat (40mm dia)	No	I
26	Lighting Earthwire	No	I
27	Aluminium Tube & Busbar materials	No	II
28	Outdoor Receptacle	No	I
29	Nut / Bolts / Spring Washers (Gr 5.6/5)	No	II
30	LT Transformer	Yes	III
31	Battery	No	II
32	Battery Charger	Yes	III

Annexure-G

Sl. No.	Item / Equipment	Requirement of MQP/ITP/FAT	Inspection Level
33	D. G. Set	No	II
34	Split A.C/window A.C.	No	I
35	Substation Automation system	No	III
36	Telephone wires	No	I
37	Telephone sockets	No	I
38	Aluminium ladder	No	I
39	Occupancy sensors for control of lighting	No	I
40	Sub Station Structure (lattice/pipe type)	Yes	III
41	HG fuse	No	II
42	PLCC equipment Viz PLCC Terminal ,Carrier equipment, Protection Coupler , Coupling Device but excluding EPAX / HF Cable/ SDH Equipment	Yes	III
43	HF Cable / GPS Clock	No	I
44	EPAX	No	I
45	Cable Glands / Joints /Clamps/ Termination	No	I
46	Video Monitoring System	No	II
47	Controller for switching	No	IV
48	Solar based street lighting pole including solar panel as per technical specification	No	III
49	Event Logger	No	III
50	Lighting transformers	Yes	II
51	String Hardware	Yes	IV
52	Test Equipment	No	I *
53	GS Earthwire	Yes	IV
54	Oil Storage Tank	Yes	III
55	Insulating Oil	No	III
56	Flow sensitive conservator isolation valve	No	II **
57	On-Line insulating oil drying system	No	II **
58	On line DGA & Moisture Analyzer	No	II **
59	WAMS-(PMU & Accessories)	Yes	III
60	FO Cable	Yes	III
61	Re-rollers of MS/HT Angle Section and galvanized tower parts.	Yes	IV
62	Hardware fittings & Earthwire Accessories	Yes	IV
63	OPGW & H/W	Yes	III
64	Bolts & Nuts Gr up to 5.6/5	Yes	II
65	Bolts & Nuts of Gr 8.8 / 8	Yes	IV
66	D-shackle/ Hanger / Links	Yes	IV
67	Danger Plate /Phase Plate / Number Plate / Circuit plate	No	I
68	Pipe Type & Counter Poise Earthing	No	II
69	Spring Washer	No	II
70	ACD & Barbed wire for ACD/Bird guard	No	II

Annexure-G

Sl. No.	Item / Equipment	Requirement of MQP/ITP/FAT	Inspection Level
71	Span Marker & Obstruction Light	No	III
72	GIS including spares	Yes	IV
73	GIS Bus Duct	Yes	IV
74	GIS Bushing	Yes	IV
75	SF6 Gas processing Unit	No	II
76	Partial Discharge Monitoring System	No	II
77	STATCOM including Valve, valve base electronics, DC capacitor, series reactor and all accessories	Yes	IV
78	Mechanically switched Reactor bank (3-ph) including all accessories (MSR Branches)	Yes	IV
80	Mechanically switched Capacitor bank (3-ph) including all accessories (MSC Branches)	Yes	IV
81	Pass Harmonic filters	Yes	IV
82	Valve cooling system	Yes	III
	FODP including pigtail	No	II
	Radio link Telecom	Yes	III
	Hardware Fittings for Fibre Optic approach cable	Yes	III
	SDH Equipments (ADM), PDH, Primary Multiplexer	Yes	IV
	Drop & Insert Multiplexer	Yes	IV
	DACS	Yes	IV
	Main Distribution Frame	No	I
	HDPE Pipe	No	II
	NMS, TMN	Yes	IV
	Synchronization Equipment	No	Level-I
93	HT Capacitor	Yes	IV
94	PLC Capacitor	Yes	III
95	48V DCPS	Yes	III
96	Nitrogen Injection system	Yes	III
97	Foundation/Anchor bolts	Yes	III
98	EOT crane/Lift	No	II
99	Optical Signal Column	No	II
100	Maintenance Platform	No	II
101	Spark Gap	Yes	III
102	Thyristor Valve	Yes	III
103	DC current & voltage measuring device	ITP	III
104	Furniture	No	I

Note:

* **MICC for test and measuring equipment shall be issued only after actual verification/demonstration of satisfactory performance at site.**

** **Though level-2 items, CIP can be issued also on review of TCs and visual inspection of these items.**

SECTION-4

ANNEXURE-A

COMPLIANCE CERTIFICATE OF TECHNICAL SPECIFICATION

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.

2. There are no deviation(s) with respect to specification other than those furnished in the 'schedule of technical deviations'.

3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.

4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

Date: Bidder's Stamp & Signature

ANNEXURE – B

SCHEDULE OF TECHNICAL DEVIATIONS

Bidder shall list below all technical deviation clause wise w.r.t. tender specifications:

S.No.	Section/ Page No.	Clause No.	Deviation	Reason / Justification

Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date: Bidder's Stamp & Signature

Technical Pre-Qualifying Requirements – For Illumination System – Fatehgarh II and Bhadla II

The bidder should have satisfactorily designed and supplied Illumination System for at least two projects of State Electricity Boards/ Central Utilities/State or Central Transmission Utilities/ Industrial Installations, in the last 5 years as on the date of technical bid opening.

Bidder has to submit proof of design, by submitting the approved design documents and/or drawings,
Bidder has to submit proof of supply by submitting the Purchase Order copy and performance certificates/MRC etc.

Prepared By: Nishant Singh (Sr Engineer)

Checked By: Sanjeev K. Shrivastava (DGM)

Approved By: Aruna Gulati (AGM)