BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NOIDA

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TYPE OF DOC.	**TECHNICAL SPECIFICATION**	**NAME**	**Vyom**	**SK**	**SKS**
TITLE		**SIGN**			
ILLUMINATION SYSTEM		**DATE**			
		GROUP	TBEM	**W.O. No**	86005
CUSTOMER	**NTPC SAIL POWER COMPANY (P) LIMITED (NSPCL)**				
CONSULTANT	**MECON, RANCHI**				
PROJECT	**NSPCL-Rourkela PP-II Expansion (1x250 MW)**				

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Rev No.	**Date**	**Altered**	**Checked**	**Approved**	**REVISION DETAILS**

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SECTION 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0.1 This technical specification covers the requirements of design, manufacture, testing at works, packing, dispatch, storage, erection, testing & commissioning of complete Illumination and associated electrical auxiliary system, complete with accessories. No deviation from the requirements specified in various clauses of this specification shall be allowed. A certificate to this effect shall have to be furnished along with the offer as per attached Annexure-1.

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

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

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

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

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

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

Name of Owner :	**:**	M/s NSPCL LTD.
Name of EPC Vendor	**:**	M/s BHEL
Name of Project	**:**	NSPCL-Rourkela PP-II Expansion (1x250 MW)

Refer Section-3 for Project Details and General Specifications.

1.1 ILLUMINATION & SMALL POWER SYSTEM REQUIREMENT FOR VARIOUS AREAS

The illumination system shall be provided for the following areas:

(i) 220kV Switchyard area – Complete area inside fence of 220kV SWITCHYARD as per layout drawing (Drg. No. TB-1-390-001 Rev-02).

(ii) Switchyard Control Building as per ARCHITECTURE LAYOUT OF

1. CONTROL BUILDING LAYOUT (Drawing No : TB-X-386-316-007 Rev-0).
2. GIS BUILDING LAYOUT (Drawing No : TB-X-386-316-006 Rev-02)

1.2 DESIGN CRITERIA FOR SWITCHYARD AREA

As per Section-2.

1.3 SCOPE OF SUPPLIES & SERVICES

1.3.1 SCOPE OF SUPPLY MATERIAL & ERECTION MATERIAL

This specification covers the specific technical requirements of Illumination system Comprising

a) Design, engineering, manufacture, Supply, testing at works, packing and dispatch of equipment & material to site.

b) Erection, testing and commissioning.

The Illumination System shall be provided for the following areas:

- Switchyard Area
- Switchyard Control Room cum Administrative Office Building
- Switchyard GIS Building
- Street lighting
- LT Transformer area

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

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

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

f) 415V ACDB & 220V DCDB boards are being supplied and erected by the owner. Illumination contractor will terminate the cables in these panels.

1.3.2 FREE ISSUE ITEMS FROM PURCHASER

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

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

1) 2core x 2.5 sq.mm (PVC/ Cu.)
2) 2core x 6 sq.mm (PVC/ Al.)
3) 4 core x 6 sq.mm (PVC/ Al.)
4) 4 core x 16 sq.mm (PVC/ Al.)
5) 3.5 core x 35 sq.mm (PVC/ Al.)
6) 3.5 core x 70 sq.mm (PVC/ Al.)
7) 3.5 core x 150 sq.mm (PVC/ Al.)
8) 3.5 core x 300 sq.mm (PVC/ Al.)

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

1.3.3 SCOPE OF SERVICES

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

1.3.3.1 Erection, Commissioning & Testing

The Contractor shall give the offer for Erection, Testing and Commissioning of the Illumination Equipments at Site.
The scope of ETC shall include receipt of material at site, safe storage of material, handling of equipment/ material at site, erection of equipment / material at site including fabrication, equipment and system testing, commissioning of the entire system.
Conducting lux level measurement as per approved designs to the satisfaction of Owner / purchaser.
Laying and termination of power and control cables for the equipment under the scope of this specification.
All material and consumables required for erection work shall be in Contractor's scope. Erection material shall cover, but not be limited to, Clamps etc for Luminaries, Connections between Junction Boxes and Luminaries in outdoor area, All cable glands, lugs and ferrules require for cabling/ wiring. Any other material required for erection shall deemed to be in Contractor's scope. Holes shall not be drilled on the Galvanised substation gantry and LM structures.
Earthing of all electrical equipment.
Contractor shall arrange all machinery tools & tackles, instruments and consumables required for erection, commissioning and testing of the system.
Contractor shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The contractor shall furnish a list

of Commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the Bidder.

1.3.3.2 Civil Works

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

1.4 TYPE TESTS

The type test reports shall not be more than ten years prior from 02/04/2015. If any or all test reports are more than ten years old or are not valid then type tests shall be conducted free of charge.

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

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

1.5 QUALITY PLAN

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

1.6 HANDING & TAKING OVER

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

1.7 UTILITIES AVAILABLE

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

ANNEXURE-1

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

Signature of the authorized representative of Bidder

Name _____

Designation_____

Place_____

Date _____

Company seal

Annexure – 2:

Sno.	Item's Description	Unit	Qty.
	Supply Scope		
A	**Indoor**		
1	**LIGHTING PANELS :**		
a	**Supply :** Normal LP/Emergency LP (Indoor)	Nos.	5
b	**Supply :** DCLP	Nos.	3
2	**RECEPTACLES :**		
a	Supply : 240 V, 6/16 A Receptacle (Decorative)	Nos.	51
b	Supply : 20A, 240V: Indoor-door Receptacle 2 pole, 3-pin type (Industrial)	Nos.	28
c	Supply : 415 V, 63A, 3-PH, Receptacle (Industrial)	Nos.	4
3	**LIGHTING FIXTURES :**		
a	Supply : Surface Mounted LED; 45W	Nos.	27
b	Supply : Recess Mounted LED; 45W	Nos.	74
c	Supply : Industrial corrosion proof Surface Mounted LED; 40W	Nos.	7
d	Supply : LED Type Industrial batten Lighting Fixture 40W	Nos.	45
e	Supply: High bay type Lighting Fixture LED-210W.	Nos.	7
f	Supply : Bulk Head type lighting fixtures (with GLS lamp)	Nos.	20
g	Supply : Down-lighter type lighting fixture (with GLS Lamp)	Nos.	30
h	Supply : Exit Sign Board(Non LED Type)	Nos.	13
4.1	**Supply : SWITCHBOARDS**	Nos	20
5.1	**Supply : Sensors (Photo level and Occupancy)**	Nos	10
7.1	Supply : Fans(Wall fans, ceiling fans, Exhaust fans)	Nos.	42
B	**Outdoor**		
1	**LIGHTING PANELS :**		
a	Supply : NLP (Outdoor)	Nos.	2
b	Supply : Street Lighting Panel	Nos.	1
c	Supply : Sub Lighting Panel	Nos.	5
2	**STREET LIGHTING**		
a	Supply: Steel Tubular Pole - 9mtrs. Height (MS Swaged Type)	Nos.	40
b	Supply: Street light LED type Lighting fixtures (45W).	Nos.	40
c	Supply : Pole JBs	Nos.	40
3	**RECEPTACLES :**		
a	Supply : 415 V, 63A, 3-PH, Receptacle (Industrial)	Nos.	3
4	**LIGHTING FIXTURES :**		
a	Supply : LED type Flood light fixture (250W)	Nos.	26
b	Supply : LED type Flood light fixture (150W)	Nos.	13
c	Supply : Post top lantern type LED Lighting Fixture (30W)	Nos.	3
d	Supply : 4.5 Mtr Pole for post top lantern fixtures (E1 Type)	Nos.	5
5	**LIGHTING MAST**		
a	Supply : 30 mtr high Lighting Mast	Nos.	2
6	**Supply** of Galvanized rigid steel conduit of 20mm size with accessories	Mtr.	200

7	**Supply** of Galvanized rigid steel conduit of 25mm size with accessories	Mtr.	200
8	**Supply** of Galvanized rigid steel conduit of 40mm size with accessories	Mtr.	150
9	**Supply** of 1C, 2.5 sqmm PVC insulated stranded Cu. Wire	Mtr.	200
10	**Supply** of 1C, 4 sqmm PVC insulated stranded Cu. Wire	Mtr.	100
11	**Supply** of 50 mm GI conduits	Mtr.	100
12	**Supply** of 100 mm GI conduits	Mtr.	100
13	**Supply of** 35x6 mm GI Flat for earthing.	Mtr.	100
14	**Supply of** 25x3 mm GI Flat for earthing.	Mtr.	100
15	**Supply** of 16 SWG GI Wire (For earthing of Lighting fixtures, switches conduits etc.)	Mtr.	100
16	**Supply** of 12 SWG GI Wire (For earthing of Power receptacles Junction Boxes etc.)	Mtr.	100
ETC Works			
C	**Indoor**		
1	**LIGHTING PANELS :**		
a	**ETC :** Normal LP/Emergency LP (Indoor)	Nos.	5
b	**ETC :** DCLP	Nos.	3
2	**RECEPTACLES :**		
a	ETC : 240 V, 6/16 A Receptacle (Decorative)	Nos.	51
b	ETC : 20A, 240V: Indoor-door Receptacle 2 pole, 3-pin type (Industrial)	Nos.	28
c	ETC : 415 V, 63A, 3-PH, Receptacle (Industrial)	Nos.	4
3	**LIGHTING FIXTURES :**		
a	ETC : Surface Mounted LED; 45W	Nos.	27
b	ETC : Recess Mounted LED; 45W	Nos.	74
c	ETC : Industrial corrosion proof Surface Mounted LED; 40W	Nos.	7
d	ETC : LED Type Industrial batten Lighting Fixture 40W	Nos.	45
e	ETC : High bay type Lighting Fixture LED-210W.	Nos.	7
f	ETC : Bulk Head type lighting fixtures (with GLS lamp)	Nos.	20
g	ETC : Down-lighter type lighting fixture (with GLS Lamp)	Nos.	30
h	ETC : Exit Sign Board(Non LED Type)	Nos.	13
4.1	**ETC : SWITCHBOARDS**	**Nos**	**20**
5.1	**ETC : Sensors (Photo level and Occupancy)**	**Nos**	**10**
6.1	ETC : Fans(Wall fans, ceiling fans, Exhaust fans)	Nos.	42
D	**Outdoor**		
1	**LIGHTING PANELS :**		
a	ETC : NLP (Outdoor)	Nos.	2
b	ETC : Street Lighting Panel	Nos.	1
c	ETC : Sub Lighting Panel	Nos.	5
2	**STREET LIGHTING**		
a	ETC: Steel Tubular Pole - 9mtrs. Height (MS Swaged Type)	Nos.	40
b	ETC: Street light LED type Lighting fixtures (45W).	Nos.	40

c	ETC : Pole JBs	Nos.	40
3	**RECEPTACLES :**		
a	ETC : 415 V, 63A, 3-PH, Receptacle (Industrial)	Nos.	3
4	**LIGHTING FIXTURES :**		
a	ETC : LED type Flood light fixture (250W)	Nos.	26
b	ETC : LED type Flood light fixture (150W)	Nos.	13
c	ETC : Post top lantern type LED Lighting Fixture (30W)	Nos.	3
d	ETC : 4.5 Mtr Pole for post top lantern fixtures (E1 Type)	Nos.	5
5	**LIGHTING MAST**		
a	ETC : 30mtr high Lighting Mast	Nos.	2
6	**ETC** of Galvanized rigid steel conduit of 20mm size with accessories	Mtr.	200
7	**ETC** of Galvanized rigid steel conduit of 25mm size with accessories	Mtr.	200
8	**ETC** of Galvanized rigid steel conduit of 40mm size with accessories	Mtr.	150
9	**ETC** of 1C, 2.5 sqmm PVC insulated stranded Cu. Wire	Mtr.	200
10	**ETC** of 1C, 4 sqmm PVC insulated stranded Cu. Wire	Mtr.	100
11	**Laying, Testing & Commissioning** of 2C, 2.5 sqmm PVC insulated, Armoured Cu. Cable (provided by BHEL)	Mtr.	100
12	**Laying, Testing & Commissioning** of 2C, 6 sqmm XLPE insulated, Armoured Al. Cable (provided by BHEL)	Mtr.	100
13	**Laying, Testing & Commissioning** of 4C, 6 sqmm XLPE insulated, Armoured Al. Cable (provided by BHEL)	Mtr.	100
14	**Laying, Testing & Commissioning** of 4C, 16 sqmm XLPE insulated, Armoured Al. Cable (provided by BHEL)	Mtr.	100
15	**Laying, Testing & Commissioning** of 3.5C, 35 sqmm XLPE insulated, Armoured Al. Cable (provided by BHEL)	Mtr.	100
16	**Laying, Testing & Commissioning** of 3.5C, 70 sqmm XLPE insulated, Armoured Al. Cable (provided by BHEL)	Mtr.	100
17	**Laying, Testing & Commissioning** of 3.5C, 150 sqmm XLPE insulated, Armoured Al. Cable (provided by BHEL)	Mtr.	100
18	**Laying, Testing & Commissioning** of 3.5C, 300 sqmm XLPE insulated, Armoured Al. Cable (provided by BHEL)	Mtr.	50
19	**Laying** of 50 mm GI conduits at a depth of 300 mm including excavation, backfilling, making & repairing of walls in trenches, cutting, threading, fixing of sockets/bends where required etc to complete. Also between pull pit boxes to JB/LP.	Mtr.	100
20	**Laying** of 100 mm GI conduits at a depth of 300 mm including excavation, backfilling, making & repairing of walls in trenches, cutting, threading, fixing of sockets/bends where required etc to complete. Also between pull pit boxes to JB/LP.	Mtr.	100
21	**Construction** of Pull Pit Boxes of sizes 400mmx400mmx400mm at the free ends and turning of GI pipes if pipe length exceeds 4M	No.	5
22	**Earthing using** 35x6 mm GI Flat	Mtr.	100
23	**Earthing using** 25x3 mm GI Flat	Mtr.	100
24	**Earthing using** 40 mm dia. MS Rod Electrodes (provided by BHEL)	No.	50
25	**Earthing using** 50x6mm GI Flat (provided by BHEL)	Mtr.	50
26	**Earthing using** 75x10mm GI Flat (provided by BHEL)	Mtr.	50
27	**Earthing of Fixtures, Exhaust Fans etc. using** 16 SWG GI Wire	Mtr.	100

28	**Earthing of Fixtures, Exhaust Fans etc. using** 12 SWG GI Wire	Mtr.	100
29	**Services** - Lux measurement at site	Lot	1
30	**Supply & ETC** of EXTRA ITEMS REQUIRED FOR COMPLETION OF JOB AS PER SPECIFICATION BUT NOT COVERED ABOVE, SHALL BE QUOTED SEPARATELY. DETAILS TO BE PROVIDED BY BIDDER AT TENDER STAGE. (Price to be quoted on Lumpsum basis)	Lot	1

Notes:

1. BOQ furnished above is as per the preliminary estimate. Bidder shall submit detailed calculation for achieving the required lux levels & submit final BOQ for approval at contract stage.

2. The Bidder should quote the prices on unit rate basis for the Outdoor Switchyard package. In case of change in the requirements during detailed design after placement of order, additions/deletions to the scope shall be settled as per unit rates furnished in the Contract.

3. After placement of order, the bidder has to design the system as per relevant standards/codes to the satisfaction of BHEL / NSPCL.

4. The individual quantity can vary upto any extent, however, the overall value of the contract may vary upto +/- 30 % at contract execution stage.

5. Aluminum Flat, GI Bolt with nut and washer for fixing indoor & outdoor lighting panels, GI Bolt with nut and washer for fixing control gear boxes, GI Bolt with nut and washer for fixing outdoor JBs, GI Bolt with nut and washer for fixing outdoor lighting fixtures, GI Earth wire form JB to lighting fixtures, Mounting brackets for lighting fixtures and all other accessories required for successful completion of project etc is deemed to be in the supply scope of the Contractor.

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SECTION- 2

TECHNICAL SPECIFICATION FOR ILLUMINATION SYSTEM

01.00.00 GENERAL

01.01.00 This specification covers the general description of design, manufacture and construction features, testing, supply, installation and commissioning of the Station Lighting system equipment.

Illumination of Transformer yard, switchyard building/area adjoining roads, [redacted] Service building etc. are also included in the scope of the bidder.

The Illumination System shall be provided for the following areas:

- ❑ Switchyard Area
- ❑ Switchyard Control Room cum Administrative Office Building
- ❑ Switchyard GIS Building
- ❑ Street lighting
- ❑ LT Transformer area

02.00.00 CODES AND STANDARDS

02.01.00 All work shall be carried out as per the codes & standards chapter of this volume .

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03.00.00 LIGHTING SYSTEM DESCRIPTION

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

(a) Normal AC Lighting System
(b) Emergency AC Lighting System
(c) DC Lighting System

03.01.00 **Normal AC Lighting System**

Normal AC lighting system 415V, 3Phase, 4wire, shall be fed from lighting panels (LPs) which in turn shall be fed from the lighting distribution boards (LDBs)/Switch board MCC.

03.02.00 **Emergency AC Lighting System**

This system shall be provided for certain important areas in the main plant. The lighting fixtures connected to this system shall be normally "ON" along with the normal AC system. These shall be fed from emergency lighting panels (ELPs) which in turn shall be fed 3-phase, 4-wire supply from the emergency lighting distribution boards (ELDB'S). These lights shall go off for a few seconds in case of AC supply failure at Emergency Switchgear, but shall be automatically restored when Emergency Switchgear is energised by Diesel generator set. Four (4) nos. 240V AC lighting fixtures fed from UPS (provided by bidder) shall be provided on each stacker reclaimer machine.

03.03.00 **DC Lighting System**

03.03.01 At strategic locations in the main plant, a few lighting fixtures fed from 220V, DC supply, shall be provided to enable safe movement of operating personnel and access to important control points during an emergency, when both the normal AC and Emergency Lighting system fail. These lighting fixtures shall be fed from 220V DC LDBs which in turn shall be fed from DC lighting panels

03.03.02 The supply to the DC lighting panels shall be automatically switched ON in case of loss`of AC supply at station service switchgear as well as Emergency switch-gear. The DC supply shall be automatically switched OFF after about 3 minutes following the restoration of supply to normal AC or emergency AC lighting system.

03.03.03 In auxiliary /off site buildings except Coal Handling plant, emergency DC lighting is to be provided through self contained DC emergency fixture at strategic locations. The fixtures shall be switched 'ON' automatically in case of failure of AC supply.

04.00.00 DESIGN PHILOSOPHY

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

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

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

4. The system shall include distribution boards, normal/ emergency lighting panels, lighting fixtures, junction boxes, receptacles, switch boards, lighting pole/masts, conduits, cables and wires, etc. The system shall cover all interior and exterior lighting such as area lighting, including Transformer yard & Switch yard area, aviation obstruction lighting, Street lighting, security lighting, etc. The constructional features of lighting distribution boards shall be similar to AC/DC distribution boards described in chapter of LT Switchgear. Outgoing circuits in LPs shall be provided with MCBs of adequate ratings.

5. The illumination system shall be designed on the basis of best engineering practice and shall ensure uniform, reliable, aesthetically pleasing and glare free illumination. The lighting fixtures shall be designed for minimum glare. The design shall prevent glare/luminous patch seen on VDU/ Large video screens, when viewed from an angle. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection. The diffusers/ louvers used in fluorescent fixtures shall be made of impact resistant polystyrene sheet and shall have no yellowing property over a prolonged period. The Lux levels to be adopted for various area are indicated at Annexure - A. (placed at the end of this Chapter).
Further Lighting System shall be designed considering maximum utilization of natural light. To achieve this lighting circuit may be designed with segregation and usage of lux control philosophy. Energy efficiency codes shall be followed in principle.

6. Different Lighting Systems envisaged for various plant areas are indicated in Annexure-B: While finalizing the detailed layout of lighting fixtures, the position/location and layout of equipments should be taken into account to have adequate illumination at desired locations.

7. **LED Luminaires:**

   LED Luminaires shall be used for the lighting of all the Control Room & Control Equipment areas and all HT & LT Switchgear rooms in bidder's scope. In false ceiling area LED luminaires shall be recessed mounting type & in non-false ceiling area the LED luminaires shall be surface mounting type.

The individual lamp wattage for LED shall be min 3 watt. The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall be not less than 70 Lm/W. Suitable heat sink shall be designed & shall be provided in the luminaire. The LED used in the luminaires shall have colour rendering index (CRI) of Min 65. Colour designation of LED shall be "cool day light" (min 5700K) type. The LED luminaire shall have minimum life of 25,000 burning hours with 80% of lumen maintenance at the end of the life. The beam angle for LED chip shall be 120 degrees. The max. junction temperature of LED shall be 85 deg C, further the lumen maintenance at this temperature shall be min 90%. The THD of LED Luminaires shall be less than 10%. Further the EMC shall be as per relevant standards. The power factor of the luminaire shall not be less than 0.9. The marking on luminaire & safety requirements of luminaire shall be as per IS standards. Suitable heat sink with proper thermal management shall be designed & provided in the luminaire. The connecting wires used inside the system, shall be low smoke halogen free, fire retardant PTFE cable and fuse protection shall be provided in input side specifically for LED luminaires. Care shall be taken in the design that there is no water stagnation anywhere. The entire housing shall be dust and water proof protection as per IS 12063. Driver Circuit: LED modules and drivers shall be compatible to each other. The LED module driver's ratings and makes shall be as recommended by corresponding LED manufacturer.

LED Drivers may have following control & protections :-

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

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

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

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

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

11. Wires of different phase shall normally run in separate conduit.

12. Power supply shall be fed from 415 / 240 V normal AC supply, emergency AC supply and 220V DC supply through suitable number of conveniently located lighting distribution boards (LDB) and lighting panels (LP). AC lighting supply shall be isolated from main supply by isolation transformers of max. rating of 100KVA and fault level restricted to 3 KA at Lighting Panels.

13. Atleast one 6/16A, 240V AC universal socket outlet with switch shall be provided in offices, cabins, etc. Further 20A, 240V AC industrial receptacle with switch shall be provided strategically in all industrial areas (For conveyor gallery and track hopper shed at 30m interval on both sides and for yard conveyor at 50m interval on one side). Suitable number of 63A, 3ph, 415V AC industrial receptacles shall be provided for entire plant for welding purposes, particularly near all major equipment and at an average distance of 50m. Atleast one 63A, 3ph, 415V AC receptacle shall be provided in each floor of off-site buildings/ structures, at 50m interval (starting from one end) on both sides of the conveyor galleries and at 50m interval on one side of the yard conveyor. In coal handling plant, One no 10A, 24V AC receptacle with IP55 DOP shall be provided in each switchgear/[redacted]

The welding receptacle will be wall mounted type. It will be interlocked such that
a) Switch can be put ON only when the plug is fully engaged
b) Plug can be taken out only when the switch is in OFF position.
c) Cover can be opened only when the switch is in OFF position.

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

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

16. Aviation warning lights shall be provided as per the recommendations of ICAO and Director general of civil aviation, India. The arrangement

of light should be marked such that the object is indicated from every angle in azimuth. The aviation warning lighting system shall also conform to the latest Indian standard IS 4998.

04.01.00 **Ballasts**

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

04.02.00 All luminaires and their accessories and components shall be of type readily replaceable by available Indian makes.

04.03.00 **Fans & Regulator**

04.03.01 Ceiling Fans, to be provided in non air-conditioned office/control room area, shall be suitable for operation on 240 V +/-10%, 50 Hz, AC supply comprising of class 'E' or better insulated copper wound single phase motor, 1200mm sweep, aerodynamically designed well balanced AL blades (3 Nos.), down rod, die cast aluminium housing, capacitor, suspension hook, canopies etc. finished in stove enameled white or with electro static powder coating. Power factor of fans shall not be less than 0.9. Fan regulators shall be stepped electronic type suitable for operation on 240V +/-10% AC supply.

04.04.00 Junction Boxes, Conduits, Fitting & Accessories , Pull Out Boxes

Junction box for indoor lighting shall be made of fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. Junction boxes for street lighting poles and lighting mast if applicable , shall be deep drawn or fabricated type made of min. 1.6 mm thick CRCA Sheet. The box shall be hot dip galvanized. The degree of protection shall be IP55. All switches and receptacles upto 16A shall be modular type. These shall be provided with pre-galvanized/galvanized modular switchbox & plate. Conduits, Pipes and Accessories Galvanised heavy duty steel conduits for normal area and galvanised heavy duty steel conduits with an additional epoxy coating for corrosive area shall be offered. Alternatively glass reinforced epoxy conduits with comparable compressive and impact strength with that of heavy duty steel conduits may be offered. Rigid steel conduits shall be heavy duty type,hot dip galvanised conforming to IS : 9537 Part-I & II shall be suitable for heavy mechanical stresses, threaded on both sides and threaded length shall be protected by zinc rich paint. Conduits shall be smooth from inside and outside. Flexible conduit shall be water proof and rust proof made of heat resistant lead coated steel. Pull out boxes shall be provided at suitable interval in a conduit run .Boxes shall be suitable for mounting on Walls, Columns, Structures, etc.. Pull-out boxes shall have cover with screw and shall be provided with good quality gasket lining. Pull out boxes used outdoor shall be weather proof type suitable for IP :55 degree of protection and those used indoor shall be

suitable for IP :52 degree of protection. Pull out box & its cover shall be hot dip galvanised.

04.05.00 **Lighting Wires**

04.05.01 Lighting wires shall be 1100 V grade, light duty PVC insulated unsheathed, stranded copper/aluminium wire for fixed wiring installation. colour of the PVC insulation of wires shall be Red, Yellow, Blue and Black for R,Y,B phases & neutral, respectively and white & grey for DC positive & DC negative circuits, respectively. Minimum size of wire shall not be less than 1.5.sq.mm. for copper and 4 sq.mm. for aluminium.

04.06.00 **Lighting Poles**

04.06.01 The Street Light system and peripheral lighting shall be designed generally in line with design guidelines. The Poles shall be mounted above ground using base plate and minimum height of pole shall be 8 mtrs The poles shall be hot-dip galvanized as per relevant IS2629/ IS2633/ IS4759. The average coating thickness of galvanizing shall be min. 70 micron. The System shall be capable of withstanding the appropriate wind load etc as per IS 875 considering prevailing soil/ site condition considering all accessories mounting on pole. The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB.

04.07.0 **Lighting Masts**

04.07.01 Lighting Mast shall be of continuously tapered polygonal cross section hot dip galvanised. The Mast shall be of 30 M or suitable height with lantern carriage to enable raising/lowering for ease of maintenance, including the Head Frame, Double Drum Winch, continuous stainless steel wire rope, in built power tool, luminaires, suitable aviation warning light, lightning alongwith necessary power cables within the mast. The mast shall be delivered in not more than three sections & shall be joined together by slip stressed fit method at site. No site welding or bolted joints shall be done on the mast The Mast together with the fixtures shall be capable of withstanding the appropriate wind loads as per IS:875. The Mast shall be fabricated from special steel plates conforming to BS-EN10-025 and folded to form a polygonal section. Suitable feeder pillar with TPN MCB, contactors, timer, MCB and other necessary accessories for operation & protection of the mast and fixtures shall be provided.

04.08.00 Lighting fixtures shall generally be group controlled directly from lighting panel. However, in office areas, control shall be provided through switch boxes. Each switch shall control a maximum of three fluorescent fixtures.

04.09.00 A.C. normal, AC emergency and DC system wiring shall run throughout in separate conduits. Wires of different phase shall run in different conduits

04.10.00 Lighting panels, etc. shall be earthed by two separate and distinct connections with earthing system. Switch boxes, junction boxes, lighting fixtures, fans, single phase receptacles etc. shall be earthed by means of separate earth continuity conductor. The earth continuity conductor 14 SWG GI wire shall be run alongwith each conduit run. Cable armours shall be connected to earthing system at both the ends.

04.11.00 Alternately Vendor may offer technically superior and proven product subject to approval of owner.

05.00.00 TESTS

05.01.00 All equipment to be supplied shall be of type tested design. During detail engineering, the bidder shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

05.02.00 However if the bidder is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the bidder shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.

05.03.00 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

05.04.00 Selection of samples for type test, acceptance test & routine test and acceptance criteria for all the items shall be as per relevant I.S

05.05.00 Type test reports of the following items as per relevant standards shall be submitted for approval.

i. Lighting fixtures of each type
ii. Lamps of each type and rating.(life cycle and rating test only)
iii. Lighting panel of each type (Degree of Protection)
iv. Junction Box of each type

05.06.00 Acceptance Test and Routine Test

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

05.06.02 Junction boxes, switch boxes, receptacle enclosure etc. shall be subjected to physical and dimensional checks.

05.07.00 **Galvanizing Tests**

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

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

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

06.00.00 COMMISSIONING CHECKS

1. On completion of installation work, the Bidder shall request the Project manager for inspection and test with minimum of fourteen (14) days advance notice.
2. The Project manager shall arrange for joint inspection of the installation for completeness and correctness of the work. Any defect pointed out during such inspection shall be promptly rectified by the Bidder.
3. The installation shall be then tested and commissioned in presence of the Project manager.
4. The bidder shall provide all, men material and equipment required to carry out the tests.
5. All rectifications, repair or adjustment work found necessary during inspection, testing and commissioning shall be carried out by the Bidder without any extra cost. The handing over the lighting installation shall be effected only after the receipt of written instruction from the Owner/his authorized representative.
6. The testing shall be done in accordance with the applicable Indian Standards and codes of practices. The following tests shall be specifically carried out for all lighting installation.
   (a) Insulation Resistance.
   (b) Testing of earth continuity path.
   (c) Polarity test of single phase switches.
   (d) Functional checks.
7. The lighting circuits shall be tested in the following manner :
   (a) All switches ON and consuming devices in circuit, both poles connected together to obtain resistance to earth.
   (b) Insulation resistance between poles with lamps and other consuming devices removed and switches ON.

ANNEXURE-A

Sl. No	Location	Average Illumination Level(Lux)	Type of Fixture
1	Turbine Hall operating floor	200	HPSV high/medium bay
2	Turbine Hall Other Platforms	200	HPSV high/medium bay, HPSV well glass fixtures
3	Switchgear rooms, Charger, Rectifier room	200	LED luminaire equivalent to Industrial trough type fluorescent fixture
4	Control room, computer room, control equipment room	350	LED luminaire equivalent to Mirror optics with anti-glare features type fluorescent or CFL downlighter
5	Offices, conference rooms, etc.	300	Decorative mirror optics Type fluorescent or CFL downlighter
6	Battery rooms	100	Totally enclosed corrosion Proof fluorescent
7	Transformer yard	20 (general) 50 (on equipment)	(general) HPSV flood light
	Boiler platforms	100	HPSV well glass fixtures,
8	Diesel generating room, Compressor room, pump house etc.	150	HPSV medium bay/ Industrial trough type house etc. fluorescent
9	Fuel oil pump house	150	Flame proof fluorescent fixtures suitable for division-2 hazardous area
10	Cable galleries/vault	50	Industrial trough type fluorescent
11	Street lighting- HPSV street lights primary roads, secondary roads	20	HPSV Street Lights
12	Outdoor storage handling and unloading area	20	HPSV flood light,
13	DM plant, water treatment plant	150	Industrial trough type/ corrosion proof fluorescent, HPSV high/medium bay/ Floodlight
14	Cement stores	150	Industrial trough type fluorescent dust proof
15	Chemical stores/House	150	Corrosion proof fluorescent
16	Permanent stores	150	HPSV high/medium bay /

			industrial trough type fluorescent
17	Workshop. Building	150	Industrial trough type Fluorescent, Industrial high bay
18	Laboratory General Analysis area	 150 300	Mirror optics Fluorescent Corrosion resistant, Fluorescent
19	Garage/Car Parking	50	Industrial trough type Fluorescent
20	AIS Switchyard and Substation	20 (general) 50 (on strategic equipment)	HPSV flood light
21	CW pump house, Chlorination plant building, Raw water and fire water pump house	150	Industrial trough type fluorescent/ Well glass HPSV fitting or HPSV high/ medium bay fitting/ HPSV flood light
22	Transfer points, crusher house, Sheds, tunnels, bunker house etc.	100	HPSV Dust tight/Well glass type
23	Cooling Tower	10 (general) 50 (on equipment)	Well Glass Fixtures
24	Facility building, canteen etc	150	Industrial trough type Fluorescent
25	ESP platform	150	HPSV well glass fixtures
26	DC Lighting- Control room	-	In candescent down light fixtures, Decorative recessed type with cylindrical reflector
27	DC Lighting- Other Area	-	Incandescent Industrial Bulkhead
28	Corridors, Walkways	50	Fluorescent type
29	Building Periphery Lighting	-	Street Light fixture, HPSV Floodlight fixtures
30	Security Lighting along Boundary	10	Street Light fixture HPSV Floodlight fixtures
31	Gate complex/Time Office	150	HPSV Flood Light/ Fluorescent fixtures
32	GIS Hall	150	HPSV medium bay/ Industrial trough type house etc. fluorescent

ANNEXURE-B

Sl. No.	Plant Areas	Normal AC	Emergency AC Lighting	220 V DC Lighting	Portable DC Fixtures

		Lighting System	System	System	
1.	TG Building(turbine hall, switchgear room etc)	80%	20%	√	
2.	Boiler Platform	80%	20%	√	
3.	DG Area/ Room	80%	20%		
4.	Compressor Room				√
5.	ESP Control Room	80%	20%		√
6.	Unit Control Room	70%	30%	√	
7.	Switchyard Control Room	80%	20%	√	
8.	Battery Room	80%	20%		
9.	Cable Spreader Room/ Vault	80%	20%	√	
10.	Make Up Water Pump House	100%			√
11.	Chemical House	100%			√
12.	Fuel Oil Pump House	100%			√
13.	Ash Handling Plant	100%			√
14.	Water Treatment Plant	100%			√
15.	CT Switchgear Room	100%			√
16.	Cooling Towers	100%			
17.	Workshop	100%			√
18.	Service Building	100%			
19.	Area Lighting	100%			
20.	Street Lighting	100%			
21.	Transformer Yard and Storage Yard	100%			
22.	Coal Handling Plant	100%		√	
23.	AIS Switchyard	80%	20%		

DC Emergency Lighting:

Sl. No.	Area	Average Lux Level
1.	Unit Control Room	100
2.	Control Equipment Room	100
3.	Switchyard Control Room	20
4.	Strategic Control Points (In TG Building & Boiler Area, Switchgear room, SWAS, Battery Room, UPS Area, TG Hall, Lube oil Room etc	20
5.	Cable Vault & Galleries	1 fixture at every 20 metres spacing along walkways
6.	Boiler Stair Case	1 fixture at every 20 metres spacing along walkways
7.	Exit/ Entry of Main Plant Building	1 fixture
8.	Fire Exit Sign	1 fixture
9.	Coal Handling Plant	Control room - 50 Swgr room - 50 Strategic control points - 20 Others areas(cl3.03.04)- 20

SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections of tender documents and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall prevail.

3.1 PROJECT DETAILS

Name of the Project: 220kV GIS - ROURKELA POWER PROJECT (PP – III: 1X250 MW)

Name of the Customer: NTPC SAIL POWER COMPANY (P) LIMITED

Location & Land Availability:

The proposed unit of 1x250 MW will be installed on the western side of existing 2x60 MW units within the boundary of Rourkela Steel Plant in Sundergarh district of Orissa.
Approximately 80 acres of land is available for construction main plant and accessories. For ash dyke about 70 acres of land is available at a distance of approx 6 KM from plant towards southwest. Presently most of land is filled with blast furnace slag. The main power house building of proposed unit of 1x250 MW will be located on western side of existing 2x60 MW switchyard. The indicative latitude & longitude of the proposed site is as follows:

□	Latitude	:	22°13’19”	N
□	Longitude	:	84°53’51”	E

Availability of Infrastructure Facilities Road
The site is connected by road of NH-23 through a link road from a road junction at Panposh located approx. 10 KM from proposed site.

Railway siding
The nearest railway station Rourkela is situated about one km from the proposed plant site. A new railway siding will be developed for receiving coal from the source.

Airport/Air strip
The nearest airport is at Ranchi which is about 170 KM by rail and 225 KM by road from the proposed site.

Seaport
The nearest seaport is at Paradip (Orissa) which is around 400 Kms from the proposed site.

3.1.1 SITE CONDITIONS

1.	Average elevation above mean sea level	194m
2.	Barometric pressure	983 mb
3.	Ambient temperature	
	a. Absolute maximum	48 ^{0}C
	b. Absolute minimum	6 ^{0}C
4.	Relative humidity (Maximum)	65 %
5.	Annual Average Rainfall	2656.6 mm
6.	Heaviest in 24 Hrs.	257.8 mm
7.	Seismic Zone	Zone-II (As per latest Revision of IS 1893 /2002) Part-I
8.	Pollution Level	Very Heavily Polluted

3.1.2 SYSTEM PARAMETERS

3.1.2.1	Continuous current carrying capacity (rms) at 50° C ambient temperature.	2500A (min)
3.1.2.2	Short time current carrying Capacity	40kA for 3 sec (220 kV)
3.1.2.3	Maximum temperature rise over ambient of 50° C	28 ^{o} C
3.1.2.4	Voltage	220/245kV (Nom/Max)
3.1.2.5	Frequency	50Hz
3.1.2.6	System neutral earthing	Effectively earthed
3.1.2.7	Insulation Level	

3.1.2.8	One minute Dry Power frequency Withstand Voltage (kV rms)	460
3.1.2.9	One minute Wet power frequency Withstand Voltage	460
3.1.2.10	Impulse withstand (kV)	1050
3.1.2.11	Creepage distance	31 (mm/kV)

3.1.3 AUXILIARY POWER SUPPLY

Supply	Description	Consumer
H.T. Supply	6600 V, 3ph, 3W, 50 Hz non-effectively earthed, Fault level 40 KA symm.	Transformers(6.6KV/415V)
L.T. Supply	415V, 3 phase , 4W, 50 Hz, effectively earthed, Fault level 50 KA symm	Motors and loads up to 160 KW for CHP and 200KW for remaining areas and lighting transformers (1:1)
	240V, 1ph, 2W, 50 Hz, effectively earthed	Motors up to 200W, Lighting, space heaters, A.C. control & protective devices.
	240V AC,1 ph,50 Hz. UPS system	DCS/PLC, control & instrumentation
	110V,1ph, 50 Hz	Control, protection & metering
	24V AC	Maintenance Lighting
D.C. Supply	220V, 2W, unearthed, Fault level 25 KA*	D.C. alarm, control & protective devices, DC motors, Emergency lighting.
	24V DC	Control & Instrumentation

RANGE OF VARIATION

A.C. Supply

Voltage: ± 10% Frequency: ± 5% Combined Volt: 10%+ frequency (absolute sum)

During starting of largest motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment, while running, shall successfully ride over such period without affecting system performance.

D.C. Supply Voltage:
198 to 240 Volt

System Earthing
220KV, 33KV & 415V systems are effectively earthed. High resistance type non-effective earthing shall be used for 6.6 kV systems to limit earth fault current. Resistors shall be connected to the Star point of the concerned transformers.

Fault Levels

1	220 KV System	40KA for 3 secs.
2	6.6 KV System	40KA for 3 secs.
3	415 V system	50KA for 1 secs.
4	220V DC	20KA for 1 secs.

3.1.4 The various minimum heights of the switchyard shall be as given below from plinth level:

Voltage	Equipment /1st Level
220kV	6000mm

The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or support insulators to the bottom of the equipment structure, where it rests on the foundation pad shall be 2550mm.

3.2 SPECIAL INSTRUCTIONS TO BIDDERS

General

The Bidder shall base the equipment design on the information given in this specification. The equipment shall be complete in all respects. Any item which is not specifically mentioned herein but found essential for safe and efficient operation and maintenance and satisfactory performance of the system shall be deemed to have been included in the scope of the Bidder. It shall be presumed that the Bidder has studied the site, all the drawings, tender documents and is fully aware of the scope of work involved and the site conditions prevailing.

The Bidder shall include one set of new and unused Tools & Tackles as specified in relevant sections of the specification.

The Bidder shall include in his scope, the requirement of chemicals, resins, lubricants, lube oils, and all other consumables required for testing, commissioning upto the completion of trial operation of unit.

A stainless steel name plate with letters engraved in English language shall be provided for the equipment. The name plate shall indicate make, identification, number, capacity, rating and weight of the equipment. The name plate shall be fitted at a prominent place on the body of each equipment with the help of S.S. screws.

All the instruments shall be calibrated only in metric units. English shall be the language of all communications.

Any additional work / equipment and materials which may not have been specially mentioned in this specification but are required to make the equipment complete in every respect in accordance with technical specification and are necessary for safe & efficient operation & maintenance and guaranteed performance of the equipment shall be deemed to have been included under the scope of this specification and shall be provided by the bidder within the quoted price.

The Bidder shall furnish all the drawings, documents, load data and other information / data like fault diagnosis, operation, maintenance, erection manuals etc, general details and layout drawings, design calculations and equipment specification of equipment, together with “as built drawings” for the equipment.

3.3 Codes and Standards

a. All equipment, systems and works covered under this specification shall comply, in all respect, with requirements of applicable latest statutes and that of latest editions of codes and standards. Latest regulations and safety & environmental requirements as applicable in India / state of installation shall also be complied with.

b. All codes and standards mentioned shall mean as relevant and applicable to a particular equipment / system.

c. All other codes/standards not covered in Section 1 / Section 2 but required for the plant and system offered shall also be referred / followed by the Bidder. The Bidder, along with the bid, shall submit a comprehensive list of codes and standards to be followed for various equipment / system.

d. In all cases where IBR does not govern, German, American, British, ISO or other international standards established to be equivalent or superior to the codes specified are also acceptable. In the event of any conflict between the requirements of equivalent codes and standards and the requirements of Indian standards / regulations, the latter will govern unless specified otherwise in the specifications.

e. The Bidder shall be responsible to be in possession of all the specified Codes / Standards and ensure reference to the same before submitting the offer/ bid.

f. Mandatory codes / local regulations to be followed for safety, design, fabrication and operation of the switchyard shall be, followed:

g. If the equipment supplied does not conform to the codes and standards mentioned in this specification, but is manufactured to the Bidder's own standard, developed as a result of his experience, is also acceptable provided the same is found to be superior to the above mentioned codes and standards. The Bidder shall identify such equipment and shall also present sufficient data to the Owner / Consultant to support his design and to establish the superiority. The design may be accepted by Owner/ his Consultants only if the Purchase / his consultant is satisfied that sufficient experience exists with the design proposed.

h. Design not meeting the stipulations of the codes and standards will not be acceptable.

i. Apart from various codes and standards mentioned in Section 1/2, the Manufacturer shall comply with other requirements of codes and standards mentioned in this Specification for detailed design, manufacture, testing, erection, construction etc.

Control System	IEEE – 122 , 1992
Metering / Dosing pumps	API 675 – 1987 (Positive displacement pumps – controlled volume) API 676 – 1987 (Positive displacement pumps – Rotary).
Centrifugal pumps	API 610 – 1990, ASME PTC 8.2 – 1965
Gear Box	API 613 – 1993 & AGMA 420 & 421
Coupling	API 671 – 1993
Structural	IS 1893 – 1991, IS 875-1992 & IS 800 – 1991
Pressure Vessel	ASME Sec. VIII, Div. 1 – 1995
Piping	ANSI B 31.1-1995 / 31.3 – 1993, IBR
Valve	API
Instrument	ISA, API
Electrical	As per specification attached & relevant
	IS/IEC
Tanks	API 650- 1993
Electrodes	AWS, IS
Painting	IS Standards
Performances Tests	
Overload test of crane and hoists	IS 3177

3.4 Deviations and Assumptions

Bidders requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. The Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions. In the event of conflict between the Technical Specifications and the condition of contract, the requirements as indicated in the technical specification shall govern, unless confirmed otherwise by the Owner in writing before the award of contract, based on written request from the bidder for such a clarification.

In the event of conflict between requirements of any two clauses of the specification documents, the more stringent requirements shall apply, unless otherwise confirmed by the Owner in writing before the award of this contract, based on a written request from the Bidder for such clarification.

The Bidders are advised that while making their Bid Proposals and quoting prices, all terms and conditions of bidding documents may appropriately be taken into consideration. Bidders are required to furnish a certificate indicating their full compliance to the terms and conditions of the bidding documents.

3.5 Limit of Contract

Equipment furnished shall be complete in all 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 respective specifications, unless included in the list of exclusions. All similar standard components/ parts of similar standard equipment provided shall be interchangeable with one another.

During execution of the contract, successful Bidder (Bidder) shall furnish the engineering data / drawings / calculations, etc. in accordance with the schedule of information agreed between Owner and the Bidder. Review of these data by the Owner’s Engineer / Consultant will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under specifications, external connections and of the dimensions which might affect plant layout.

This review by the Owner’s Engineer / Consultant may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicative of the accuracy of the information submitted. This review and/ or approval by the Engineer shall not be construed by the Bidder, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements specified under these specifications and documents.

3.6 Latent Defects

Notwithstanding the issue of the Take Over Certificate, the Contractor shall be responsible for making good with all possible speed any Latent Defect in any Works /equipment of the plant which appears at any time before the expiry of defect liability period. And shall remedy such defect at its own cost and expense. The latent defect liability period shall be a minimum of 5 years from the end of defect liability period. The defects to which this applies are defects in design, materials or workmanship or defects arising from any act or omission of the Contractor done or omitted prior to Take-over of the portion of the Plant affected by the defects or during the Warranty Period which a reasonable examination at the end of the Warranty Period would not have disclosed.

3.7 Completion Schedule

The Bidder shall submit Time Bar chart indicating completion date of major activities such as submission of design data / calculations and drawings for approval, manufacturing of components / units, supply, inspection etc. without which the Tender shall not be considered. Time Bar Chart furnished shall afterwards form part of the contract and cannot be altered arbitrarily except Force Majeure conditions as may be agreed with the Owner.

3.8 Drawings & Documents for Owner's use and Archives

The Bidder shall submit all final drawings, documents, manuals for Owner's use and for reference / record required during course of operation and maintenance of the plant. Numbers of copies and their form (hard copy, electronic form, reproducible) to be submitted and the details of the documents, drawings, manual etc. to be furnished by the Bidder are described elsewhere in the specification.

Drawings, documents, calculation, data & Information to be submitted by the Bidder along with the offer:

Technical Data to be submitted with the Tender

1) List of performance tests proposed by the Bidder to demonstrate the guaranteed parameters for generator and other electrical equipment.
2) Specific energy consumption.
3) Type test certificates for major categories of equipment, issued by independent testing authority.
4) Guaranteed Technical Parameters.
5) Technical catalogues.
6) Manufacturing Quality Plan

3.9 DRAWINGS & DOCUMENTS TO BE SUBMITTED BY THE SUCCESSFUL BIDDER AFTER AWARD OF CONTRACT

One set of soft copies of all the approved drawings, documents including as built drawings shall be furnished by the Bidder to the Owner / Consultant in compact discs.

White prints or other non-reproducible drawings can be mailed folded. Blue prints shall generally not be used.

All drawings, prepared by the Bidder shall be as per IS: 696. Supplier's standard drawings are exempted from the above size limitation, unless his "standard" includes drawings of very large size or length. There shall be sufficient reference notes on the drawings to permit identification of all the drawings which are required for a proper understanding.

Bills of material and drawings shall be cross-referenced for easy identification.

All drawings shall be dimensioned in the metric system. Where drawings are usually made in the British (or other) system, they shall also have metric system dimensions in parentheses or below dimension line. Titles and written notations shall be in English. If the original is in another language it shall carry English translation. The translations will appear immediately on the drawings. Attached lists of translated words shall not be accepted.

Drawings and bills of material shall be identified by a numbering system to be mutually agreed later on. Any additional identification numbers or symbols that the Bidder selects to use for his own purposes are permissible so long as Owner's number is the prime means of identification.

The scale of the drawing shall be shown clearly in the title block of the drawing. Wherever possible, scales of drawings shall be:-

1 : 1	1 : 2.5	1 : 5	1 : 10	1 : 20	1 : 25
1 : 50	1 : 100	1 : 200	1 : 300	1 : 500	
1 : 1000	1 : 2000	1 : 5000			

All reproducible must be made from original drawings.

All revised drawing shall clearly indicate the number, date and subject to each revision. All the revisions carried out in the drawings shall be clearly identified and marked.

Drawing list shall be kept up-to-date, incorporating all new additions, cancellations and changes, and will be reissued periodically with Progress Report.

General arrangement drawings shall be submitted for approval to the Owner/ Consultant prior to the commencement of detail engineering by the Bidder. These drawings shall show to scale all major equipment including electrical equipment and building outlines and overall dimensions as well as tie-in dimensions and clearances shall be clearly indicated. Approved arrangement drawings shall be used as basis for design and preparation of detail drawing to be prepared by the Bidder. The Bidder shall furnish all the necessary drawings, data etc., of the plant/equipment with appropriate "Status" stamp in adequate no. of copies as indicated below:

S. No.	**DESCRIPTION**	**TENDER STAGE**	**CONTRACT STAGE FOR APPROVAL**	**FINAL DOCUMENTATION**	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	6	6	-
2	Drawings “As Built “	-	-	6	-
3	Type Test Reports	1	6	6	02
4	Erection Manuals	-	6	6	-
5	Operation and Maintenance Manuals	-	6	6	-
6	Manufacturing Quality Plan	1	6	6	-
7	Field Quality Plan	1	6	6	-
8	Inspection Test Reports	-	-	6	-

All instruction manuals / O&M Manual/”as built drawing” : 6 copies each

Operation & Maintenance Manuals

Instruction manuals, presenting the basic categories of information for the operating and/or maintenance personnel, as detailed herein below shall be furnished by Bidder.

The instruction manuals shall present the following basic categories of information in particular complete and comprehensive manner and prepared for the use by operating and/or maintenance personnel.

i. Instructions for initial commissioning, short duration and long duration shut down.
ii. Instruction for operation, routine inspection and maintenance including preventive maintenance.
iii. Recommendation for inspection points, method of inspection and period of inspection.
iv. Information on detection, cause and rectification of troubles and faults.

v. Instructions on normal repairs and overhaul.
vi. Complete parts list with proper and complete identification (Tag nos./Serial nos. as shown in the respective approved drawings) and ordering information for all replaceable parts. The identification details of equivalent and alternative makes for these spare parts which are not manufacturer's own product shall also be listed.
vii. List of all special tools and tackle & spares and instructions for use of such tools and tackle & spares.
viii. One complete set of as built drawings of the entire systems.
ix. The information shall be organized in a logical and orderly sequence. A general description of equipment including significant technical characteristics shall be included to familiarize operating and maintenance personnel with the equipment. Such description and technical characteristics shall not differ from the approved data.
x. Necessary drawings, curves and other illustrations shall be included or copies of appropriate approved drawings shall be bound in the manuals. Tests, adjustment and calibration information, as appropriate, shall be included. Safety and other warning notices and installation, maintenance and operating cautions shall be emphasized.
xi. Write-up, figures, part list etc., shall be clearly legible. The manuals shall be prepared on good quality paper securely bound in durable folders.
xii. The instruction manuals shall be subject to Consultant's approval in the same fashion as that for drawings.
xiii. Instruction manual shall give step by step procedure for Erection, testing and commissioning

xiv. Operation, Maintenance and Repair Instruction manual shall also contain:

xv. List of spare parts with ordering specifications and manufacturer's catalogues

xvi. List of consumables, lubricants, chemicals with specifications, brand names and annual consumption figures.
xvii. Drawings relevant for erection, operation, maintenance and repair of the equipment.
xviii. Procedure for ordering spares.
xix. Maintenance Manual shall also include:
xx. Diagnostic trouble shooting / fault location charts
xxi. Tests for checking of proper functioning.

Drawings / documents for approval

List of drawings with schedule of submission five (05) days from the date of placement of order.
Quality Control & Quality Assurance plan.
G.A. and Cross Sectional drawings of all equipment indicating weights, material of construction, bill of material, dimension, specification etc.
Final design calculations and assumptions.
Actual performance data and characteristic curves based on the testing at site.

Technical specification of all equipment, motors, for all system and all other accessories.
Final list of drawings.
As built drawings.

Technical document for Reference / Information

Civil foundation drawings with static & dynamic load data of all equipment indicating cable trench, pipe trench, conduits, inserts, cable entries to motor, field devices etc.

Technical literature and catalogue of bought out items.

Drive list to be furnished within fifteen (15) days from the date of placement of order.

List of special tools & tackles to be supplied

Test certificates.

Part number and description of all spare parts.

Reproducible of all final drawings.

Total list of all equipment with dispatch schedule.

All other relevant drawings / documents / certificates not specifically mentioned above but deemed essential for successful functioning of the equipment.

Methodology of drawing Approval

Bidder shall submit all drawings / documents / data sheets / calculations etc. which require approval clearly indicating the category (Approval / Information) to BHEL in hard copies/ soft copies in adequate number. BHEL shall compile the observation/ comments along with MECON/NSPCL's comments and shall send stamped copies of the drawing / document to Bidder for further action at their end.

Bidder shall send the Approved working drawings to BHEL for their record, reference and use.

Electrical wiring diagram for all interlock in lubrication system etc., including wiring inside local panel.

Foundation drawing with loading data.

Miscellaneous

i. General arrangement and cross sectional drawings of all major components with bill of material.

ii. Foundation drawings, load data & design calculation for all equipment.

iii. Erection drawings for all equipment and structures showing complete erection details.

iv. Engineering and design calculations of installations and units.

v. QAPs

vi. Detailed procedures of shop testing of all the items applicable shall be submitted to the Owner/ Consultant for approval before conducting tests.

vii. Following shop test certificates/test curves/data, shall be furnished.

- Materials and components test certificates.
- Performance test results and characteristic curves of all fans, pumps, and electric drive motors etc.
- Non-destructive test results as applicable.
- Reports and test certificates of shop tests.
- Type test & routine test certificates.

viii. Detailed quality assurance program along with quality plan shall be submitted.

Following data shall be furnished:-

a. Technical data of all the plant, equipment, drive motors, instruments, panels, etc. shall be furnished.

b. Following lists/tables / write ups shall be furnished, complete with tag nos. and brief specification. Proper numbering system as approved by Consultant/Owner shall be adopted.

i. Instrument schedule (with service, range, make of instrument).
ii. Flow element schedule.
iii. Valve schedule.
iv. Pipe schedule.
v. Cable schedule (Power & Control).
vi. Schedule of actuators (electric/pneumatic)

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalized at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	Approval/comments/by employer on Initial submission	Within 2 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.
iii.	Approval or comments	Within 2 weeks of receipt of resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

3.10 Workmanship and Quality Control

All moving parts of equipment, which can conceivably cause injury to the operator and otherwise authorized personnel within the vicinity of working area shall be suitably guarded and warning displays shall be put at prominent places.

The Bidder shall clearly indicate and identify the plans and procedures, which shall be followed in the design, manufacture and installation of plant and equipment to control and assure to the Owner of the desired quality.

3.11 Provision for exposure to hot and humid climate

a. ENCLOSURE

Enclosure protection class shall be as detailed in the respective chapters.

Equipment enclosure, intended for outdoor service, shall be of weather-proof construction, generally conforming to degree of protection IP-55.

For equipment located in hazardous areas like lub oil handling, hydrogen handling areas, FOPH etc. increased safety type enclosure, such as flame/explosion proof type, shall be provided. Such enclosures shall be certified by recognized authority as suitable for use in that particular environment.

b. TROPICAL PROTECTION

All electrical equipment, accessories and wiring shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

Fine mesh screen of corrosion resistant material shall be furnished on all ventilating openings to prevent entry of insects.

c. SPACE HEATERS

The heaters shall be suitable for continuous operation at 230 V as supply voltage. On –off switch and fuse shall be provided.

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.

The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centered in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conducting and electrical insulation properties or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternatively, they shall consist of a resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

d. FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistance 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.

e. VENTILATION OPENING

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

3.12 NAME PLATE

Nameplate of approved design shall be furnished on each panel and for each instrument or device mounted on panel.

The material for nameplate shall be 3 mm thick lamicoid or approved equal, with white letters on black background.

3.13 GALVANISING

i.The galvanised surface shall consist of a continuous film adhering to the steel. The finished surface shall be clean and smooth, and shall be free from defects like dissolved patches, base, spot, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking or peeling off, etc. The presence of any of these defects shall render the material liable to rejection.

ii.All exposed ferrous parts shall be hot dip galvanised as per IS:2629 & IS:2633, Galvanising shall be uniform, smooth continuous and free from acid spots. Should the galvanising of the sample be found defective, the entire batch of steel shall have to be re-galvanised at Contractor's cost. The amount of zinc deposit shall be not less than 610 gms. per sq.m. of surface area and in addition, the thickness of zinc at any spot shall not be less than 85 microns. The Employer reserves the right to measure the thickness of zinc deposit by Elkometer or any other instrument acceptable to Employer and reject any component which shows thickness of zinc at any location less than 85 microns. The testing on the galvanised materials shall be carried out as per IS:2633.

iii.The amount of zinc deposit over threaded portion of the bolts, nuts and screws shall not be less than 300 gms. per sq. meter of surface area. The amount of zinc deposit on washers shall not be less than 340 gms. per sq. meter of surface area. The threads having extra deposit of zinc shall be removed by die cutting after the completion of galvanising. The removal of extra zinc shall be carefully done so that threads shall have minimum deposits of zinc on them as specified.

3.14 Surface Preparation and Painting

The surface of plant & equipment shall be suitably cleaned and coated with anti-rust primer to protect against corrosion and damage during transit and transportation to the site.

Painting shall be done as per details indicated in the relevant Sections of this specification.

Unless explicitly stated in relevant chapters of the specification, the painting of all electrical equipment shall be as follows:
Epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be acceptable for finish coat. Paint shade shall be as per technical specification.

All sheet steel work shall be pretreated, in tanks, in accordance with IS: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "Class-C" as specified in IS: 6005. The phosphated surfaces shall be rinsed and passivated. After passivation, Electrostatic Powder Coating shall be used. Powder should meet requirements of IS 13871 (Powder costing specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the Owner. The paint thickness shall not be less than 50 microns. Finished parts shall be suitably packed and wrapped with protective covering to protect the finished surfaces from scratches, grease, dirt and oil spots during testing, transportation, handling and erection.

3.15 QUALITY ASSURANCE

i. The Contractor shall follow his standard procedures for quality assurance and control. A copy of the said standard procedures shall be submitted to the Owner / Purchaser for his reference. However, Owner / Purchaser reserves the right to review the same and give his observations, if any, for compliance.

ii. The procedures shall be in such a form as to clearly delineate the manufacturing sequence, inspection points, tests and test procedures, acceptable ranges / values, reference drawings etc.

iii. The Owner / Purchaser shall inform the Contractor as to which of the inspection points and tests shall be witnessed. As a minimum, inspection and testing of the finished equipment shall be made prior to shipment, unless specifically waived by the Owner / Purchaser. The contractor shall give at least fifteen (15) days advance notice regarding readiness of the equipment.

iv. Manufacturing and quality control procedures shall be available for audit to the Owner / Purchaser and/or its representative at the place of manufacture.

v. The Owner / Purchaser reserves the right to inspect the equipment at the point of manufacture and witness factory and other such tests as may be necessary to ensure conformance to the specification.

vi. The Owner / Purchaser may inspect the Contractor's facilities prior to award of contract.

vii. The Owner / Purchaser may witness any or all of the tests stipulated in the relevant standards and this specification.

viii. The Owner / Purchaser may conduct surveillance of the Contractor's facilities for compliance to his standard procedures of Quality Assurance and Quality Control while work on the specified equipment is in progress.

QUALITY ASSURANCE REQUIREMENTS

3.15.1.1 QUALITY ASSURANCE PROGRAMME

a. To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorized representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following:

b. His organization structure for the management and implementation of the proposed quality assurance programme.

c. Documentation control system.

d. Qualification data for Bidder's key personnel.

e. The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

f. System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

g. Control of non-conforming items and system for corrective actions.

h. Inspection and test procedure both for manufacture and all site related works.

i. Control of calibration and testing of measuring and testing equipments.

j. System for quality audit.

k. System for indication and appraisal of inspection status.

l. System for authorizing release of manufactured product to the Owner.

m. System for handling storage and delivery.

n. System for maintenance of records.

o. Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed at Annexure-I to this section.

3.15.1.2 GENERAL REQUIREMENTS - QUALITY ASSURANCE

i) All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Authorized representative for approval. Schedule of finalization of such quality plans will be finalized before award.

ii) Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organization, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing.

iii) Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control organization, during various stages of site activities from receipt of materials/equipment at site.

iv) The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc. will be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorized representative shall identify customer hold points (CHP), test/checks which shall be carried out in presence of the Owners Engineer or his authorized representative and beyond which the work will not proceed without consent of Owner/Authorized representative in writing. All deviations to this specification, approved quality plans and applicable

standards must be documented and referred to Owner/Authorized representative for approval and dispositioning.

v) No material shall be dispatched from the manufacturer's works before the same is accepted subsequent to pre-dispatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/Authorized representative, and duly authorized for dispatch issuance of Material Dispatch Clearance Certificate (MDCC).

vi) Materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report as per Owner's approved QAP. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

vii) Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.

viii) All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner.

ix) All brazers, welders etc. employed on any part of the contract at Contractor's/Sub-Contractor's works or at site shall be qualified as per ASME Section-IX orBS-4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorized representative.

x) For welding of pressure parts and high pressure piping the requirements of IBR shall also be complied with.

xi) All non-destructive examination (NDT) shall be carried out in accordance with approved international standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non-destructive examination). Results of NDT shall be properly recorded and submitted for approval.

xii) All the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Contractor and finalized with the Owner shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalized and approved by the Owner/Authorized representative and form part of the Purchase Order between the Contractor and the Vendor.

xiii) All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalized with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed. Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance. Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject an equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.

xiv) Quality requirements for main equipment shall equally apply for spares and replacement items.

xv) Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.

xvi) For quality assurance of all civil works refer to the specifications for civil works.

3.15.1.3 QUALITY ASSURANCE DOCUMENTS

i) The Contractor shall be required to submit two (2) copies and two (2) sets of microfilms of the following Quality Assurance documents within three (3) weeks after dispatch of the equipment:

ii) Material mill test reports on components as specified by the specification.

iii) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.

iv) Non-destructive examination results /reports including radiography interpretation reports.

v) Factory tests results for testing required as per applicable codes and standards referred in the specification.

vi) Welder identification list listing welder's and welding operator's qualification procedure and welding identification symbols.

vii) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

viii) Stress relief time temperature charts.

ix) Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following will also be recorded :

x) When some important repair work is involved to make the job acceptable.

xi) The repair work remains part of the accepted product quality.

xii) Letter of conformity certifying that the requirement is in compliance with finalized specification requirements.

3.16 Inspection and Testing

The plant and equipment shall be subjected to inspection and witnessing of shop tests by the Owner / Consultant or the agency mutually agreed between Owner and the Bidder / Supplier. The supplier shall inform the Owner/ his Consultants at least fifteen days in advance of the date when the plant and equipment shall be made available for inspection and testing. The Owner and / or his Consultant shall be given full access to the tests and testing premises and can inspect the factories and offices of the supplier or sub-vendor, if so required. After inspection and testing, all certificates /documents as required by the Owner / Consultant shall be submitted for approval to the Owner before clearance for dispatch of equipment can be given.

For plant and equipment for which tests at works may not have been witnessed by Owner / Consultant, the tests and quality certificates duly signed by appropriate authority acceptable to Owner / Consultant shall be submitted to the Owner / Consultant for approval within 6 weeks in advance of the dispatch.

Inspection by the Owner or his representative shall not relieve the Bidder of his liability for rectifying any defects which may subsequently appear or be detected during or after erection and during guarantee test. After rectification, the testing of equipment shall be repeated to the satisfaction of the Owner / Consultant.

Drawings / Data to be submitted with the Tender

In order to enable the Owner / Consultant to properly evaluate the tenders, the drawings / documents / technical particulars.

3.17 Packing, Dispatch, Handling & Transportation

All equipment, shall be suitably packed for protection against mechanical damages and climatic conditions during transit and storage. Packing and weather proofing shall be subject to approval of the Owner / his Consultant. This approval shall be general and may not be required every time for an article to be dispatched. However, the Owner reserves the right to examine the packing for any particular consignment at supplier's/ manufacturer's works before dispatch.

The supplier shall be entirely responsible for the insurance, shipment, handling and transportation.

The equipment shall not be dispatched by the Bidder from the place of manufacture to the site until the dispatch instructions are issued by the Owner.

3.18 ELECTRICAL SWITCH BOARDS

General

Switchboards shall be dead-front, free-standing, vertical, cubicle/panel type, completely wired, having access doors with concealed hinges and locking type latches.

Panels shall be fabricated from minimum 2 mm. thick CRCA (cold rolled continuously annealed) sheet steel, free from any surface imperfections and suitably reinforced to provide a sturdy and rigid assembly. Gland plate thickness shall be min 3.0 mm of non-magnetic material.

Panels shall be adequately sized for installation of field cables and access for maintenance. The working zone shall be limited between 450 mm and 1800 mm from floor level.

Each panel shall be provided with internal illumination lamp operated by door switch, space heater with switch fuse unit, and plug socket with switch for hand lamp.

Removable eye bolt/lifting lugs shall be furnished on all panels.

Module selection chart is included in this specification for guidance purpose. Bidder to note that this is only for guidance of the bidder. Actual size, rating etc. shall be as per detailed engineering by the bidder.

3.18.1 Equipment Mounting

All instruments, switches etc. mounted on the front face of the panels shall be of flush type.

All equipment shall be so mounted that removal and replacement may be accomplished individually without interruption of service to others.

All equipment inside the panel shall be so located that their terminals and adjustments are readily accessible for inspection and maintenance. Adequate ventilation shall be provided in enclosed panel.

Each of the LV switchboards shalll be designed for 1.1 times the required rating as a spare capacity. Further all LV Switchboard shall be provided with 20 % spare modules of each rating and type of module.

3.18.2 Panel Wiring

All panels shall be fully wired at the factory to ensure proper functioning of all control, protection and interlock schemes. All wiring for external connections shall be brought to terminal blocks and numbered.

All auxiliary wiring shall be carried out with 650V grade, single core stranded copper conductor, color coded, PVC insulated wires. Conductor size shall be 1.5 mm2 (min.) for control circuit wiring and 2.5 mm2 (min) for CT, PT and space heater circuits.

Solderless compression/clamp type connection shall be used for wire terminals. Wiring shall be continuous between terminals without splicing. Each wire shall be identified at both ends with permanents markers having wire numbers as per approved wiring drawings.

3.18.3 Terminal block

Terminal blocks shall be 650V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be either screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design.

Terminal blocks for CT and VT secondary leads shall be of stud type, made up of unbreakable polyamide 6.6 grade. They shall be provided with links to facilitate testing, isolation star / delta formation and earthing. Terminal blocks for CT secondary shall have the short circuiting facility. The terminals for remote ammeter connection etc. shall also be disconnecting type only. All metal parts shall be of nonferrous material. Screws shall be captive.

All panel wring for external connections shall terminate on separate terminal blocks which shall be suitable for connecting two (2) stranded copper conductors of 2.5 sq. mm on each side, or alternatively, the terminal blocks shall have the possibility of double shorting space to facilitate looping.

Not more than two wires shall be connected to one terminal. Spare terminal equal in number to 20% of active terminals shall be furnished.

Terminal housing Material should be a) Fire resistant/retardant, b) Of high aging stability and c) Unbreakable.

Cable terminals Material should a) be of copper alloy b) Be able to rigidly hold the cable with adequate pressure, c) have low contact resistance and d) have sufficient contact surface.

3.18.4 Grounding

A copper ground bus, sized to carry maximum short circuit current, shall run along the entire length of panel structure and shall have terminal connector at each end for connection to station ground grid (50 X 6 mm G.I. flat).

Tests
Each panel shall be completely assembled, wired, adjusted and tested at the factory prior to shipment. The test shall include wiring continuity tests, insulation tests and functional tests to ensure satisfactory operation and control of individual equipment.

Special Cables
Special cables for specific purpose, as required, shall be supplied and installed by the Bidder.

3.18.5 CONDUITS

Conduits shall be of heavy gauge rigid steel, hot-dip galvanized, cut square reamed, threaded and screwed tight at all joints.

Conduit entrances to pull boxes and switches shall have double lock nuts & insulating bushings. No running thread shall be used.

Flexible metallic conduit shall be used for connection to equipment, which are subject to vibration, and also for connection to level/limit/pressure switches.

3.19 Performance Guarantee and Penalties

All the plant and equipment supplied shall be guaranteed for quality workmanship and compliance with the specified requirements for integrated performance to deliver rated outputs. Non-compliance and non-performance shall be subjected to correction.

3.20 TYPE, ROUTINE & ACCEPTANCE TESTS:

All equipments to be supplied shall be of type tested design. During contract stage, bidder shall submit for Owner's approval the reports of all the type tests listed in this specification and carried out within last ten years from the date **02/04/2015**. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the tests should have been either conducted at an independent laboratory or should have been witnessed by a client.

However if contractor is not able to submit report of the type tests conducted within ten years from the date **02/04/2015** or in the case of type test reports are not found to be meeting the specification requirements, the bidder shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/ owners representative and submit the reports for approval.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

3.21 Title Block :

NTPC–SAIL POWER COMPANY (P) LIMITED				
Project	ROURKELA PP–II EXPANSION PROJECT (1X250 MW)			
Consultant (मेकॉन लिमिटेड) MECON LIMITED				
BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP	DRN			
	DESN			
	CHD			
	APPD			
DEPT : TBG	SCALE NTS		DRAWING NUMBER	
TITLE :				Pg.No 1/--

----------XXXX----------

SECTION-4
GUARANTEED TECHNICAL PARTICULARS

Sl. No.	ITEM	
1	**FIXTURES & ACCESSORIES**	
1.1	**General**	
1.1.1	Name of Manufacturer & Country for fixtures	
1.1.2	Manufacturer's type & Catalogue no. for fixtures	
1.2	**Technical details (Separate details of each type of fixtures, each type of components and each type of lamps shall be furnished)**	
1.2.1	**Fixtures**	
1.2.1.1	a) Starting current (A)	
	b) Full load input current at normal working voltage (A)	
1.2.1.2	Temperature rise of the fixture in continuous operation at the design air temp. of 40 deg. C	
1.2.1.3	Maximum estimated working temp. of the fixture, with the fixture mounted close to ceiling and operating in still air ambient temp. as specified.	
	a) Ambient within fixture housing	
	b) Ballast case hot spot temp. (deg C)	
	c) Average Ballast winding temp. (deg C)	
1.2.1.4	Estimate average life expectancy of complete fixture, including control gear continuously mounted.	
	a) In still air at ambient temp of 25 deg. C (Years)	
	b) In still air at 40 deg. C ambient temp. (Years)	
1.2.1.5	Average total light output per fixture as percentage of combined lamp light output at normal working voltage and frequency	
	a) In still air at ambient temp of 25 deg. C (Years)	
	b) In still air at 40 deg. C ambient temp. (Years)	
1.2.1.6	Average downward (0-90) light output per fixture as percentage of total fixture light output (%)	
1.2.1.7	Average downward (90-180) light output per fixture as percentage of total fixture light output (%)	
1.2.1.8	Maximum withstand voltage of fixture (50 Hz sine wave test) (V)	
1.2.1.9	Beam angle for flood light fixture in	
	a) Horizontal plane (Deg.)	
	b) Vertical plane (Deg.)	
1.2.2	**Ballasts**	
1.2.2.1	Type	
1.2.2.2	Make	
1.2.2.3	Catalogue No.	
1.2.2.4	Maximum permissible supply voltage variation (%)	
1.2.2.5	Power loss per Ballast at nominal working voltage and frequency (Watt)	
1.2.2.6	Recommended/ Designed maximum hot spot temp. of ballast case (deg C)	
1.2.2.7	Recommended/ Designed maximum average ballast winding temp (deg C)	
1.2.2.8	Conductor material of ballast	
1.2.2.9	Insulation class of ballast winding	

SECTION-4
GUARANTEED TECHNICAL PARTICULARS

Sl. No.	ITEM	
1.2.2.10	Average life of ballast (Hrs)	
1.2.3	**Starters**	
1.2.3.1	Type	
1.2.3.2	Make	
1.2.3.3	Catalogue No.	
1.2.3.4	Average life of starters (Hrs)	
1.2.3.5	Enclosure material of starters	
1.2.4	**Capacitors**	
1.2.4.1	Type	
1.2.4.2	Make	
1.2.4.3	Catalogue No.	
1.2.4.4	Power factor at nominal working voltage and frequency	
1.2.4.5	Type of capacitor	
1.2.4.6	Rating of capacitor (micro F)	
1.2.4.7	Tangent of loss angle per capacitor at nominal working voltage and frequency	
1.2.4.8	Recommended maximum working temp. of capacitor measured on case (deg C)	
1.2.5	**Ignitors for HPSV lamps**	
1.2.5.1	Type	
1.2.5.2	Make	
1.2.5.3	Catalogue No.	
1.2.5.4	Average life of ignitors (Hrs)	
1.2.5.5	Enclosure material of ignitors	
1.2.6	**Fuses**	
1.2.6.1	Type	
1.2.6.2	Make	
1.2.6.3	Catalogue No.	
1.2.6.4	Category of fuse duty	
1.2.6.5	Rated Current (A)	
1.2.6.6	Maximum prospective rms fault current interruption value of fuse at nominal voltage and frequency (A)	
1.2.7	**Louvers**	
1.2.7.1	Material of louvers	
1.2.7.2	Size of louvers	
1.2.7.3	Shielding angle of louver (Deg.)	
1.2.8	**Diffusers**	
1.2.8.1	Material of diffusers	
1.2.8.2	Thickness of diffuser (mm)	
1.2.9	**Reflectors**	
1.2.9.1	Material of reflector	
1.2.9.2	Thickness of reflector (mm)	
1.2.10	**Lamps**	
1.2.10.1	Type	
1.2.10.2	Make	
1.2.10.3	Catalogue No.	
1.2.10.4	Nominal voltage (V)	
1.2.10.5	Maximum permissible supply voltage variation	
	a) Incandescent (+/-) (%)	

SECTION-4
GUARANTEED TECHNICAL PARTICULARS

Sl. No.	ITEM	
	b) Fluorescent (+/-) (%)	
	c) HPSV (+/-) (%)	
1.2.10.6	Luminous output at specified design temp.	
	a) After 100 burning hours (Lumens)	
	b) After 1000 burning hours (Lumens)	
1.2.10.7	Average life expectancy of each type and each wattage of lamp when operated continuously	
1.2.10.8	Burning position of lamp	
1.2.10.9	Color of the light rendered by the lamps	
1.2.11	**Lamp holders**	
1.2.11.1	Type	
1.2.11.2	Make	
1.2.11.3	Material	
1.2.12	Termination at fixtures suitable for	
	a) Cable/ Conduit entry size	
	b) Size & type of cable	
1.2.13	Earthing terminal	
	a) Material	
	b) Suitable for earthing conductors of size (Sq. mm)	
1.2.14	Internal wiring size (Sq. mm)	
1.2.15	**Terminal Blocks**	
1.2.15.1	Type	
1.2.15.2	Make	
1.2.15.3	Material	
1.2.15.4	Rating	
1.2.15.5	Suitable for conductor size (Sq. mm)	
1.2.16	Aluminum/ Sheet Steel thickness of	
	a) Housing (SWG)	
	b) Reflector (SWG)	
1.2.16	Wire Guard	
1.2.17.1	Material	
1.2.17.2	Thickness	
1.2.17.3	Painting	
1.2.18	Weight of the fixture (Kg)	
2	**LIGHTING SYSTEM INSTALLATION**	
2.1	**Point Wiring**	
2.1.1	Wires/ Cables	
	a) Make	
	b) Galvanised (Yes/ No)	
	c) Minimum size/ gauge	
	d) Applicable standards	
2.1.3	Accessories	
2.1.3.1	Material and gauge for	
	a) Saddles	
	b) Spacers plates	
	c) Fixing hardware	
2.1.3.2	Accessories and hardware galvanized (Yes/ No)	
2.1.3.3	Junction/ Pull Boxes provided with necessary terminals	

SECTION-4
GUARANTEED TECHNICAL PARTICULARS

Sl. No.	ITEM	
	a) Material	
	b) Thickness	
	c) Dimensions	
	d) Galvanised (Yes/No)	
2.1.3.4	Applicable Standards	
2.1.4	Mounting/ Suspension Conduits	
2.1.4.1	Make	
2.1.4.2	Material and gauge for each size	
2.1.4.3	Size (mm)	
2.1.4.4	Galvanised (Yes/No)	
2.1.4.5	Applicable Standards	
2.1.5	Flexible Conduit	
	a) Material	
	b) Size	
	c) Make	
	d) Applicable Standards	
	e) Domestic type (Yes/ No)	
2.2	**RECEPTACLES WITH MCB**	
2.2.1	Receptacles	
	a) Make	
	b) Applicable Standards	
	c) Ratings as specified (Yes/No)	
2.2.2	MCBs	
	a) Make	
	b) Rating	
	c) Applicable Standards	
2.2.3	Catalogue enclosed (Yes/No)	
2.2.4	Boxes with Sunmica sheet top for housing switches/ receptacles/ MCBs	
	a) Applicable Standards	
	b) Material and gauge of Box	
	c) Galvanise (Yes/No)	
	d) Thickness of Sunmica Sheet	
	e) Earthing terminal provided (Yes/ No)	
	f) Material and thickness of cover sheet	

SECTION 5

ENCLOSURES TO THE SPECIFICATION

(i) 220kV Switchyard area – Complete area inside fence of 220kV SWITCHYARD as per layout drawing (Drg. No. TB-1-390-001 Rev-02).

(ii) Switchyard Control Building as per ARCHITECTURE LAYOUT OF

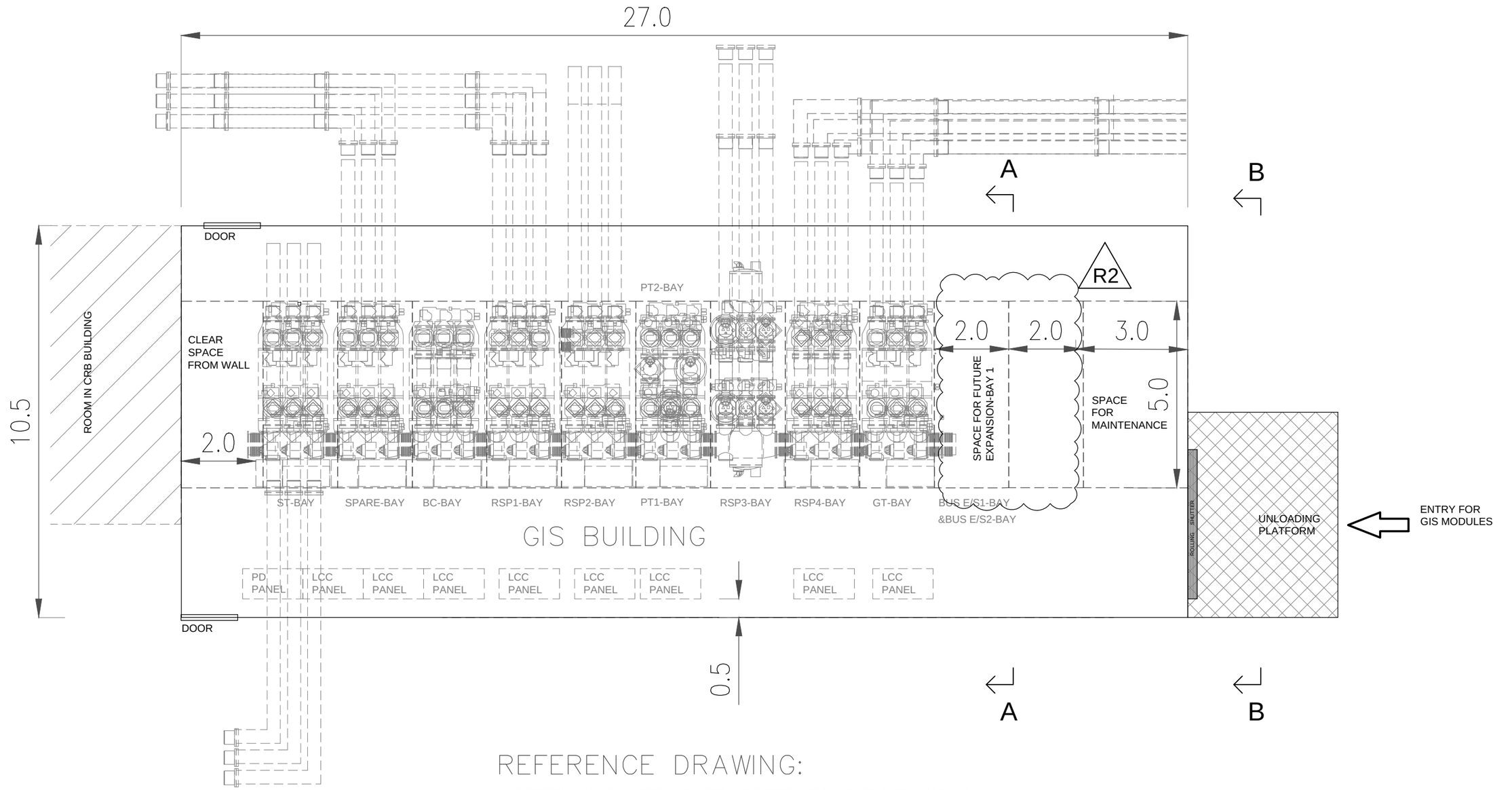
1. CONTROL BUILDING LAYOUT (Drawing No : TB-X-386-316-007 Rev-0).
2. GIS BUILDING LAYOUT (Drawing No : TB-X-386-316-006 Rev-02).

-----XXX-----

DRAWING NO. TB-1-390-316-06

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM



REFERENCE DRAWING:

1. ELECTRICAL LAYOUT & SECTION OF 220kV SUBSTATION DRG. NO. TB-1-390-316-001
2. 220kV SWITCHYARD SLD DRG. NO. TB-1-390-310-001

NOTES:

1. ALL DIMENSION ARE IN MTRS UNLESS NOTED OTHERWISE.
2. DETAILED CIVIL STRUCTURAL DRAWING WILL BE SUBMITTED SEPARATELY.
3. THE SIZE, LOCATION AND QTY. OF ALL PANELS & GIS BAY ARE INDICATIVE & ACTUAL DIMENSIONS, LOCATION, QTY & ARRANGEMENT SHALL BE INCORPORATED AFTER APPROVAL OF PANEL/ BATTERY DRAWINGS.
4. WALL THICKNESS, ROOF TYPE, BEAM AND COLUMN LOCATION SHALL BE SUBMITTED AS PART OF DETAILED CIVIL ENGINEERING DRAWINGS.
5. INDIVIDUAL DIMENSIONS AS INDICATED HERE SHOULD BE TREATED AS MINIMUM CLEAR DIMENSIONS OF ROOMS DURING DETAILED ENGINEERING, ALL REQUIREMENTS OF SPECIFICATION WRT CIVIL ARCHITECTURAL AND ELECTRICAL ARE TO BE TAKEN CARE OF.
6. DETAILS OF CABLE TRAY/TRENCH ARRANGEMENT SHALL BE FURNISED IN A SEPARATE DRAWING.
7. THE NOMEUCLATURE OF THE BAYS AS INDICATED AND MAY BE REARRANGED AT A LATER STAGE SUITING TO THE LAYOUT REQUIREMENT.
8. DETAILS OF ROLLING SHUTTER SHALL BE FURNISHED IN CIVIL ARCHITECTURAL DRAWING.

REVISED : R1

1. DIMENSION OF THE GIS BUILDING
2. TENTATIVE NAMES OF THE BAYS ADDED.

REV 1	DATED 07.10.16
DRN	PK
CHD	VYOM
APPD	AS

NTPCL

NTPC–SAIL POWER COMPANY (P) LIMITED

Project: ROURKELA PP–II EXPANSION PROJECT (1X250 MW)

Consultant: मेकॉन लिमिटेड MECON LIMITED

BHARAT HEAVY ELECTRICALS LTD
MADE BY TRANSMISSION BUSINESS GROUP

DRN	PK		15/09/16
DESN	Vyom		15/09/16
CHD	AS		15/09/16
APPD	RS		15/09/16

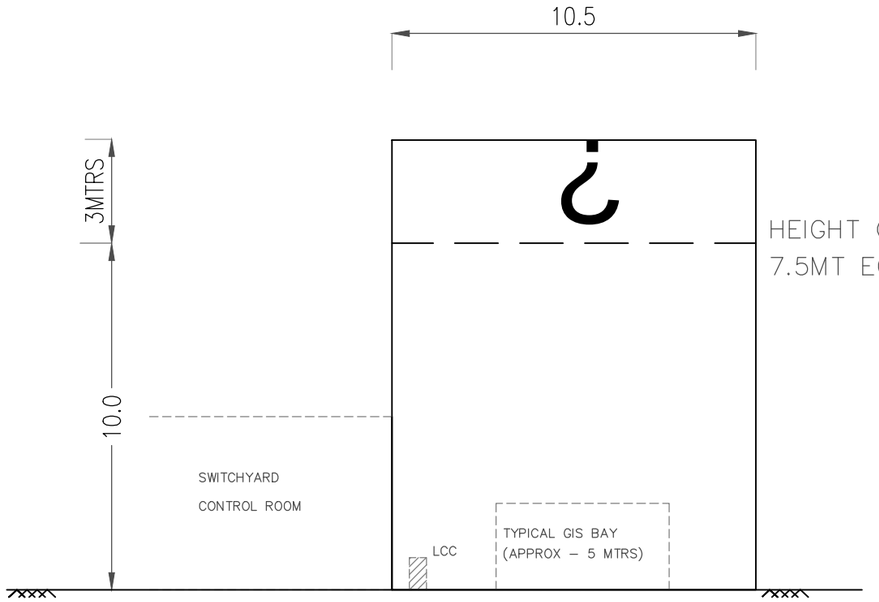
DEPT : TBG | SCALE NTS | DRAWING NUMBER TB-X-386-316-006 | Rev2

TITLE : CONCEPTUAL LAYOUT OF GIS BUILDING OF 220kV S/s | Pg.No 1/2

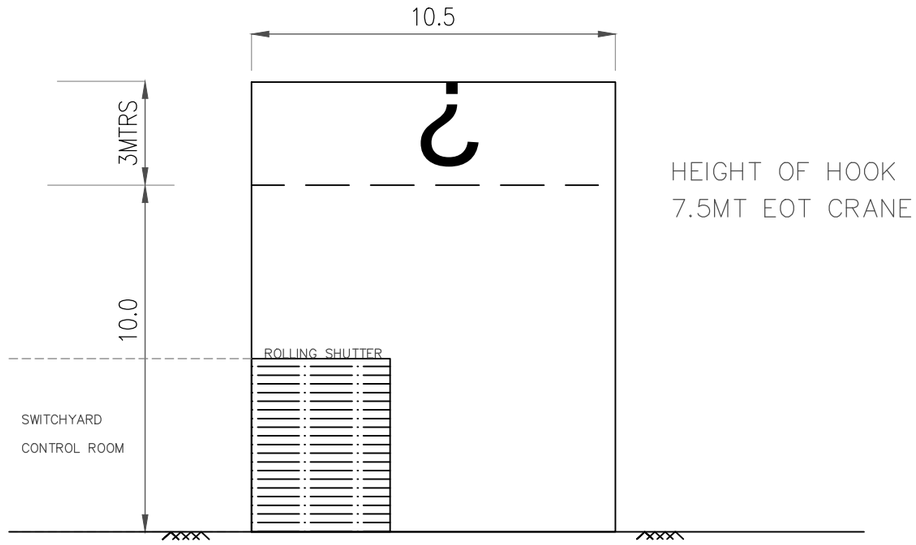
COMPUTER FILE NAME : PC-DC-445-100A001

DRAWING NO. TB-1-390-316-06

COMPUTER FILE NAME: PE-DOS-HS-150-MW01

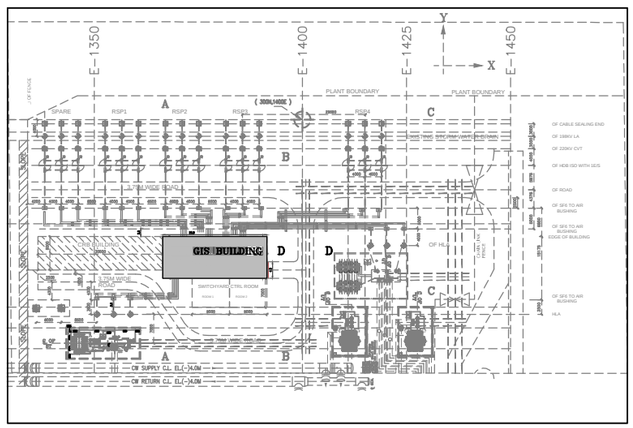


SECTION A



SECTION B

KEY PLAN



REVISED :

1. DIMENSION OF THE GIS BUILDING
2. TENTATIVE NAMES OF THE BAYS ADDED.

REV 1	DATED 07.10.16
DRN	PK
CHD	VYOM
APPD	AS

NTPC-SAIL POWER COMPANY (P) LIMITED

Project: ROURKELA PP-II EXPANSION PROJECT (1X250 MW)

Consultant: (मेकॉन लिमिटेड) MECON LIMITED

BHARAT HEAVY ELECTRICALS LTD
TRANSMISSION BUSINESS GROUP

DRN	PK		15/09/16
DESN	Vyom		15/09/16
CHD	AS		15/09/16
APPD	RS		15/09/16

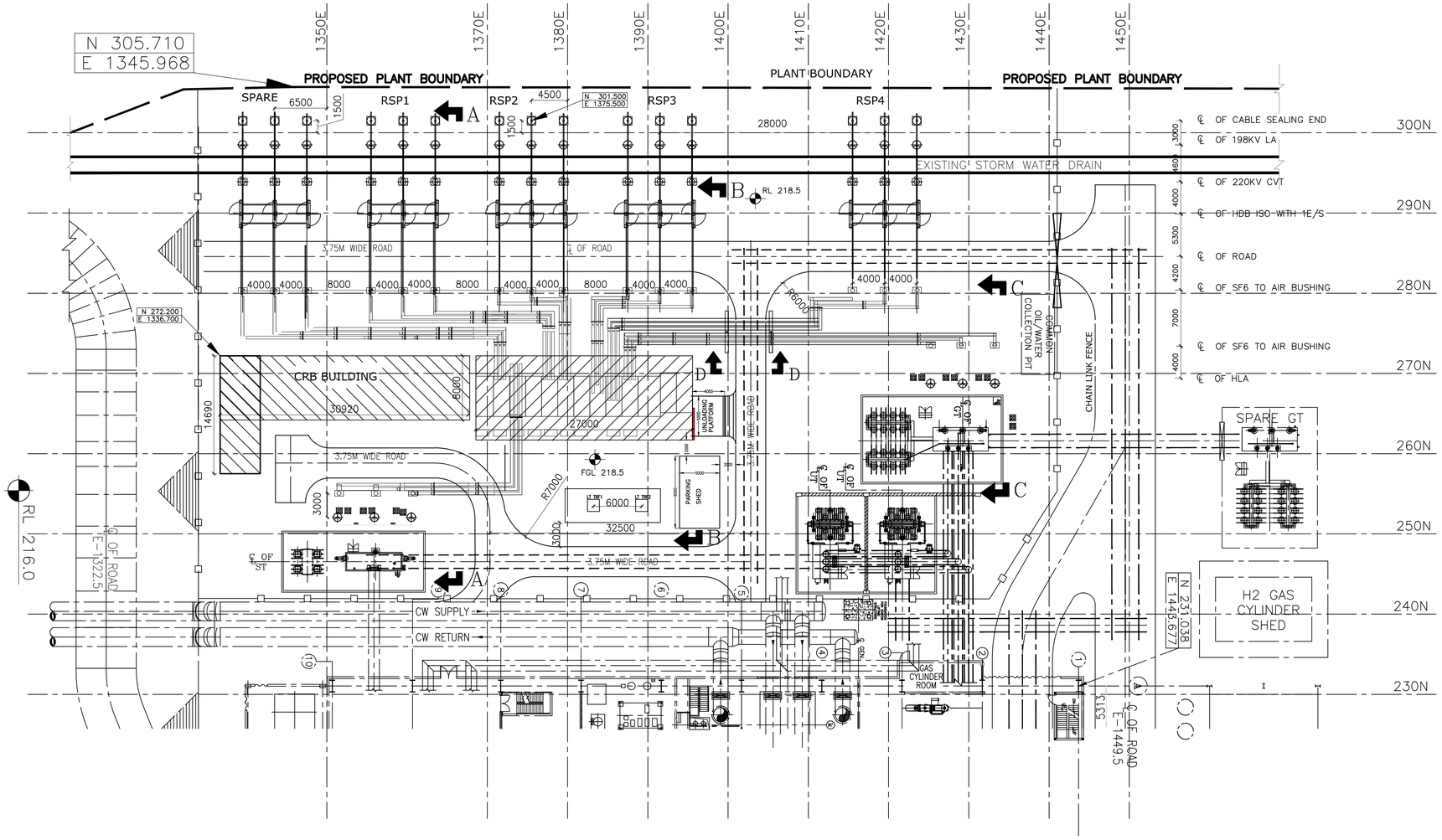
DEPT : TBG | SCALE: NTS | DRAWING NUMBER: TB-X-386-316-006 | Rev2

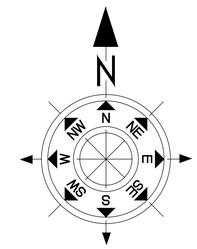
TITLE: CONCEPTUAL LAYOUT OF GIS BUILDING OF 220kV S/s | Pg.No 2/2

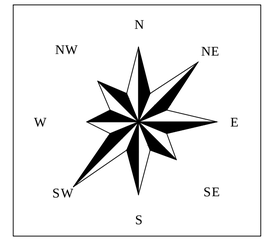
DRAWING NO. TB-1-390-316-02

CATEGORY-II,APPROVED AS NOTED,06.03.2017,REFER MOM DATED 03.03.2017 AND REVISE THE DRG /DOC. ACCORDINGLY.

CATEGORY-II







NOTES:-

1. ALL DIMENSIONS ARE IN mm UNLESS SPECIFIED OTHERWISE.
2. LIGHTNING PROTECTION SHALL BE WITH LM/SHIELD WIRE FOR 220kV SWITCHYARD.
3. PLINTH LEVEL FOR OUTDOOR EHV EQUIPMENT – 300mm ABOVE FGL.
4. EARTH WIRE 800kg./CONDUCTOR.
5. THE REQUIRED CLEARANCES AS PER CLEARANCE TABLE ABOVE AND AS PER PROVISION OF I.E. RULE & OTHER STATUTORY REGULATION ETC SHALL BE MAINTAINED BY BHEL.
6. LINE SIDE INTERCONNECTION SHALL BE THROUGH 220KV EHV CABLE THROUGH CABLE SEALING END .THE SUPPLY OF CSE SHALL BE IN SCOPE OF M/s RSP.
7. SWITCHYARD LIGHTING SHALL BE PROVIDED ON LM/BUILDING.
8. THE DIMENSIONS OF THE BUILDINGS AS PER CONCEPTUAL LAYOUT OF GIS AND CRB BUILDING.

BILL OF QUANTITY – 220kV

SCHEDULE OF EQUIPMENT (OUTDOOR)

ITEM CODE	DESCRIPTION	SYMBOL	QUANTITY IN NOS.
1	245KV, 2500A, 40kA/1s HDB ISOLATOR WITH 1E/S (3–Ph)		05
2	245KV CAPACITIVE VOLTAGE TRANSFORMER (1–Ph)		15
3	198 KV SURGE ARRESTER (1–Ph)		15
4	198 KV SURGE ARRESTER (1–Ph)–HIGH LEVEL		06
5	SF6 TO AIR BUSHING (1 PHASE)		21

SYSTEM PARAMETERS :-

1.	NOMINAL SYSTEM VOLTAGE	220kV
2.	HIGHEST SYSTEM VOLTAGE	245kV
3.	RATED FREQUENCY	50hz
4.	RATED SHORT TIME CURRENT	40kA FOR 3 SEC
5.	RATED FULL WAVE WITHSTAND VOLTAGE	1050kVp
6.	DRY & WET IMPULSE WITHSTAND VOLTAGE	460kVrms(+ve & –ve)
7.	MINIMUM CREEPAGE	(31MM/kV)
8.	SYSTEM NEUTRAL EARTHING	EFFECTIVELY EARTHED

CLEARANCE TABLE :-

MINIMUM CLEARANCE TABLE	220kV
PHASE TO PHASE (PP)	2400mm
PHASE TO EARTH (PE)	2100mm
SECTION CLEARANCE (SC)	5000mm
HEIGHT OF TUBE CENTRE LINE OF FIRST LEVEL (MIN.) (FROM PLINTH LEVEL)	5900mm
HEIGHT OF TUBE CENTRE LINE AT ROAD CROSSINGS	8000mm

STRINGING DETAILS :-

	CONDUCTOR
LINE SIDE INTERCONNECTION	220KV EHV CABLE
ALL EQUIPMENT INTERCONNECTION	4" IPS AL./TWIN MOOSE
SUB CONDUCTOR SPACING FOR TWIN	250 mm
EARTHWIRE	10.98MM DIA GS WIRE (OPGW).

LEGEND TABLE :-

———	PRESENT SCOPE
———	SCOPE NOT RELATED TO SWICTHYARD
←———	SHIELD WIRE
———	FENCE
▭	ISO. AND E/S BOX, CT/PT/CVTJB
▦	LIGHTNING MAST (LM)
⋈	GATE

REFERENCE DWG :-

DWG. NO.	TITLE
TB–1–390–510–001	SINGLE LINE DIAGRAM 220KV SUBSTATION ROURKELA
TB–X–386–316–006	CONCEPTUAL LAYOUT OF GIS BUILDING
TB–X–386–316–007	CONCEPTUAL LAYOUT OF CRB BUILDING

NTPC–SAIL POWER COMPANY (P) LIMITED

Project: ROURKELA PP–II EXPANSION PROJECT (1X250 MW)

Consultant: मेकॉन लिमिटेड / MECON LIMITED

BHARAT HEAVY ELECTRICALS LTD — TRANSMISSION BUSINESS GROUP

DRN	PK	05/02/17
DESN	VYOM	05/02/17
CHD	MS	05/02/17
APPD	PLK	05/02/17

DEPT : TBG | SCALE NTS | DRAWING NUMBER TB-1-390-316-001 Rev2

TITLE : ELECTRICAL LAYOUT AND SECTION OF 220KV SUBSTATION NSPCL–ROURKELA PROJECT

Pg.No 1/2

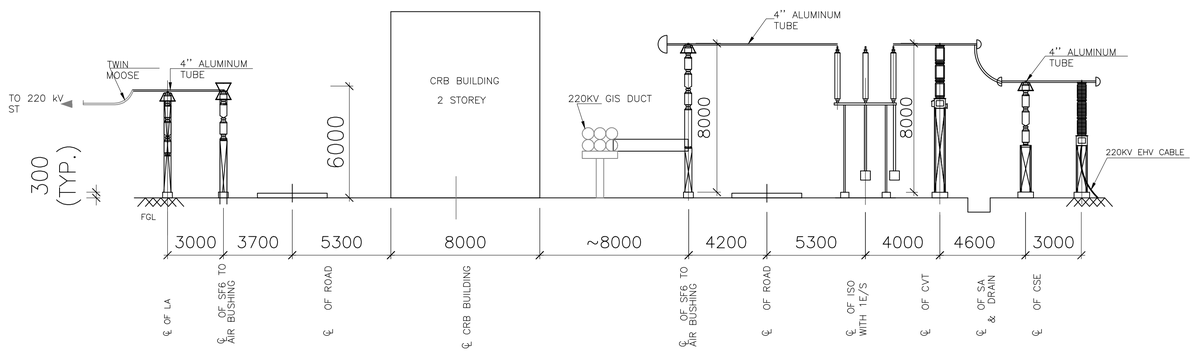
COMPUTER FILE NAME: PE-DCK-043-190401

DRAWING NO. TB-1-390-316-02

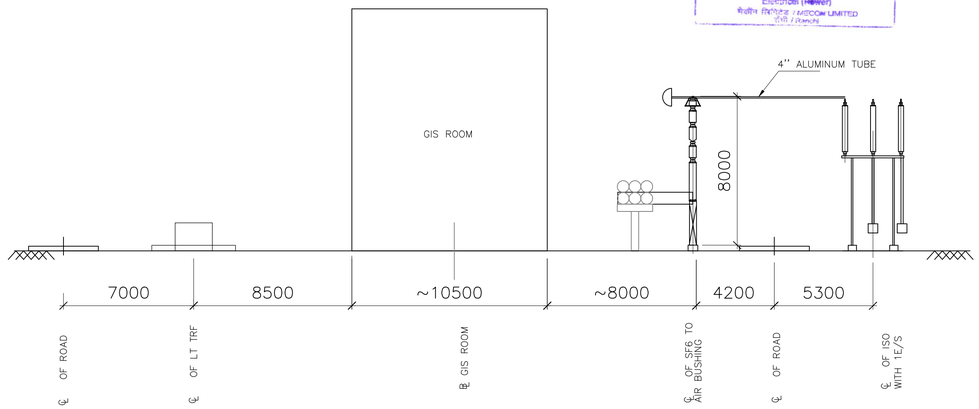
FIRST ANGLE PROJECTION | ALL DIMENSIONS ARE IN MM

CATEGORY-II,APPROVED AS NOTED,06.03.2017,REFER MOM DATED 03.03.2017 AND REVISE THE DRG /DOC. ACCORDINGLY.

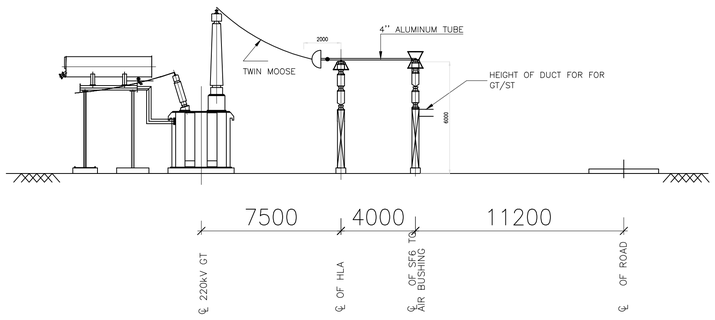
CATEGORY-II



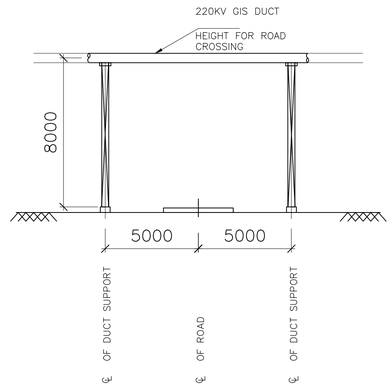
SECTION A–A



SECTION B–B



SECTION C–C



SECTION D–D

(ROAD CROSSING BY GIS DUCT)

Project	NTPC–SAIL POWER COMPANY (P) LIMITED ROURKELA PP–II EXPANSION PROJECT (1X250 MW)
Consultant	(मेकॉन लिमिटेड) MECON LIMITED

BHARAT HEAVY ELECTRICALS LTD — TRANSMISSION BUSINESS GROUP

DRN	PK	05/02/17
DESN	VYOM	05/02/17
CHD	MS	05/02/17
APPD	PLK	05/02/17

DEPT : TBG | SCALE NTS | TB-1-390-316-001 Rev2

TITLE: ELECTRICAL LAYOUT AND SECTION OF 220KV SUBSTATION NSPCL- ROURKELA PROJECT

Pg.No 2/2

COMPUTER FILE NAME: PE-SLC-415-150-R001

ANNEXURE - A
SCHEDULE OF TECHNICAL DEVIATIONS

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

S.No.	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: Tenderer's Stamp & Signature