

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
 NEW DELHI

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Illumination System

GROUP	TBEM
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W.O. No	86008
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CUSTOMER	POWER GRID CORPORATION OF INDIA LIMITED
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PROJECT	Substation Package for Extension of 400kV Tumkur Pooling station (Pavagada) (including transformer & Reactor), Extension of 400/220kV Mysore Substation and Extension of 400/220kV Tumkur (Vasantnarsapur) (including Transformer) under Transmission System for Ultra Mega Solar Power Part at Tumkur (Pavagada), Karnataka-Phase-II
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SECTION 1

1.0 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-A.

The illumination System is required for the following project.

Name of the Customer : POWER GRID CORPORATION OF INDIA LIMITED (PGCIL)
Name of the Project : Substation Package for Extension of 400kV Tumkur Pooling station (Pavagada) (including transformer & Reactor),
Extension of 400/220kV Mysore Substation and Extension of 400/220kV Tumkur (Vasantnarsapur) (including Transformer) under Transmission System for Ultra Mega Solar Power Part at Tumkur (Pavagada), Karnataka-Phase-II

Refer Section-3 for Project Details and General Specifications.

The specification comprise of following sections:

Section-1: Scope, specific technical requirements & Bill of Quantities.

Section-2: Detailed Technical Requirement - Equipment specification.

Section-3: General technical requirements for all equipments under the project.

Section-4: Guaranteed Technical Particulars (to be reviewed and approved during Contract stage)

Section-5: Check list

In case of any conflict between various sections, order of precedence shall be in the same order as listed above.

- 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 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, practice to the satisfaction of BHEL/PGCIL.**
- 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 any work and 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 In case of any deviation, the bidder shall indicate separately the clause wise deviation with respect to the specification in the "Schedule of deviations". Deviations in any other form including clarifications / assumptions etc. will not be considered and it will be construed as the bid conforming strictly to the specification. Deviations pertaining to non-availability of specified equipment / material in the market or pertaining to economy in offer will only be considered.
- 1.0.7 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.
- 1.0.8 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.

1.1 ILLUMINATION & SMALL POWER SYSTEM REQUIREMENT FOR VARIOUS AREAS

The Illumination system shall be provided for the following areas:

- ☐ Switchyard Area
- ☐ Switchyard Panel Room's

Complete lighting and illumination for the switchyard shall be provided by the bidder as per BOQ.

The roads & the area of the outdoor switchyard to be illuminated are as marked on the enclosed drawings under Annexure-3. Other relevant drawings are also enclosed under Annexure-3.

1.2 DESIGN CRITERIA

The illumination System for outdoor Switchyard shall comprise of:

- ☐ Normal AC lighting
- ☐ Emergency AC Lighting

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

The lux levels to be maintained in the switchyard shall be as per following:

Sl. No	Area	Average Lux Level
i)	Switchyard	50 lux on main Equipments (i.e, Transformer, Reactor, CVT, SA) at first level (Equipment connections level.) 20 lux on balance area of switchyard and street / Road at ground level 10 lux (Area between fence and peripheral roads around the switchyard). The lighting between the fence and the peripheral road around switchyard shall be done by providing the lighting fixtures on lighting pole of suitable height, if required.

The minimum lux level to average lux level ratio should not be less than 0.3 (i.e $E_{min}/E_{av} > 0.3$). The maintenance factor for outdoor illumination design shall be considered as 0.65.

For achieving the specified lux levels in the switchyard, the contractor shall provide LED flood lights (as mentioned in Customer's specification for Illumination System) as per requirement.

The contractor shall submit detailed calculation for reaching the above Lux level. Contractor shall confirm the lux levels at different locations of the switch yard and street lighting by measurement.

In an area, the lighting fixtures shall be arranged in different phase / LPs such that even in case one lighting panel is faulty complete lighting is not affected. In case of any location the lighting shall be arranged from all three phases for normal as well as normal/emergency supply.

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

The detailed drawings showing lighting layout, disposition and location of lighting fixtures, receptacles, switchboards, ceiling fan points etc, wiring scheme, wiring & conduit layout, fixing details, OGAs of all equipment, Cable schedule for switchyard etc shall be submitted for approval.

The lighting fixtures for switchyard lighting shall be mounted on LM (lightning mast) wherever LMs are provided. Where LMs are not available, the fixtures may be mounted on gantry structures or on lighting poles to be provided by the contractor.

All lighting panels, junction boxes, receptacles fixtures, conduits etc. shall be grounded in compliance with the provision of Customer Specification/I.E. rules.

Refer Annexure-1 for Customer Specification.

1.3 SCOPE OF SUPPLIES & SERVICES

BOQ is per enclosed Annexure-2.

Notes:

1. BOQ furnished above is as per the preliminary estimate. Bidder shall submit detailed calculation for achieving the required lux levels (as per specification requirement) & submit final BOQ for approval at contract stage.
2. The prices quoted shall be for total scope on unit rate basis as per above BOQ. 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. If any material required to complete the total switchyard illumination work which are not mentioned in the BOQ, the same shall be specifically mentioned in the technical/commercial bid otherwise any extra material required to complete the work which is not covered under BOQ shall be supplied free of cost by the bidder.
3. After placement of order, the bidder has to design the system as per relevant standards/codes to the satisfaction of BHEL/PGCIL.
4. Total quantity may vary upto $\pm 30\%$ at Contract stage. The quantity of individual items may however vary upto any extent.
5. The contractor shall provide outdoor power receptacle (with 400A rating) suitable for oil filtration unit near Reactors & Autotransformer Receptacle shall be suitable for termination of 3.5C X 300 Sq.mm XLPE Power cable.
6. Being an extension job, it is the responsibility of bidder to do Site visits to get acquaintance with existing system and there by design Illumination system for area under present scope. Charges for Site visits are deemed to be included in quoted prices of Illumination System.

1.3.1 SCOPE OF SUPPLY MATERIAL & ERECTION MATERIAL

- a) The equipment/services to be furnished for Substations under this contract are detailed in Bill of Quantity (Annexure-2) and shall be read in conjunction with other clauses of this specification.
- b) All associated items, though not specifically mentioned but required to meet specification and for safe and satisfactory operation of equipment/ system will also be treated as included and the same shall be supplied at NO EXTRA COST to Purchaser.
- c) Further, in case any type of luminaries/ panels etc not included below but are required to meet the technical specification shall be specifically brought out in the offer & shall be supplied.
- d) Supply of necessary cable for consumption within the street light/lighting pole assembly, such as pole mounted JB to respective light fittings, battery etc shall be in Contractor's Scope.

- e) LIGHTING JUNCTION BOX - The Contractor shall supply and install junction boxes complete with terminals as required. The brackets, bolts, nuts, screws etc required for erection are also included in the scope of the Contractor.
- f) Where cables are to be laid in PVC Pipe, excavation, filling etc. deemed to be included in erection cost quoted.
- g) Buried cable trench can be used in outdoor area. Contractor shall construct the cable trenches required for directly buried cables. The scope of work shall include excavation, preparation of sand bedding, soil cover, supply and installation of brick or concrete protective covers, back filling and ramming, supply and installation of route markers and joint markers.
- h) Commissioning Spares :
Contractor shall take commissioning spares required to site to commission the system without delay. The Contractor shall finalize the list with BHEL during detailed engineering stage.

1.3.2 FREE ISSUE ITEMS FROM PURCHASER

The following shall be free issue items from BHEL:

- ☐ Multicore power cables (listed in BOQ)
- ☐ 75x12 mm GI flat for earthing
- ☐ 50x6 mm GI flat for earthing
- ☐ 110/50 mm GI / PVC pipe
- ☐ 40 mm dia MS rod for earthing

The sizes of cables indicated are tentative. Actual size required shall be decided at detailed engineering stage. ETC rate quoted shall remain same even if size changes.

Erection, testing and commissioning of these cables, MS Rod & earth strip will be in bidder's scope. Contractor to furnish the quantity of each type of cables, GI flat, 40 dia MS Rod required for the completion of works within 3 weeks of issue of LOI. Supply of all other items such as cables, wires, steel wire, lugs, Cable glands, earthing material etc required to complete the works are in bidder's scope.

1.3.3 SCOPE OF SERVICES

The bidder shall quote for ETC, civil works, cabling including termination & earthing against each item as applicable. The list is attached as Annexure-2 (Bill Of Quantity).

1.3.3.1 Erection, Testing & Commissioning

- a) The Contractor shall give the offer for Erection, Testing and Commissioning of the Illumination Equipment at Site.

- b) 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.
- c) Conducting lux level measurement as per approved designs to the satisfaction of Owner/ purchaser.
- d) Laying and termination of power and control cables from ACDB to MLDB/EDB, MLDB/EDB to Lighting Panels shall be in BHEL scope. Cabling from outdoor Lighting panel to JB & from JB to fittings etc for the equipment under the scope of this specification shall be in Bidders scope.
- e) 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.
- f) Earthing of all electrical equipment as per requirement is in Contractor's scope.
- g) Contractor shall arrange all machinery tools & tackles, instruments and consumables required for erection, testing and commissioning of the system.
- h) Contractor shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The Contractor shall finalize the list with BHEL during detailed engineering stage. The unused commissioning spares shall be returnable to the Bidder.

1.3.3.2 Civil Works

- a. Civil works such as foundation for Street Lighting Poles, Lighting Panels etc. shall be done by the bidder. The rates for these civil works shall be deemed included in the erection rates of respective items.
- b. Wherever cable is laid in PVC Pipe/buried trench, excavation, filling etc deemed to be included in erection cost quoted.
- c. All final adjustment of foundation levels, chipping and dressing of foundation surfaces, setting and grounding of anchor bolts, sills, inserts and fastening devices shall be carried out by the contractor including minor modification of civil works as may be required for erection.
- d. Any cutting of masonry / concrete work, which is necessary shall be done by the contractor at his own cost and shall be made good to match the original work.

- e. Civil works such as grouting, filling up of crevices/ cut outs etc during installation of equipment shall also be in contractor's scope. Any other damage caused to civil works during ETC work of the equipment/ system shall be made good to the original finish by the Contractor at no extra cost to the Purchaser.

1.4 TYPE TESTS

Bidder shall submit valid type test reports (as per relevant IEC/IS Standard) for approval. The type test reports submitted shall be of tests conducted within last 10 years prior to the date of bid opening i.e. 08.08.16. The bidder should have conducted type test on identical or similar equipment/ components to those offered. In case type test reports are found to be technically unacceptable to BHEL/PGCIL, the type test shall be conducted without cost and delivery implication to BHEL.

1.5 QUALITY PLAN

Bidder to follow valid PGCIL approved Quality Plan as per PGCIL procedure. In case the bidder don't have PGCIL approved QP, it will be the bidder's responsibility to get its QP approved directly from the ultimate customer.

1.6 TITLE BLOCK

The drawings / documents submitted shall be project and product specific and shall incorporate following details:

CUSTOMER	POWERGRID CORPORATION OF INDIA LIMITED				
PROJECT	Substation Package for Extension of 400kV Tumkur Pooling station (Pavagada) (including transformer & Reactor), Extension of 400/220kV Mysore Substation and Extension of 400/220kV Tumkur (Vasantnarsapur) (including Transformer) under Transmission System for Ultra Mega Solar Power Part at Tumkur (Pavagada), Karnataka-Phase-II				
CONTRACT NO	CC-CS/702-SR2/SS-3340/7/G7/CA-I/7102, dtd. 16.01.17 (supply) CC-CS/702-SR2/SS-3340/7/G7/CA-II/7103, dtd. 16.01.17 (services)				
BHEL P.O. No.		PROJ. DOC. No.		REV. No.	
CONTRACTOR	BHARAT HEAVY ELECTRICALS LIMITED				
VENDOR'S STANDARD TITLE BLOCK					

1.7 LIST OF DRAWINGS ENCLOSED (Refer Annexure-3)

ANNEXURE-3**Drawings**

Sl No	Drwg. No.	Description
1	TB-0-393-316-002, Sh.1/2	Electrical layout Plan for 400/220 kV Tumkur (Pavagada) S/s Extn.
2	TB-0-393-316-002, Sh.2/2	Section Elevation for 400/220 kV Tumkur (Pavagada) S/s Extn.
3	TB-0-393-316-003	Trench layout for 400/220 kV Tumkur (Pavagada) S/s Extn.
4	TB-1-393-316-012	Electrical layout Plan & Section Elevation for 400 kV Mysore S/s Extn.
5	TB-1-393-316-014	Trench layout for 400 kV Mysore S/s Extn.
6	TB-0-393-316-022, Sh.1/2	Electrical layout Plan for 400/220 kV Tumkur (Vasantnarsapur) S/s Extn.
7	TB-0-393-316-022, Sh.2/2	Section Elevation for 400/220 kV Tumkur (Vasantnarsapur) S/s Extn.
8	TB-0-393-316-023	Trench layout for 400/220 kV Tumkur (Vasantnarsapur) S/s Extn.
9	C-ENGG-STD-PR-ARCH-3000	Standard Switchyard Panel Room Architectural Drawing of Panel Room
10	C-ENGG-STD-SPR-STR-3011	Standard Switchyard Panel Room GA and RCC Detail of Panel Room

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ANNEXURE-A

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

Section -LIGHTING SYSTEM (Rev.06)

Sl. No.	Description	Page No.
1.	GENERAL	1
2.	GENERAL DESIGN CRITERIA	1
3.	GRID INTERACTIVE SOLAR PV POWER PLANT	2
4.	LIGHTING SYSTEM DESCRIPTION	2
5.	LIGHTING SYSTEM INSTALLATION WORKS	11

Annexure-I	Bill of Quantity
Annexure-II	Details of Lighting Fixture
Annexure-III	Technical Specification of Grid Interactive Solar PV Power Plant
Annexure-IV	Drawing of Portable Flood Light Panel (PFL)
Annexure-V	Drawing of Lighting Pole

Section -LIGHTING SYSTEM (Rev.06)

Major Changes in Technical Specification Lighting System (Rev.06):-

1. Quantities of Indoor Lighting Fixtures for Control Room cum Administrative Building, GIS Building, FFPH and SPR have been specified in the Specification thus avoiding the designing requirement of Indoor Lighting System. In view of the same LUX Level for various building has not been mentioned in specification.
2. For Outdoor Lighting, LED fixtures of 150W & 250W has been specified in place of Conventional Sodium Vapor Lamps (to be supplied as per BPS).
3. Bidder shall be required to submit LM-79, LM-80 and TTC reports for LED Luminaries.
4. Firewall mounted Flood Lights have been envisaged for Transformer & Reactors (to be supplied as per BPS).
5. Portable Flood Light Panel for Maintenance purpose has been specified. Typical Drawing is also enclosed (to be supplied as per BPS).
6. Roof top Solar Grid System with battery **has been replaced** by Grid Interactive Roof Top Solar Grid System of 15kW to be integrated in ACDB. (to be supplied as per BPS).
7. Considering maintenance issue of Pole mounted battery, **Solar Panel alongwith battery** used for Street Lighting System has been deleted and Street Lighting using LED Luminaries is retained.
8. AC Emergency Lighting in GIS building, SPR, DG Area and LT Transformer Area has been specified.
9. DC Emergency Lighting added for GIS building.
10. Lighting System for Township Area deleted.
11. Stainless steel Panels/Junction Boxes of thickness 1.5 mm for Outdoor application has been specified.
12. Indoor Lighting Panels Bus Bar has been changed from Copper to Aluminum Alloy.
13. Technical Specification for Receptacle RQ-1 (250A) & RQ-2 (400A), 415V, 3-phase has been included for Oil filtration purpose.
14. All concealed Conduit shall be PVC type and all surface mounted conduit shall be of Galvanized steel.
15. Lighting Steel tubular Poles **painting** changed to hot deep galvanizing with PU (Polyurethane) coating in Suzuki Silver color.
16. Fixtures Model and Vendor names have been deleted and general technical parameters of LED fixtures have been included for Indoor as well as Outdoor Fixtures.

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

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1

GENERAL

The scope of work comprises of design, engineering, testing, supply, installation, testing and commissioning of various lighting fixtures complete with lamps, supports and accessories, ceiling fans with electronic regulators, exhaust fans with accessories, lighting panels, Sub-Lighting Panels, lighting poles with distribution boxes, PVC conduits, lighting wires, G.I. earth wire, receptacles, tag block & telephone socket, switchboards, modular switches, junction boxes, pull out boxes, aluminum ladders for maintenance, **solar grid system** complete with accessories. The bidder shall quote on unit rate basis as indicated in bid proposal sheets for outdoor Illumination and lump sum basis for Indoor Illumination. Various type of outdoor & indoor Lighting fixtures required are detailed in Annexure-II.

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

i) Indoor Lighting

- a) Control Room cum administrative building
- b) Firefighting pump house
- c) Switchyard panel rooms
- d) GIS Building
- e) Other Buildings

ii) Outdoor Lighting

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

2

General Design Criteria

The illumination system shall be designed on the basis of best engineering practice and shall ensure uniform, reliable, aesthetically pleasing and glare free illumination. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection. The diffusers/ louvers used in the lighting fixtures shall be made of impact resistant polystyrene sheet and shall have no yellowing property over a prolonged period Illumination. The Lighting Fixture to be used in different areas shall be as per Annexure-I.

For Indoor and Outdoor Illumination, detailed drawings showing the lighting layout, Conduit layout and electrical distribution diagram shall be prepared by the Contractor and submitted for approval. The above layout drawings will include disposition and location of lighting fixtures, receptacles, lighting panels etc. While finalizing the detailed layout of lighting fixtures, the position/location and layout of equipments should be taken into account to have adequate illumination at desired locations with Bill of Quantities requirement as per Annexure-I.

Section -LIGHTING SYSTEM (Rev.06)

2.1 Indoor Illumination

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

2.2 Outdoor Illumination

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

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

3 GRID INTERACTIVE SOLAR PV POWER PLANT

Solar Grid System (if specified in BPS) shall be supplied as per detail mentioned in as per Annexure-III.

4 LIGHTING SYSTEM DESCRIPTION

The lighting system shall comprise of the following:

4.1 AC Normal Lighting System

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

4.2 AC Emergency Lighting System

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

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4.3 D.C. Emergency lighting System

DC emergency lighting fixtures with 60 W GLS Lamp shall be operated on the 220/110V DC system (as per available Station DC Supply) and will be provided in the strategic locations including Control Room Building, Fire Fighting Pump House, GIS Building and other critical areas etc.

The supply to the DC lighting panels shall be automatically switched ON in case of loss of Normal & Emergency AC supply at station or when under voltage occurs in the AC MLDB. The DC supply will be automatically switched OFF after about 3 minutes following the restoration of supply to normal AC or emergency AC lighting system.

Exit Lightings Signage are to be provided in the all rooms of Control Room Building, Fire fighting pump house & GIS Building including Corridors & Staircase so that the operating personnel can safely find their way even during emergency of total AC failure.

4.4 DESCRIPTION OF ITEMS

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

4.4.1 LED LUMINAIRES

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

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

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

4.4.2 LIGHTING PANELS

4.4.2.1 CONSTRUCTIONAL FEATURES OF LIGHTINNG PANELS

- i) Each panel shall be provided with one incoming triple pole Miniature Circuit Breaker (MCB) with neutral link and outgoing MCBs. The panels shall conform to IS-8623.
- ii) All Outdoor Lighting Panels shall be Stainless sheet steel of Grade 304 and shall be dust, weather and vermin proof. Panels shall be of thickness not less than 1.5 mm smoothly finished, leveled and free from flaws. Stiffeners shall be provided wherever necessary.

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- iii) The panels shall be of single front construction, front hinged and front connected, suitable for either floor mounting on channels, sills or on walls/columns by suitable M.S. brackets. Indoor Lighting panels shall be modular flush mounted and wall embedded of slim depth.
- iv) All panels shall have a dead front assembly provided with hinged door(s) and with suitable locking arrangement.
- v) All Outdoor panel's removable covers and doors shall be gasketed all around with neoprene/EPDM gaskets/ puff arrangement.
- vi) The outdoor panels shall be suitable for cable/conduit entry from the bottom. Suitable removable cable gland-plate shall be provided in the bottom of panels. For indoor lighting panels the provision of cable/conduit entry shall be from both top and bottom side with suitable removable gland plate. The thickness of the gland plate shall be 3 mm. Necessary number of double compression brass type cable gland shall be supplied, fitted on to these gland plates.
- vii) The panels shall be so constructed as to permit free access to connection of terminals and easy replacement of parts.
- viii) Each panel shall have a caution notice fixed on it.
- ix) Each panel will be provided with laminated as built circuit diagram suitably pasted in the panel.
- x) **Main Bus Bars**
Bus bars shall be of aluminum alloy conforming to IS: 5082 and shall have adequate cross-section to carry the rated continuous current and withstand short circuit currents. Maximum operating temperature of the bus bars shall not exceed 85 deg. C. The bus bars shall be able to withstand a fault level of 9 kA for 1 sec. for AC panels and 4 kA for 1 sec. for DC panels.

4.4.2.2 **CONFIGURATION OF INDOOR AND OUTDOOR LIGHTING PANELS**

Type of Panel	Description	Detail Of Feeders
ACP 1	Indoor AC Lighting panel	Bus Bars: 415V, 63A, 3 phase 4 wire bus bars with Colored LED indication lamps with fuse for each phase. Incomer: One no. 415V, 63A 1PN MCB with 300mA 63A Four Pole RCCB. Outgoings: 12 nos. 230V, 16A Single Phase feeder with Single Pole MCB and 1 no. 5/15A Switch with Socket Mounting: The indoor ACP shall be of slim depth suitable for embedding in the wall and will be flush mounted.

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ACP 2	Outdoor-Switchyard AC Lighting panel	Bus Bars: 415V, 63A, 3 phase 4 wire bus bars with Colored LED indication lamps with fuse for each phase. Incomer: One no. 415V, 63A TPN MCB. Outgoings: 6 nos., 230V, 20A Single Phase feeder with Single Pole MCB and 3 Nos. 230V, 32A TPN MCB with suitable timer and contactor for automatic switching and 1 no. 5/15A Switch with Socket. Mounting: Suitable for Outdoor applications.
ACP 3	Outdoor - Street AC Lighting Panel	Bus Bars: 415V, 63A, 3 phase 4 wire bus bars with Colored LED indication lamps with fuse for each phase. Incomer: One no. 415V, 63A TPN MCB. Outgoings: 3 nos. 32A TPN MCB with suitable timer and contactor for automatic switching and 1 no. 5/15A Switch with Socket. Mounting: Suitable for Outdoor applications.
DCP	Indoor-DC Lighting panel	Bus Bars: 220/110V DC (as applicable) 32A two wire Bus Bar. Incomers: 220/110V DC (as applicable) with one 32A DP Contactor backed up by 32A double pole MCB. Outgoings: 6 nos.16 A Double Pole MCB Mounting: The indoor DCP shall be of slim depth suitable for embedding in the wall and will be flush mounted
SLP	Outdoor Sub-lighting panel	Incomers: 4 pole 32A TPN MCB suitable for 415V AC supply Outgoings: 8 nos. terminal blocks suitable for cable upto 16 sq. mm cable. Mounting: Suitable for Outdoor applications with Loop in and Loop out facility.

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Sub-DB	Indoor Type AC Sub Distribution Box	Incomers: 32A TPN MCB suitable for 415V AC supply. Outgoings: 6 nos. 230V, 16A Single Phase feeder with Single Pole MCB. Mounting: The MCB Box shall be of slim depth suitable for embedding in the wall and will be flush mounted/surface mounted as per site requirement.
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4.4.2.3 AUXILIARY ITEMS FOR LIGHTING PANELS

(i) TERMINAL BLOCKS

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

(ii) RESIDUAL CURRENT CIRCUIT BREAKERS (RCCB)

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

(iii) MINIATURE CIRCUIT BREAKER (MCB)

- a) The miniature circuit breakers shall be suitable for manual closing, opening, automatic tripping under overload and short circuit. The MCBs shall also be trip free. MCB of Type C tripping characteristics as per IS 8828 will be used for Illumination purposes.
- b) The MCBs and MLDDB panel MCCBs together shall be rated for full fault level. In case the MCB rating is less than the specified fault level the bidder shall co-ordinate these breaker characteristics with the backup MCCB in such a way that if fault current is higher than breaker rating, the MCCB should blow earlier than the MCB. If the fault current is less than MCB breaking capacity, MCB shall operate first and not the incomer MCCB.
- c) The MCBs shall be suitable for housing in the lighting panels and shall be suitable for connection with stranded copper wire connection at both the incoming and outgoing side by copper lugs or for bus bar connection on the incoming side.
- d) The terminals of the MCBs and the 'open/trip' and 'close' conditions shall be clearly and indelibly marked.

(iv) CONTACTORS

Contactors shall be of the full voltage, direct-on line air break, single throw, electro-magnetic type. They shall be provided with at least 2'NC' and 2'NO' auxiliary contacts. 3-Phase Contactor shall be provided with the three

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elements, positive acting, ambient temperature compensated time lagged, hand reset type thermal overload relay with adjustable settings to suit the rated current. Hand reset button shall be flush with the front of the cabinet and suitable for resetting with starter compartment door closed. The bidder shall check the adequacy of the Contactors rating, wire with respect to lighting load.

(v) PUSH BUTTONS

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

(vi) LABELS

- a) Designation labels shall be provided on the front of lighting Panels. The panel designation labels shall be of 3 mm thick plastic plate. The letter shall be black engraved on white back ground.
- b) All incoming and outgoing circuits shall be provided with labels. Labels shall be made of non-rusting metal or 3 ply lamicaid. Labels shall have white letters on black or dark blue background.

(vii) EARTHING TERMINALS

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

4.4.3 RECEPTACLES

Suitable number of 63A, 3ph, 415V AC receptacles shall be provided for welding purposes in GIS Halls and near major equipments in switchyard. 250A/400A Receptacle shall be provided for oil filtration purpose near alternate Transformer/Reactor. All receptacles shall be of heavy duty type, suitable for fixing on wall/column and complete with individual switch. The outdoor Receptacles shall have IP 55 protection. The receptacles shall be of following types:

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

Type RP - 63A, 415V, 3 phase, 4 pin interlocked plug and socket with body earthing arrangement with TPN MCB. The receptacle shall be suitable for 3.5C x 35/3.5Cx70 sq.mm and suitable for installation in moist outdoor location. Aluminum conductor cable entry and shall also be suitable for loop-

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in and loop out connection of cables of similar size. Receptacles shall be housed in a box made out of 2mm thick Stainless Steel of Grade 304, with hinged door with suitable locking arrangement. Door shall be lined with good quality gasketing.

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

4.4.4 LIGHTING ACCESSORIES

(i) JUNCTION BOXES

- a) The Indoor junction boxes shall be provided with 4 way knockouts suitable for two numbers 10 sq. mm. wire/ Cable. These junction boxes shall be concealed type for indoor lighting.
- b) The outdoor junction boxes shall be complete with conduit knockouts/threaded nuts and provided with terminal strips. The junction boxes shall be suitable for termination of Cable glands of required size. The junction boxes shall be provided with 4 way knockouts suitable for street lighting/switchyard lighting terminals suitable for 2 numbers 4C x 16 Sq mm Al. cable or as per requirement. All Outdoor Junction boxes shall be of Stainless Steel of thickness 1.6mm of grade 304. Outdoor Junction Boxes shall be suitable for mounting on columns, structures etc for Outdoor Lighting. The outdoor Junction shall have IP 55 protection.
- c) The junction boxes shall have the following indelible markings
 - (i) Circuit Nos. on the top.
 - (ii) Circuit Nos. with ferrules (inside) as per drawings.
 - (iii) DANGER sign in case of 415 volt junction box.

(ii) OCCUPANCY SENSORS:

Occupancy sensors for indoor use shall be provided in the toilets, stairs area, corridors, Relay room (in case of Centralized Control room), Local Control Room (LCR) in GIS Building. Each occupancy sensor shall be used with suitable programmable time delay to control the illumination in the area. Cost of Occupancy Sensors and associated wiring shall be deemed included in the Illumination System of respective Buildings.

(iii) SWITCH AND SWITCHBOARD

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

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- b) Switch boards/boxes shall have conduit knock outs on all the sides.
- c) The exact number of Switches including regulator for fans and layout of the same in the switchboard shall be suitable as per the requirement during installation.
- d) The maximum number of luminaries controlled by one no. 6 Amp Switch shall be 8 nos. However each Switchboard shall have minimum 2 Nos. of 6A Switches to control the Luminaries. For DC fixtures there will be no switch and the same shall be directly controlled from DCP.
- e) The Luminaries shall be wired in such a fashion that luminaries on each phase are evenly distributed all over the room.
- f) 6/16A, 240V AC modular flush mounted socket with switch outlet shall be provided in indoor areas like offices, cabins, Switchyard Panel Room etc.
- g) 25A, 240V AC modular flush mounted socket with switch shall be provided at strategic locations in GIS Halls, ACDB/Switchgear room etc.

(iv) CONDUITS & CONDUIT ACCESSORIES

- a) The conduits shall be Rigid PVC conduits of 20/25 /32 mm dia for Lighting, Telephone wiring & LAN Cabling and shall be ISI marked.
- b) Flexible conduits wherever required shall be PVC type.
- c) All conduits accessories shall be ISI marked.
- d) Galvanized Steel Conduits for Surface Conductor (e.g. GIS Hall).

(v) PULL OUT BOXES

- a) The pull out boxes shall be concealed type for indoor lighting and suitable for mounting on column, structures etc., for outdoor lighting. The supply of bolts, nuts and screws required for the erection shall be included in the installation rates.
- b) The pull out boxes shall be circular of minimum 16 SWG sheet steel and shall have cover with good quality gasket lining.
- c) The pull out boxes shall be completed with conduit knock outs/threaded hubs and provided at approximately 3 meters intervals in a conduit run.

(vi) CEILING, WALL MOUNTED & EXHAUST FANS AND REGULATORS

- a) The bidder shall supply and install 1400 mm sweep ceiling fans complete with electronic regulator and board for mounting switch, suspension rod,

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canopy and accessories. The electronic regulator for Ceiling fans will be housed in common switchboard for lighting and shall be of similar make and model as that of modular switches. The wall mounted fans shall be of 400 mm sweep. Exhaust fans shall be of 300mm size.

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

(vii) LIGHTING WIRES

- a) Wiring from Lighting/Sub-Lighting Panels to junction boxes / Switchboards/ fixtures etc. is covered under Lighting Wires. The wiring used for lighting shall be standard products.
- b) The wires shall be of 630V grade (Phase to ground), PVC insulated products.
- c) The conductor sizes for wires used for point wiring beyond lighting panels shall be 1.5 sq.mm, 2.5 sq.mm, 4 sq.mm and 6 sq.mm stranded copper wire as required.
- d) The wires used for connection of a lighting fixture from a nearest junction box or for loop-in loop-out connection between two fixtures shall be single core copper stranded conductor, 630V grade (Phase to ground) flexible PVC insulated cords, unsheathed, conforming to IS:694 with nominal conductor cross sectional areas of 2.5 sq. mm.
- e) The wires shall be colour coded as follows:

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

4.4.5 LADDER

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

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

4.4.6 LIGHTING POLES

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

(i) Type L1 Street Lighting Pole of 6 meter - for SL-L1 type fixture

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- (ii) Type D1 Post top lantern pole of 4 meter - for SI-D1 type fixture
- (ii) "L1" type poles shall be used for street lighting. "D1" type (Decorative post top lantern) poles and Bollards shall be installed In front of control room building, Fire Fighting Buildings as finalized during detailed engineering.
- (iii) Lighting poles shall be complete with fixing brackets. Cable termination box will be built inside the pole itself as per drawing enclosed.
- (iv) Poles and its Cable termination box shall be hot dip galvanized and PU (Polyurethane) coated in Suzuki silver color and inside with bituminous paint.
- (v) Terminal strips provided in street - lighting poles shall be suitable for terminating up to 2 nos. 4C x 16 sq. mm aluminum cables.
- (vi) Wiring from junction box at the bottom of the pole to the fixture at the top of the pole shall be done through 2.5 sq. mm Copper wire laid inside the tubular pole.
- (vii) Distance of center of pole from street edge should be approximately 1000 to 1200 mm or as per site conditions.
- (viii) Earthing of the poles should be connected to the switchyard main earth mat wherever it is available, else, the same should be earthed through 3M long, 20 mm dia, earth electrode.

4.4.7 TYPE TEST REQUIREMENT:

- a) Lighting Panels, Receptacles, Junction Boxes etc. shall conform to following degree of protection:
 - (i) Installed outdoor: IP- 55
 - (ii) Installed indoor in air conditioned area: IP-31
 - (iii) Installed in covered area: IP-52
 - (iv) Installed indoor in non-air conditioned area where possibility of entry of water is limited: IP-41.
- b) Lighting fixtures LED type shall conform to type test requirements of LM-79, LM-80 and TTC.

5 LIGHTING SYSTEM INSTALLATION WORKS

5.1 General

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

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All apparatus, connections and cabling shall be designed so as to minimize risk of fire or any damage which will be caused in the event of fire. All Lighting accessories mentioned in Clause 1.5.4 shall be supplied and erected as a part of Lighting System Installation works. Cost of all Lighting Accessories, Conduit System, Wiring, Cabling work, Foundation & Civil Works is built up in the Cost of the Fixture and no extra payment shall be made for any accessories items for the same.

5.2 Conduit System

- (i) Contractor shall supply, store and install conduits required for the lighting installation as specified. All accessories/fittings required for making the installation complete, including but not limited to pull out boxes (as specified in specification ordinary and inspection tees and elbow, check nuts, male and female bushings (brass or galvanized steel), caps, square headed make plugs, nipples, gland sealing fittings, pull boxes, conduits terminal boxes, glands, gaskets and box covers, saddle terminal boxes, and all steel supporting work shall be supplied by the Contractor. In case of false ceiling surface conduiting is permissible however all down run conduits will be concealed in wall below the false ceiling. The conduit fittings shall be of the same material as conduits. Separate Conduit should be laid for Communication purpose. The contractor shall also supply & install 20 mm PVC conduit and accessories for telephone wiring and LAN Cabling wherever feasible, telephone and LAN cabling can be laid in the same conduit.
- (ii) All unarmored cables/wires shall run within the conduits from lighting panels to lighting fixtures, receptacles, etc.
- (iii) Size of conduit shall be suitably selected by the bidder.
- (iv) Conduit support shall be provided at an interval of 750 mm for horizontal runs and 1000 mm for vertical runs.
- (v) Conduit supports shall be clamped-on spacer plates or brackets by saddles or U-bolts. The spacer plates or brackets in turn, shall be securely fixed to the building steel by welding and to concrete or brick work by grouting or by nylon raw plugs. Wooden plug inserted in the masonry or concrete for conduit support is not acceptable.
- (vi) For directly embedding in soil, the conduits shall be coated with an asphalt-base compound. Concrete pier or anchor shall be provided wherever necessary to support the conduit rigidly and to hold it in place.
- (vii) For long conduit run, pull boxes shall be provided at suitable intervals to facilitate wiring.
- (viii) Conduit shall be securely fastened to junction boxes or cabinets, each with a lock nut inside and outside the box.
- (ix) Conduits joints and connections shall be made through water-tight and rust proof by application of a thread compound which insulates the joints. White

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lead is suitable for application on embedded conduit and red lead for exposed conduit.

- (x) The entire GI conduit system (if used) shall be embedded, electrically continuous and thoroughly grounded. Where slip joints are used, suitable bounding shall be provided around the joint to ensure a continuous ground circuit.
- (xi) Conduits and fittings shall be properly protected during construction period against mechanical injury. Conduit ends shall be plugged or capped to prevent entry of foreign material.

5.3 Wiring

- i) The scope also includes wiring from nearest Lighting/Sub-Lighting Panel to the Controlling Switch/MCB/Lighting Fixtures.
- ii) Wiring shall be generally carried out by PVC insulated wires in conduits. All wires in a conduit shall be drawn simultaneously. No subsequent drawings of wires is permissible.
- iii) Wires shall not be pulled through more than two equivalent 90 deg. bends in a single conduit run. Where required, suitable junction boxes shall be used.
- iv) Wiring shall be spliced only at junction boxes with approved type terminal strip.
- v) For lighting fixtures, connection shall be teed off through suitable round conduit or junction box, so that the connection can be attended without taking down the fixture.
- vi) For vertical run of wires in conduit, wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/junction box.
- vii) Maximum two wires can be terminated to each way of terminal connections.
- viii) Separate neutral wires are to be provided for each circuit.
- ix) AC and DC wiring should run through the separate conduits. Similarly Communication wire/cable shall run in separate conduits.

5.4 Lighting Panels

- i) The lighting panels shall be erected at the locations to be finalized during detailed engineering.
- ii) Suitable foundations/supporting structures for all outdoor type lighting panels shall be provided by the Contractor.
- iii) The Sub lighting Panel shall be provided where independent switch of fixtures are required.

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5.5 General Requirements for Cabling Work

- i) Each cable run shall be tagged with number that appears in the cable schedules. Cables shall be tagged at their entrance and/or exit from any piece of equipment, junction or pull box, floor opening etc.
- ii) The tag shall be made up of aluminum with the number punched on it and securely attached to the cable by not less than two turns of G.I. wire. Cable tags shall be rectangular in shape for power cables and circular shape for control cables.
- iii) Location of cables laid directly under ground shall be indicated clearly by cable marker made of galvanized iron plate embedded in concrete block.
- iv) The location of underground cable joints if any shall be clearly indicated with cable marker with an additional inscription "cable joint".
- v) The marker, which is a concrete block, shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change of direction. It shall also be located on both sides of the road or drain crossing.
- vi) Road crossing of cables through suitable size of GI pipe/Hume pipe as required at site.

5.6 Foundation & civil works

- i) Foundation for street lighting poles and panels shall be done by the Contractor.
- ii) All final adjustment of foundation levels, chipping and dressing of foundation surfaces, setting and grouting of anchor bolts, sills, inserts and fastening devices shall be carried out by the Contractor including minor modification of civil works as may be required for erection.
- iii) Any Cutting of masonry/concrete work, which is necessary shall be done by the Contractor at his own cost and shall be made good to match the original work.

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ANNEXURE-I

BILL OF QUANTITY

Sr. No	Locations	Type & No of Lighting Fixture	With Anti Glare Film over the Fixture(Yes/No)
01.	Control Room cum Administrative Building-Single Storey (As applicable)		
(i)	Control Room	RSQ-I: 10 Nos.	Yes
(ii)	Station- In Charge (DGM Room)	RSQ-I: 4 Nos. and RC-I : 4 Nos.	Yes
(iii)	Administrative Area	RSQ-I: 12 Nos. and RC-I : 9 Nos.	Yes
(iv)	Conference Room	RSQ-I: 9 Nos. and RC-I : 4 Nos.	Yes
(v)	Electrical Room/Telecommunication Room	RSQ-I: 4 Nos. and RC-I : 2 Nos.	Yes
(vi)	ACDB/DCDB Room	SL-I: 16 Nos.	Yes
(vii)	Battery & Battery Charger Room	SL-I: 6 Nos.	Yes
(viii)	Corridor & Reception	SC-I: 8 Nos. and SL-I: 2Nos.	Yes
(ix)	Toilets	SC-I: 8 Nos.	No
(x)	Pantry	SL-I: 2 Nos. and SC-I: 1 No.	Yes
(xi)	Periphery of the Building	BL: 10Nos.	No
02.	Control Room cum Administrative Building- Double Storey (As applicable)		
(i)	Control Room	RSQ-I: 12 Nos.	Yes
(ii)	Station- In Charge (Sr. Officer Room)	RSQ-I: 4 Nos. and RC-I : 2 Nos.	Yes
(iii)	Administrative Area	RSQ-I: 16 Nos. and RC-I : 12 Nos.	Yes
(iv)	Conference Room	RSQ-I: 9 Nos. and RC-I : 5 Nos.	Yes
(v)	Electronic Test Lab/ Telecommunication Room	RSQ-I: 4 Nos.	Yes
(vi)	ACDB Room	SL-I: 16 Nos.	Yes
(vii)	DCDB Room	SL-I: 9 Nos.	Yes
(viii)	Battery & Battery Charger Room	SL-I: 6 Nos.	Yes
(ix)	Store	SL-I: 6 Nos.	No
(x)	Lobby/ Waiting Area	SSQ-I: 5 Nos. and RC-I : 4 Nos.	Yes
(xi)	Toilet	SC-I: 12 Nos.	No
(xii)	Pantry	SL-I: 2 Nos. and SC-I: 1 No.	Yes
(xiii)	Corridors	SC-I: 36 Nos. and SL-I: 6 Nos.	No
(xiv)	Periphery of the Building	BL: 15 Nos.	No
03.	GIS Building*		
(i)	765kV GIS Hall	IHB: 10 Nos. per 100 Sq. meter	No
(ii)	400kV GIS Hall	IHB: 8 Nos. per 100 Sq. meter	No
(iii)	220kV GIS Hall	IHB: 6 Nos. per 100 Sq. meter	No
(iv)	AHU Room	SL-I: 8 Nos. per 100 Sq. meter	Yes
(v)	C&R Room	RSQ-I: 10 Nos. per 100 Sq. meter	Yes
04.	Fire Fighting Pump House		
(i)	FFPH Building	SL-I: 9 Nos.	Yes
(ii)	Periphery of the Building	BL: 4 Nos.	No
05.	Switchyard Panel Room (SPR) (9 meter)	SSQ-I: 10 Nos.	Yes
06.	Switchyard Panel Room (SPR) (6 meter)	SSQ-I: 8 Nos.	Yes
07.	Switchyard and Outdoor Substation Area	FL-1 & FL-2: As per BPS	No
08.	Street lighting roads	SL-LI & SL-DI: As per BPS	No

Sr. No	Items	Quantity & Locations
1.	Ceiling Fans	15 Nos.-ACDB/DCDB Room , Reception, FFPH Building & Staff Room
2.	Wall Mounted Fans	6 Nos. Test Lab, Admin. Area & Control Room
3.	Exhaust Fans	8 Nos. FFPH Building, Pantry & Toilets

For GIS Building (Sl. No.3), based on actual area, the Quantity of Lighting Fixtures shall be supplied as per Pro-rata basis for which Bidder has to include in his offer total Quantity of Lighting Fixtures required for entire area of GIS Building to be constructed under the package.

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ANNEXURE-II

Details of Lighting Fixture

(a) Indoor Application

Sr. No	Technical Specification	SL-1 (Surface Mounted Linear LED Tube with Box)	RL-1 (Recessed Mounted 4 x 1 Feet LED Panel)	SC-1 (Surface Mounted Circular LED Downlight Luminaire)	Type RC-1 (Recessed Mounted Circular LED Downlight Luminaire)	Type SSQ-1 (Surface Mounted 2X2 LED Luminaire)	Type RSQ-1 (Recessed Mounted 2X2 LED Luminaire)	Type IIIB (LED Indoor High Bay)
1	System Wattage	≤ 2 X 20 W	≤ 40 W	≤ 15 W	≤ 15 W	≤ 40 W	≤ 40 W	≤ 150W
2	System Lumen Output	≥ 3600	≥ 3600	≥ 1200	≥ 1200	≥ 3400	≥ 3400	≥ 14000
3	System efficacy (Lumens/Watt)	≥ 100	≥ 100	> 80	> 80	> 85	> 85	≥ 100
4	Housing	CRC A Housing	CRC A Housing	Pressure Die Cast Housing	Pressure Die Cast Housing	CRC A Housing	CRC A Housing	Pressure Die Cast Aluminum Housing
5	Ingress Protection	IP20	IP20	IP20	IP20	IP20	IP20	IP65
6	Surge Protector	2kV	2kV	2kV	2kV	2kV	2kV	4kV (Internal) & 10kV (External)
7	Mounting	Surface Mounted	False Ceiling	Surface Mounted	False Ceiling	Surface Mounted	False Ceiling	Hanging Type under Shed
8	FHD	<10%	<10%	<10%	<10%	<10%	<10%	<10%
9	CRI	≥80	≥80	≥80	≥80	≥80	≥80	≥70
10	CCT	5700K ± 300K	5700K ± 300K	5700K ± 300K	5700K ± 300K	5700K ± 300K	5700K ± 300K	5700K ± 300K
11	Power Factor	>0.95	>0.95	>0.95	>0.95	>0.95	>0.95	>0.95
12	IK Protection	NA	NA	NA	NA	NA	NA	IK-05
13	Operating Humidity	90% RH	90% RH	90% RH	90% RH	90% RH	90% RH	90% RH
14	Burning Hours	50,000	50,000	50,000	50,000	50,000	50,000	50,000
15	Operating Temperature	-5°C to 45°C						
16	Lumen Maintenance	70% at the End of Burning Hours						

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Details of Lighting Fixture

(b) Outdoor Application

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

Section -LIGHTING SYSTEM

Annexure-III

Technical Specification of Grid Interactive Solar PV Power Plant

1.0 Scope of Work

Design, manufacture, supply, erection, testing and commissioning of "Grid Interactive Solar PV Power Plant of PV array capacity 15 kWp over Control Room". This installation shall be a supplement source to ACDB Bus, to save on conventional energy supply from the grid during solar energy generation from the plant. The equipment and materials for grid interactive Solar PV Power Plant of array capacity 15 kWp shall include but not limited to the following:

- a) PV Modules (Crystalline)
- b) Module Mounting Structure and frames
- c) Array Terminal Box
- d) Grid Interactive Inverters
- e) AC Sub Junction Box
- f) Grid interfacing LT Panel
- g) Three Phase Import/ Export Energy Meter
- h) Cable & Wires
- i) Chemical Gel Earthing system
- j) Civil works for Foundation of PV Array
- k) Integration with SAS
- l) Signage (Project Name Plate and caution as per IS)

All civil works associated with the installation & commissioning of PV Array shall have to be done by the Contractor including the necessary structural work. The Solar PV Module will be installed over the Control Room Building while the LT panels Inverters etc will be placed in ACDB Room of Control Room Building. The Contractor shall specify and submit detail GA drawing indicating indoor equipments as well as PV Array.

Special maintenance tools and tackle kits (which are proprietary in nature) as identified by the Contractor and other associated materials and accessories, which is necessary or usual for satisfactory and trouble-free operation and maintenance of the above equipment

2.0 Codes and Standards

All equipment and materials to be furnished under this specification shall be designed, manufactured and tested in accordance with the latest revisions of the relevant Indian Standard (IS)/IEC as applicable.

The electrical installation shall meet the requirement of Indian Electricity Act, and Indian Electricity Rules as amended up-to-date and also the applicable section of the latest revision of the relevant IS Code of Practice.

3.0 Completeness of Supply

It is not the intent to specify completely herein all details of the equipment. Nevertheless, the equipment shall be complete and operative in all aspects and shall

Section -LIGHTING SYSTEM

conform to highest standard of engineering, design and workmanship in order to suit with installation site with optimal output.

Such works, not listed in the schedule of works but required for completion of the project shall be deemed to have been included in the scope of this bid.

4.0 Solar PV Modules

Desired specification of Solar PV module shall include but not limited to the following:

- Total power plant capacity of Solar PV Array shall be 15 kWp
- Cell of the Modules shall be mono or poly crystalline high power silicon cells. The solar cells shall have surface anti-reflective coating to help to absorb more light in all weather conditions
- Each PV module capacity shall be minimum of 300Wp nominal rating (without any negative tolerance)
- The PV modules must qualify the latest edition of relevant IEC 61215 or IS 14286. The module shall also qualify for IEC 61730 for safety qualification: Part 1-requirement for construction and Part-2 requirements for testing. It should also comply IEC 61701 for Salt Mist Corrosion resistant & IEC 62716 for Ammonia Corrosion resistant.
- Photo Electric Conversion Efficiency of SPV module shall not be less than 15.5%
- Fill factor of the module shall not be less than 0.7
- Each module shall have superior light transmission, low iron, tempered & textured glass with anti reflective coating. It shall also have tough multi-layered polymer back sheet for environmental protection against moisture & provide high voltage electrical insulation.
- Solar PV module shall be highly reliable, light weight and shall be designed to have a long service life.
- The rated output of any supplied module shall not vary by more than 3% from average power rating of all ratings. Each module, therefore, has to be tested and rating displayed.
- The solar modules should have suitable encapsulation & sealing arrangements to protect the silicon cells from the environment. The encapsulation arrangement shall ensure complete moisture proofing for the entire life of solar modules.
- Contractor must consider shading losses as per the relevant industry standard & Practice while designing the proposed power plant.
- The bird spike shall be provided to avoid bird sitting on the solar modules at the highest point of the array/module structure.
- The Solar PV modules are to be installed & fixed with the module mounting structures with appropriate size nuts & bolts made with stainless steel.
- It shall perform satisfactory in relative humidity up to 95% and temperature between -40° C to 85° C. It shall be able to withstand wind gusts as per IS-875 (Part-3) as applicable for respective site.
- PV module junction box shall be IP67 protection class as per IEC 529

Section -LIGHTING SYSTEM

- The Contractor shall provide the sample solar PV module electrical characteristics including current-voltage (I-V) performance curves and temperature coefficients of power, voltage and current of the proposed PV Module (s).
- The following information must be mentioned on the Nameplate used on each module :
 - Name of the manufacturer of PV Module
 - Name of the manufacturer of Solar cells
 - Month and year of the manufacture (separately for solar cells and modules)
 - Country of origin (separately for solar cells and module)
 - I-V curve for the module
 - Peak Wattage, I_m , V_m and Fill Factor for the module
 - Unique Serial No. and Model No. of the modules
 - Date and year of obtaining IEC PV module qualification certificate
 - Name of the test lab issuing IEC certificate
 - Other relevant information on traceability of solar cells and module as per ISO 9000.
- Manufacturer of proposed PV modules must have ISO 9001:2008/ ISO 14001 Certification for their manufacturing unit for the said manufacturing item.

5.0 Module Mounting Structure and frames

- Entire system to be placed by providing necessary steel structures properly grouted on the ground. Any damage done to the roof to be made right after the installation.
- The array structure shall be made of hot dip galvanized MS angles or galvanized tubular frame. The minimum thickness of the galvanization shall be as per Section-GIR.
- The structure shall be designed for simple mechanical and electrical installation. It shall support SPV modules at a given orientation, absorb and transfer the mechanical loads to the ground properly.
- The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels. The structure shall be designed to allow easy replacement of any module & shall be in line with the site requirement. Array structure shall also have tilt arrangement to adjust the plane of the array for optimum tilt.
- The module mounting structure shall have to be designed and fabricated with alignment & optimum tilt angle shall be calculated to provide the maximum annual energy output. This shall be decided based on the location of array installation.
- Minimum Ground Clearance of the lowest part of the module structure should be at least 700mm.
- The support structure design & foundation shall be designed to withstand wind gust as per IS -875 (Part-3) for the respective site conditions.

Section -LIGHTING SYSTEM

- All fasteners for supporting conduits, Nut & Bolts shall be of stainless steel (Grade SS 304), supporting structures including module mounting structure shall have to be adequately protected against all climatic condition
- The array structure shall be grounded properly using maintenance free earthing kit. Since Solar PV Module are roof top mounted , all arrangement for grounding is in the scope of the Contractor.

6.0 Array foundation

The legs of the structures shall be made with hot dip GI angles or tubular supports, which shall be grouted on the concrete foundation. The base plate arrangement may be made on RCC blocks. Grade of concrete for all RCC blocks shall be 1:1.5:3 mix.

The minimum ground clearance from the lowest part of any module shall be 700 mm. While making design, due consideration will be given to weight of module assembly, maximum wind gust as per IS -875 (Part-3) for the respective site conditions. The work includes concreting, reinforcement, shuttering etc. as per direction of POWEGRID.

7.0 Array Terminal Box/Array Junction Box/DCDB

- The junction boxes will have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables.
- The array combiner box shall have IP 65 protection level as per IEC 529 and shall be dust and water proof.
- The array combiner box shall be fitted with input and output terminals, surge suppressors and DC MCBs.
- Suitable markings shall be provided on the lugs or bus-bar for easy identification and cable ferrules will be fitted at the cable termination points for identification.
- The mounting of the accessories in the Combiner Box should be DIN Rail type.
- The Junction Boxes shall have suitable arrangement for the followings:
 - Combine groups of modules into independent charging sub-arrays.
 - Provide arrangement for disconnection for each of the groups.
 - Provide a test point for each sub-group for quick fault location.
 - To provide group array isolation.
 - Current carrying rating of the Junction Boxes shall be suitable with adequate safety factor to inter connect the Solar PV array.
- The make of Junction Boxes/associated accessories like surge suppressors, DC MCBs shall be as per acceptability of POWERGRID

The array combiner box and all of its accessories should be such that it is specifically rated/made for the use of PV system as to be declared by the original manufacturer.

Note : Switches/Circuit Breakers/Connectors wherever used must comply to IEC 60947 Part-1,II,III/ EN 50521 towards General requirements Connectors-Safety (AC/DC)

8.0 Grid Connected Inverter Panel

The inverter shall be pure sine wave inverter of high efficiency. Inverters shall have display to show its own parameters along with the parameters of PV array connected to the Inverter. The inverter shall be compatible as On Grid Connected Mode (Synchronization with grid). The proposed inverter must have test certificates /

Section -LIGHTING SYSTEM

reports from any of the NABL/ IEC Accredited Testing Laboratories or MNRE approved test centers. Desired specification of inverter shall include but not limited to the following;

- The inverter shall be highly efficient based on Maximum Power Point Tracking (MPPT) control with IGBT based design. MPPT must be able to extract maximum energy from Solar array and produce 415 V, 3-ph, 50Hz AC to synchronize with the grid through LT panels.
- MPPT controller, inverter and associated control and protection devices etc. all shall be integrated into Inverter. MPPT voltage range shall be compatible with the array voltage.
- The rating of Inverter(s) shall be suitable to meet Solar PV array capacity.
- Inverter shall provide 3 phase, $415 \pm 10\%$ V, $50 \pm 3\%$ Hz supply on AC side with THD<3%.
- DC voltage ripple content shall not be more than 3%.
- Inverter should have built in Module Level Monitoring.
- Rated AC Output Power should be 16000 watt and must have fixed voltage 750V.
- Maximum input voltage should not be less than 900 V.
- Maximum DC Power Module should not be less than 21600 watt.
- Efficiency (Maximum) of Inverter shall not be less than 98% and Euro efficiency (weighted) shall not be less than 97%.
- Degree of protection should not be less than IP-21(in case of Indoor placements) or IP-65 (in case of Outdoor placement) as per IEC 529.
- It shall have protection features such as over voltage, under voltage, Short circuit, over temperature, Over Current, over and under grid frequency protection and Anti islanding protection on AC side.
- The system should be capable of providing all the data including that of meter and Inverter to the central software. All the equipments /hardware /software for complying to the same will be in the Contractor's scope.
- Inverter shall be grid interactive in nature.
- Inverter shall be capable of complete automatic operation, including wake-up, synchronization & shut down. Inverter shall have DSP control and shall operate in sleeping mode, when there is no power connected consuming least power consumption to the extent possible.
- Inverter shall continuously monitor the condition of the grid. In the event of grid failure, it shall resynchronize with system in less than two (2) minutes time after the restoration of grid or DG set.
- The Inverter shall not produce Electromagnetic interference (EMI) which may cause malfunctioning of electronic and electrical instruments including communication equipment, which are located within the facility in which the inverter is housed.
- Inverter shall conform to IEC 61683 standard for efficiency measurements, IEC 60068-2 (1, 2, 14, 30)/ equivalent BIS std. for environmental testing.

Section -LIGHTING SYSTEM

- Inverter to be communicable for remote monitoring through SCADA system. Inverter shall have facility to display basic parameters of the system through LEDs & LCD display.

Display

- Grid Voltage & Frequency
- Export Power
- Import Power
- Cumulative Export and Import Energy

Indications

- Line Status
- Inverter under voltage/ over voltage
- Inverter over load
- Inverter over temperature.

Protections

- Over voltage both at input & output
- Over current both at input & output
- Over/ under grid frequency
- Over temperature
- Short circuit
- Protection against lightning
- Surge voltage induced at output due to external source.

9.0 Power Optimizer

- (i) Power Optimizer must Provide Module Level Monitoring.
- (ii) Efficiency should not be less than 99.5%.
- (iii) Rated DC Input Power should be 700 watt.
- (iv) MPPT Operating range should be within 12.5-105 V.
- (v) Unique Safe DC which ensure rapid shutdown when AC grid turned off.
Safety Output voltage per Power Optimizer should be 1Vdc.
- (vi) It should have real time power measurement characteristic.
- (vii) Short circuit current must be 10.1 A & Output current 15A.

10.0 Power Quality Requirements

- (i) **DC Injection into the grid:** The injection of DC power into the grid shall be avoided by using an isolation transformer or other suitable means at the output of the inverter. It is proposed to limit DC injection within 1% of the rated current of the inverter as per IEC 61727.

(ii) Harmonics on AC side

- (a) The limits for harmonics shall preferably be as stipulated in the CEA Regulations on grid connectivity.

Section -LIGHTING SYSTEM

(b) Voltage Unbalance-The Voltage Unbalance in the grid shall not exceed the permissible limits.

(iii) Voltage Fluctuation

(a) The permissible limit of voltage fluctuation for step changes which may occur repetitively is 1.5%.

(b) For occasional fluctuations other than step changes the maximum permissible limits is 3%.

11.0 Integration with Substation Automation System

Solar PV Plant System shall have provision of following digital inputs for owner's substation automation purpose. These digital inputs shall be made available in the form of potential free contacts to be provided in respective modules. These potential free contacts shall be wired up to respective terminal blocks.

- Monitoring of PV Array/String Power & Energy (Daily/Monthly/Energy).
- Monitoring of Inverter output data like export/ import of Power & energy, power factor etc.

12.0 AC Distribution/Grid Interface Panel

AC power output of the inverter shall be fed to the AC Distribution Board (metering panel & isolation panel) which also houses energy meter.

All the output of Inverter shall be terminated to the Solar AC Panel through MCCB at the incoming bus (Inverter side). The incoming bus shall be connected to ACDB Bus through a MCCB and an Isolator. Output of Solar AC panel shall be terminated at ACDB bus through separate feeders in such a manner that in the event of non availability of one bus/feeder, Solar PV should continue to feed other healthy bus.

13.0 Energy Meter

3 Ø, 4 wire, 415V AC, Import/ Export Energy Meter (0.5 Class accuracy) of suitable current capacity of any reputed make acceptable to POWERGRID. Meter must be provided with the necessary data cables. The Meter to be supplied must be tested from any of the NABL/ BIS Accredited Testing-Calibration Laboratories. It shall also comply with the requirements of CEA Regulations on "Installation and Operation of Meters". The Energy meter shall be installed at the incoming of the Grid interfacing I.T panel.

14.0 Cables & Wirings:

The Specification of wiring material shall include but not limited to the following:

- Rated Voltage for AC/DC cables suitable/ compatible for Installation (AC:0.6/1.1kV, DC:0.9/1.5kV)
- Temp. Range (-)10°C to (+)85°C
- Will comply IEC 60502/ IS 7098 General Test and Measuring Method XLPE cables for working voltage up to and including 1100 V and UV resistant for outdoor installation]

Section -LIGHTING SYSTEM

- Excellent resistance to Heat, Fire, Oil, cold, water, abrasion, UV radiation
- Flexible
- i) All cables except the cable from Solar panel to DC junction box i.e. solar cable must be armored.
- ii) Conductor size of cables and wires shall be selected based on efficient design criteria such that the overall electrical energy loss in any section of cable or wire is not more than 3% under the designed operating conditions. Also wiring size of PV array shall be designed such that maximum voltage drop at full power from the PV modules to Inverter should be less than 3%.
- iii) Cable terminations shall be made with suitable cable lugs & sockets etc, crimped properly and cables shall be provided with dry type compression glands wherever they enter junction boxes/ panels/ enclosures at the entry & exit point of the cubicles. The panels bottoms should be properly sealed to prevent entry of snakes/lizard etc. inside the panel. All cables shall be adequately supported. Outside of the terminals / panels / enclosures, shall be protected by conduits. Cables and wire connections shall be soldered, crimp-on type or thimble or bottle type.
- iv) Only terminal cable joints shall be accepted. Cable joint to join two cable ends shall not be accepted.
- v) The cable must be laid through PVC conduit or metallic pipe. In case of using metallic pipe as conduit proper grounding of the conduit must be done.
- vi) All cable/wires shall be marked with good quality letter and number ferrules of proper sizes so that the cables can be identified easily.
- vii) All cable shall be suitably marked or coded for easy identification. Cables and wires shall confirm to the relevant standards like IS etc.
- viii) Cable tray (metallic preferably aluminum) of suitable size must be used for laying of cable wherever required to protect cable from physical damage.
- ix) All fasteners shall be made of Stainless steel.

14.1 Lightning & Over Voltage Protection

- SPV Power Plants will be provided with Lightning and Over Voltage Protection connected to proper earth mats.
- The Lightning conductors shall be provided as per Indian Standards (IS) in order to protect the entire Solar Array yard from Lightning strikes.
- Necessary concrete foundation for holding the lightning arresters in position will be made after giving due consideration to maximum wind speed.
- Lightning arresters shall be earthed through flats and connected to earth mats as per applicable IS with Chemical Gel earth pits.
- Necessary Masonry enclosure with proper protection of the earth pit to be provided.

14.2 Earthing

- The complete Solar PV power Plant with all its accessories will be grounded, so that in the event of a lightning strike or utility over voltage, current will find a safe path to earth. Note that a separate grounding would be provided for this purpose, separate from the one used for lightning conductor.
- Solar PV array structure shall be grounded properly as per IS standard.

Section -LIGHTING SYSTEM

- The earth conduction shall run through appropriate pipes partly buried and partly on the surface. The complete earthing system shall be mechanically & electrically connected to provide independent return path to earth

15.0 Signage:

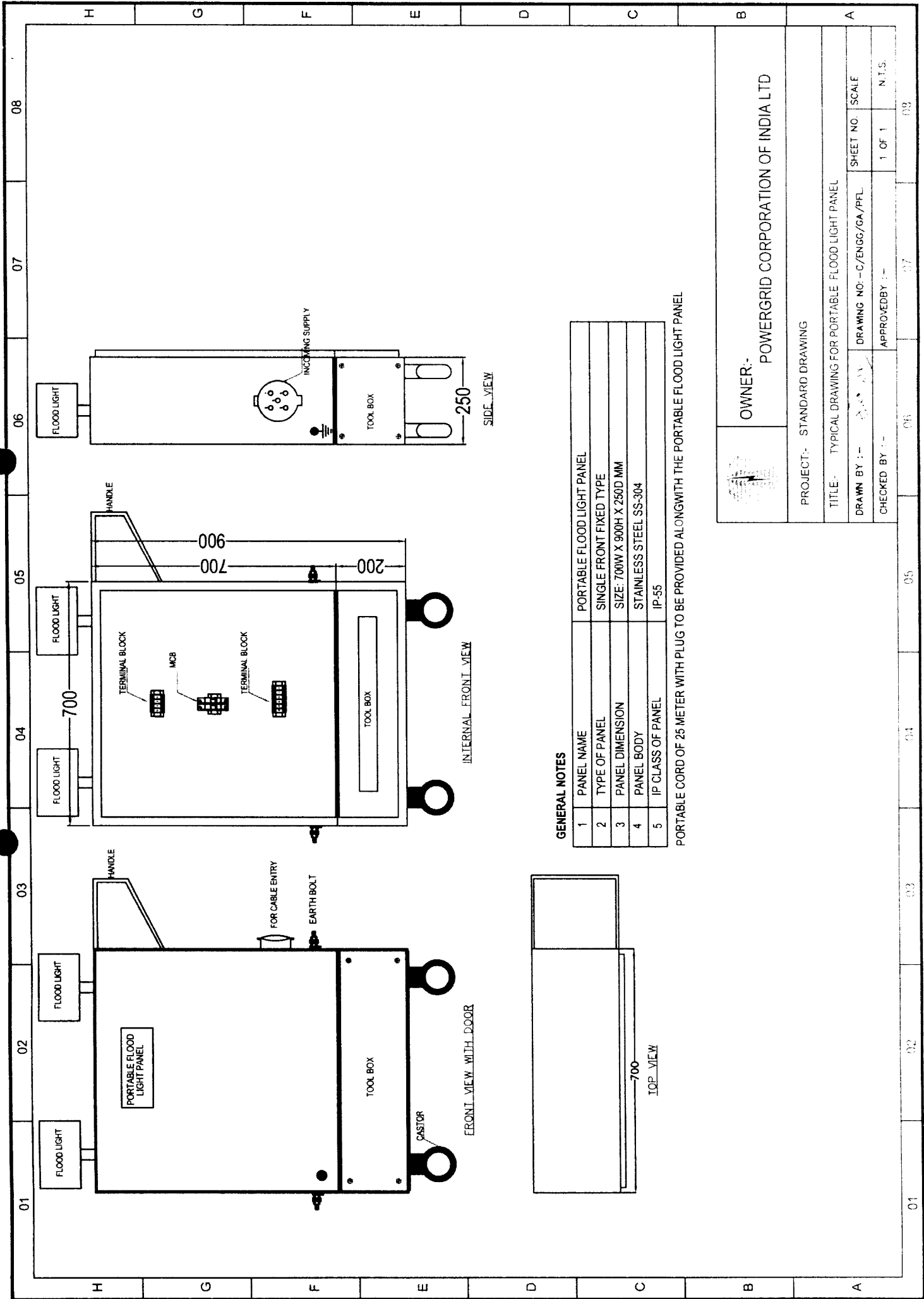
Project information Signage: The Signage shall be made up of rust free steel or equivalent materials of minimum size 3'x 2'. The Signage provide with detail of the project as approved by POWERGRID. The signage shall be prominently embossed

Safety Signage: Safety Signage must be provided mentioning the level and type of voltage and symbols as per IE Rule at different position as may be required.

16.0 Provision for Module Cleaning

Plumbing: For cleaning of the PV Modules, plumbing work should be done in tune with the existing pipeline, so that water is easily available near the PV modules for cleaning the PV Modules.

Module Cleaning: Necessary equipment is to be provided to facilitate easy cleaning of the PV Modules.



GENERAL NOTES

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

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



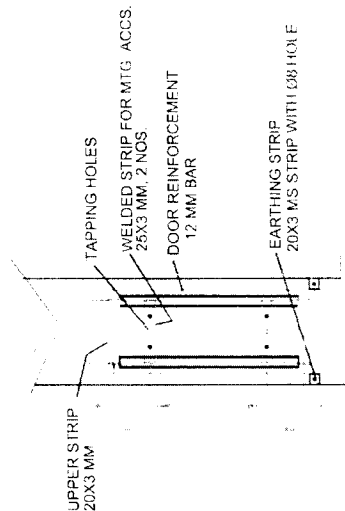
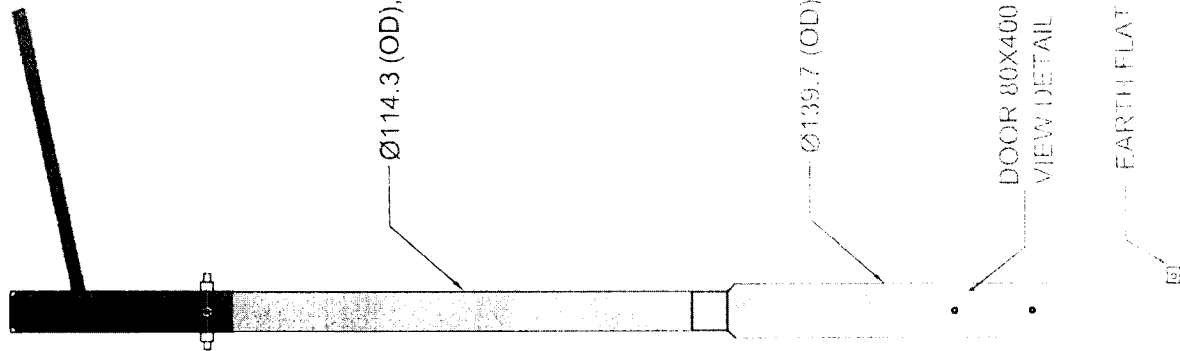
OWNER:-

POWERGRID CORPORATION OF INDIA LTD

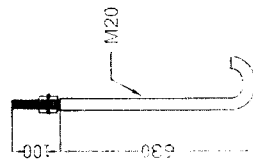
PROJECT:- STANDARD DRAWING

TITLE:- TYPICAL DRAWING FOR PORTABLE FLOOD LIGHT PANEL

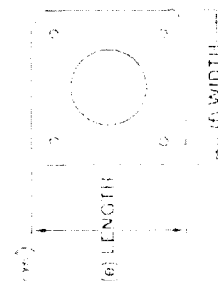
DRAWN BY :-	DRAWING NO:- C/ENGG/GA/PFL	SHEET NO	SCALE
CHECKED BY :-	APPROVED BY :-	1 OF 1	N.T.S.



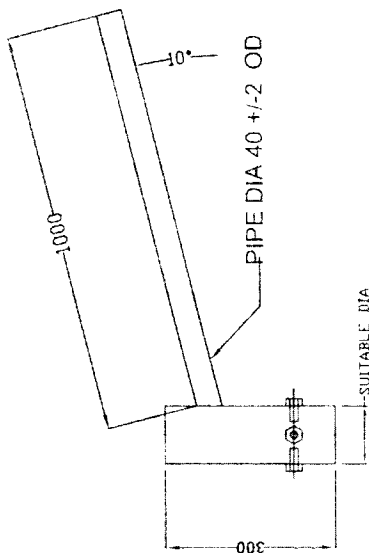
DETAIL - B
(AFTER REMOVE DOOR COVER)



FOUNDATION BOLT IS J-TYPE
WITH HARDWARE



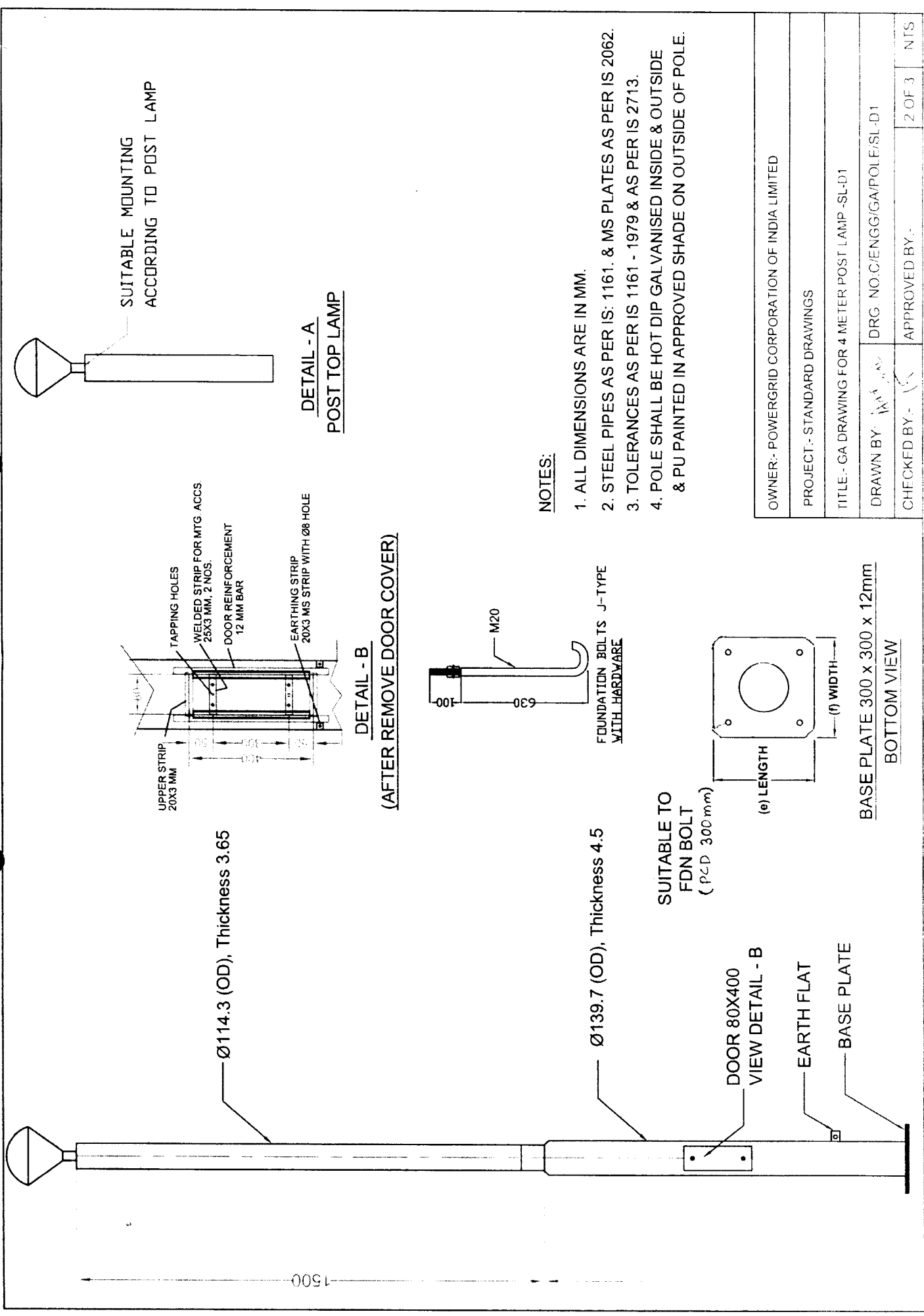
BASE PLATE 500 x 200 x 12mm
VIEW DETAIL B



SINGLE ARM BRACKET

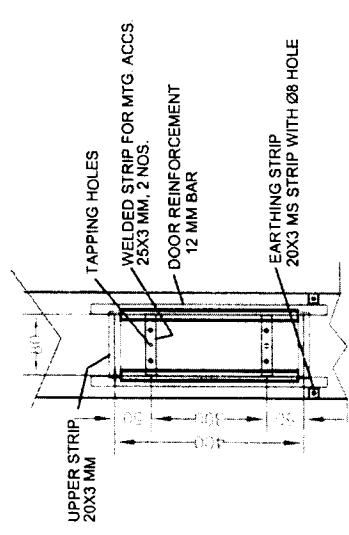
NOTES:

1. ALL DIMENSIONS ARE IN MM
2. STEEL PIPES AS PER IS 1161 & MS PLATES AS PER IS 2062
3. TOLERANCES AS PER IS 1161 - 1979 & AS PER IS 2/13.
4. POLE SHALL BE HOT DIP GALVANISED INSIDE & OUTSIDE & PU PAINTED IN APPROVED SHADE ON OUTSIDE OF POLE

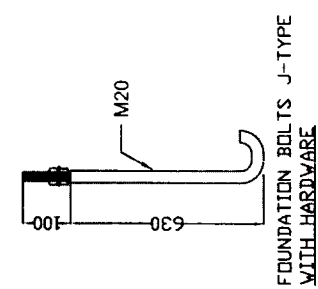


SUITABLE MOUNTING
ACCORDING TO POST LAMP

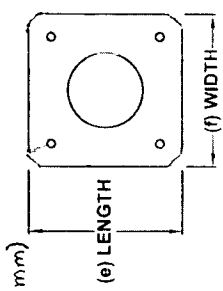
DETAIL - A
POST TOP LAMP



DETAIL - B
(AFTER REMOVE DOOR COVER)



SUITABLE TO
FDN BOLT
(PCD 300mm)



BASE PLATE 300 x 300 x 12mm
BOTTOM VIEW

DOOR 80X400
VIEW DETAIL - B

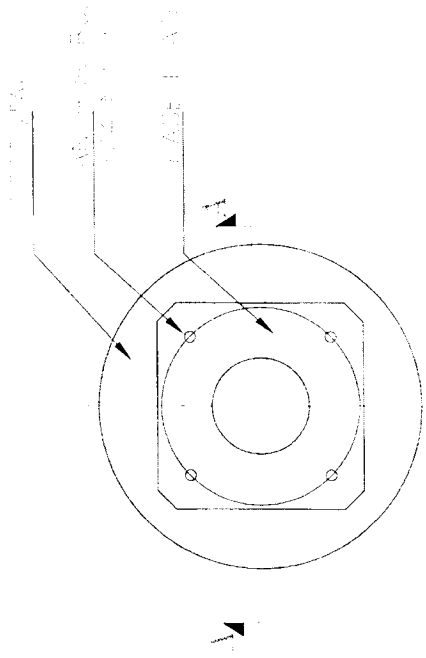
EARTH FLAT

BASE PLATE

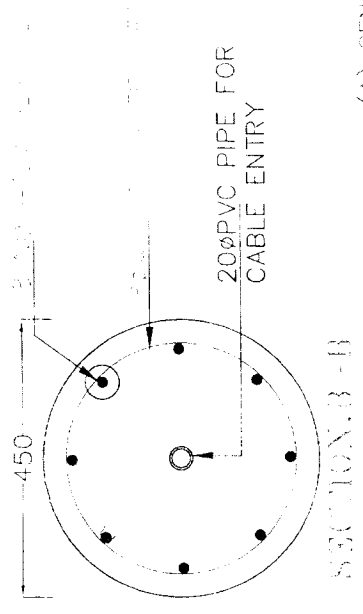
NOTES:

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

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



PLAN



(A) GENERAL NOTES:

1. THE CABLE ENTRY SHALL BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (NEC) AND THE NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) STANDARDS.

2. THE CABLE ENTRY SHALL BE INSTALLED IN A LOCATION THAT IS ACCESSIBLE TO THE OPERATOR AND SHALL BE PROTECTED FROM PHYSICAL DAMAGE.

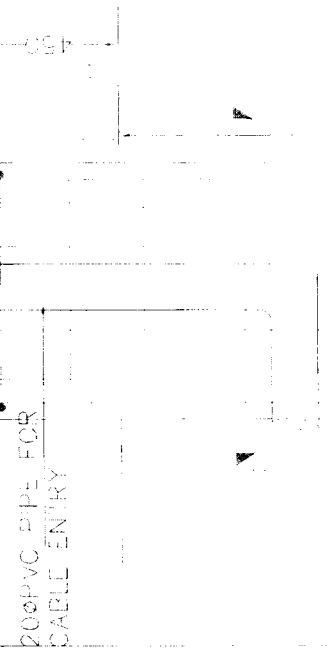
3. THE CABLE ENTRY SHALL BE INSTALLED IN A LOCATION THAT IS PROTECTED FROM WEATHER AND OTHER ENVIRONMENTAL CONDITIONS.

(B) SPECIFICATION NOTES FOR 200PVC PIPE:

1. THE PIPE SHALL BE MADE OF POLYVINYL CHLORIDE (PVC) AND SHALL BE 200MM IN DIAMETER.

2. THE PIPE SHALL BE INSTALLED IN A LOCATION THAT IS PROTECTED FROM PHYSICAL DAMAGE AND SHALL BE SUPPORTED BY A RIGID SUPPORT.

3. THE PIPE SHALL BE INSTALLED IN A LOCATION THAT IS PROTECTED FROM WEATHER AND OTHER ENVIRONMENTAL CONDITIONS.



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2. THE CABLE ENTRY SHALL BE INSTALLED IN A LOCATION THAT IS ACCESSIBLE TO THE OPERATOR AND SHALL BE PROTECTED FROM PHYSICAL DAMAGE.

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Sl. No.	DESCRIPTION	UNIT	Tumkur (Pavagada) (Qty.)	Mysore (Qty.)	Tumkur (V'pur) (Qty.)	Total Qty.
1	Supply of Lighting Fixture Type-SSQ-I	Nos.	24	10	8	42
2	ETC of Lighting Fixture Type-SSQ-I	Nos.	24	10	8	42
3	Supply of Modular switchboard with 4 Nos. 5A switches and 1 no. 6/16A socket	Nos.	6	2	2	10
4	ETC of Modular switchboard with 4 Nos. 5A switches and one no. 6/16A socket	Nos.	6	2	2	10
5	Supply of Receptacle 6/16A, 240V AC	Nos.	6	2	2	10
6	ETC of Receptacle 6/16A, 240V AC	Nos.	6	2	2	10
7	Supply of 32A DPMCB with Receptacle for split AC supply	Nos.	6	2	2	10
8	ETC of 32A DPMCB with Receptacle for split AC supply	Nos.	6	2	2	10
9	Supply of Lighting Panel type ACP-2 as per technical specification	Nos.	4	2	2	8
10	ETC of Lighting Panel type ACP-2 as per technical specification	Nos.	4	2	2	8
11	Supply of Sub Lighting panel (outdoor) type SLP	Nos.	8	4	4	16
12	ETC of Sub Lighting panel (outdoor) type SLP	Nos.	8	4	4	16
13	SUPPLY of Outdoor Junction boxes with 4-way knockouts suitable for loop-in loop-out upto 4Cx16 sq. mm. Al conductor and tap off of two nos 4Cx16 Sqmm Al Cable or as per requirement	Nos.	40	12	15	67
14	ETC of Outdoor Junction boxes with 4-way knockouts suitable for loop-in loop-out upto 4Cx16 sq. mm. Al conductor and tap off of two nos 4Cx16 Sqmm Al Cable or as per requirement	Nos.	40	12	15	67
15	Supply of Outdoor Power Receptacle for oilfiltration unit (400A)	Nos.	2	1	0	3
16	ETC of Outdoor Power Receptacle for oilfiltration unit (400A)	Nos.	2	1	0	3
17	Supply of Lighting Fixture Type-FL-1	Nos.	15	10	5	30
18	ETC of Lighting Fixture Type-FL-1	Nos.	15	10	5	30
19	Supply of Lighting Fixture Type-FL-2	Nos.	160	65	50	275
20	ETC of Lighting Fixture Type-FL-2	Nos.	160	65	50	275
21	Supply of rigid PVC conduit of 20/25/32mm size with accessories	Mtr.	150	50	50	250
22	ETC of rigid PVC conduit of 20/25/32mm size with accessories	Mtr.	150	50	50	250
23	Supply of Galvanized rigid steel conduit of 20/25/32mm size with accessories	Mtr.	75	25	25	125
24	ETC of Galvanized rigid steel conduit of 20/25/32mm size with accessories	Mtr.	75	25	25	125
25	Supply of 1C, 1.5/1C, 2.5 sqmm PVC insulated stranded Cu. Wire	Mtr.	300	100	100	500
26	ETC of 1C, 1.5/1C, 2.5 sqmm PVC insulated stranded Cu. Wire	Mtr.	300	100	100	500
27	Supply of 1C, 4/1C, 6 sqmm PVC insulated stranded Cu. Wire	Mtr.	300	100	100	500
28	ETC of 1C, 4/1C, 6 sqmm PVC insulated stranded Cu. Wire	Mtr.	300	100	100	500
29	Laying, Testing & Commissioning of 2C, 2.5 sqmm PVC insulated, Armoured Cu. Cable	Mtr.	3500	1500	1200	6200
30	Laying, Testing & Commissioning of 2C, 6 sqmm PVC insulated, Armoured Al. Cable	Mtr.	500	500	500	1500
31	Laying, Testing & Commissioning of 4C, 16 sqmm PVC insulated, Armoured Al. Cable	Mtr.	500	500	500	1500
32	Supply of 50 mm PVC conduits	Mtr.	250	100	150	500
33	Laying of 50 mm PVC 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.	250	100	150	500
34	Supply of 100 mm PVC conduits	Mtr.	250	100	150	500
35	Laying of 100 mm PVC 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.	250	100	150	500
36	Construction of Pull Pit Boxes of sizes 400mmx400mmx400mm at the free ends and turning of PVC pipes if pipe length exceeds 4M	No.	5	3	3	11
37	Supply of 35x6 mm GI Flat for earthing.	Mtr.	150	50	100	300
38	Earthing using 35x6 mm GI Flat	Mtr.	150	50	100	300
39	Supply of 25x3 mm GI Flat for earthing.	Mtr.	150	50	100	300
40	Earthing using 25x3 mm GI Flat	Mtr.	150	50	100	300
41	Earthing using 40 mm dia. MS Rod Electrodes (provided by BHEL)	No.	5	5	5	15
42	Earthing using 50x6mm GI Flat (provided by BHEL)	Mtr.	150	50	100	300
43	Earthing using 75x12mm GI Flat (provided by BHEL)	Mtr.	100	50	75	225
44	Supply of 16 SWG GI Wire (For earthing of Lighting fixtures, switches conduits etc.)	Mtr.	750	250	500	1500
45	Earthing of Fixtures etc. using 16 SWG GI Wire	Mtr.	750	250	500	1500
46	Supply of 12 SWG GI Wire (For earthing of Power receptacles Junction Boxes etc.)	Mtr.	250	100	150	500
47	Earthing of Fixtures, Exhaust Fans etc. using 12 SWG GI Wire	Mtr.	250	100	150	500
48	Services - Lux measurement at site	Lot	1	1	1	3

Notes:-

- The above quantities(BOQ) are as per preliminary design only. The detail design will be submitted by Vendor and subject to approval by Customer. The BOQ quantities which are finalised after approval has to be supplied. BHEL reserves the right for quantity variation due to any reason upto $\pm 30\%$ of total value at same unit rate and terms during execution of contract. The quantity of individual items may however vary upto any extent.
- ETC items mentioned above are deemed to be inclusive of all the materials required for the erection of the item mentioned in supply i.e.
For Outdoor works: As per Cl. No. 5, Annexure-1, Section-1 including Aluminium flat, GI Bolt with nut and washer for fixing outdoor lighting panels, GI Bolt with nut and washer for fixing control gear boxes, GI Bolt with nut and washer for fixing outdoor JB's, SLP, GI Bolt with nut and washer for fixing outdoor lighting fixtures, Mounting brackets for lighting fixtures etc.
For Indoor works: As per Cl. No. 5, Annexure-1, Section-1 including 4-way PVC circular JB (20/25/32mm), Heavy duty saddle with base (20/25/32mm), Heavy duty saddle without base (20/25/32mm), M4X25mm steel screw with nut and washer, GI check nut/ lock nut (20/25/32mm), PVC Rawl plug (6mm), Wooden screw (35mm), Earth clip/ clamp(20mm and 25mm), Cleat fabrication out of 25x6mm MS flat (for hanging conduit in false ceiling areas, Anchor fastner (M10x75mm for cleats, M12x75mm for lighting panels), Rubber bush (20mm and 25mm), 20mm PVC flexible conduit, 20mm PVC Coupling Swing out braket, 20mm Heavy duty ball socket, Machine screw (for fixing surface mounting fixtures on circular JB), PVC closure (20mm and 25mm), Reducer (20mm and 25mm) etc.
- All fixtures shall be as per Customer Specification (Annexure-1 of Section-1).



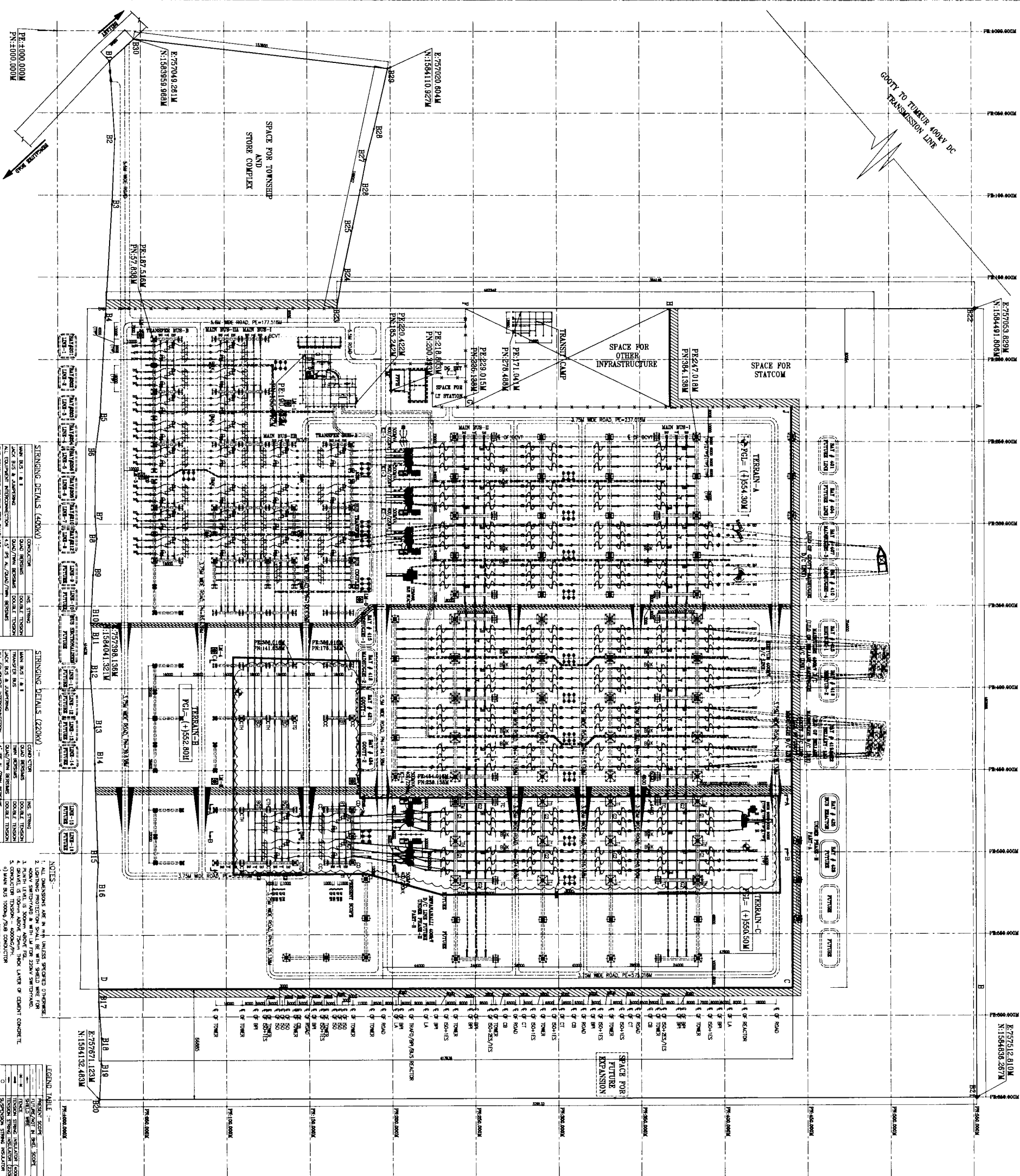
SI. No.	DESCRIPTION	UNIT	Tumkur (Pavagada) (Qty.)	Mysore (Qty.)	Tumkur (V'pur) (Qty.)	Total Qty.
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4 All Boards/ LPs shall be as per Customer Specification, unless otherwise explicitly specified.

5 Minor civil works are deemed to be included in erection rates of respective items.

6 Extra items, if required for completion of work as per specification but not covered above, shall be quoted separately as a list of items and same shall be submitted with the bid (price of supply and ETC to be quoted on Lumpsum basis).





ITEM CODE	DESCRIPTION	SYMBOL	QTY.
1	500 WVA 400/170/230V 3- ϕ AUTO TRANSFORMER		02
2	4230V 125MMVA BUS REACTOR (3- ϕ)		01
3	4230V 2500MVA 1/3 CIRCUIT BREAKER WITHOUT P&H (WITH CS2) (3- ϕ)		03
4	4230V 3150A 500MVA CIRCUIT BREAKER WITHOUT P&H (WITH CS2) (3- ϕ)		01
5	4230V 3150A 500MVA 1/3 CIRCUIT BREAKER WITH P&H (WITH CS2) (3- ϕ)		01
6	4230V 2500MVA 1/3 HOB SOLATOR WITH P&H (WITH CS2) (3- ϕ)		09
7	4230V 3150A 500MVA 1/3 HOB SOLATOR WITH 1 E/S (3- ϕ)		05
8	400V 3000VA 6 CORE 500MVA/1/3 CT (1- ϕ) (WITH 225% EXTENDED CURRENT RATING)		15
9	230V 220MVA 225% AMPLIFIER (1- ϕ)		09
10	4230V POST INSULATOR		23

ITEM CODE	DESCRIPTION	SYMBOL	QTY.
1	240W, 1800A, 400V/1-POLE CIRCUIT BREAKER (3-IN)	4 4	02
2	240W, 1800A, 400V/1-POLE ISOLATOR WITH 2 (1/2) (3-IN)	4 4	02
3	240W, 1800A, 400V/1-POLE ISOLATOR WITH 1 (1/2) (3-IN)	4 4	02
4	240W, 1800A, 400V/1-POLE ISOLATOR W/OUT W/OUT (1/2) (3-IN)	4 4	04
5	240W, 1800V/1-5 CORE, 400V/1-CT (1-1/2) WITH 120% EXPOSED CIRCUMF. RATING	●	06
6	216W SHUNT ARRESTER (1-IN)	●	06
7	240W POST INSULATOR (HIGH LEVEL)	●	06
8	240W POST INSULATOR	●	20

SYSTEM PARAMETERS :-			
1. NOMINAL SYSTEM VOLTAGE	400V	220V	
2. HIGHEST SYSTEM VOLTAGE	420V	234V	
3. RATED FREQUENCY	50Hz	50Hz	
4. RATED SHORT MVA CURRENT FOR 1 SEC	5000	4000	
5. SHORT CIRCUIT MVA	5000MVA	4000MVA	
6. 20KV SHORT CIRCUITING VOLTAGE	40KV	40KV	
7. MINIMUM CREEPING (25MM/M)	1.050MM	4.000MM	
8. SYSTEM ELECTRICAL LENGTH	0.000MM	6.125MM	
9. SYSTEM ELECTRICAL LENGTH	0.000MM	0.000MM	

MINIMUM CLEARANCE (mm)	400W	220W
PHASE TO PHASE (pp)	400V / 4200mm	2100mm
PHASE TO EARTH (pe)	21000mm	21000mm
SECTION CLEARANCE (ss)	65000mm	59000mm
WEIGHT OF TRAIL CENTRE LINE OF FIRST LEVEL (kN/m)	80000mm	59000mm
(FROM PLUNTH LEVEL)		

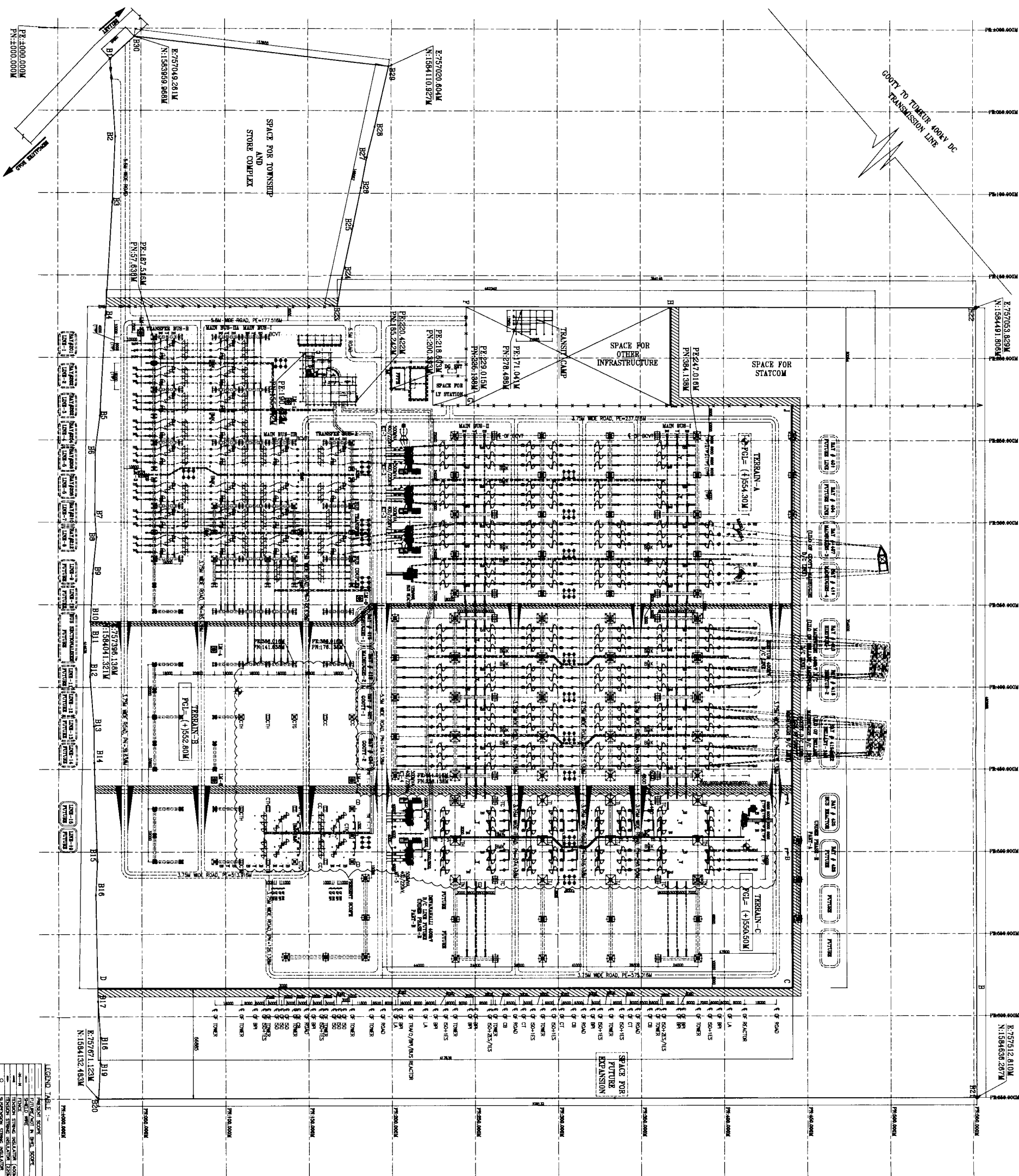
DETAILS OF TOWERS / BEAMS : 400KV				
S.NO.	STR DESIGNATION	STR HT/SP/N	QTY.	
1	TC	15M	02	04
2	TH	22M+1.5M	02	02
3	T	22M+1.5M	02	02
4	T	22M+1.5M	04	04
5	TM	15M+7M+1.5M	02	02
6	TM	15M+7M+1.5M	02	02
7	G1	24M	04	04
8	G2	24M	08	08

DETAILS OF TOWERS/BEAMS : 245w			
S.NO.	SIR DESIGNATION	SIR -H/SPIN	QTY.
1	CC	11.7M	04
2	C/C	11.7M+4.5M+3M	02
3	C/C	11.7M	03
4	C/H	11.7M	06
5	C/C	11.7M+4.5M+3M	01
6	B/C1	15M	06
7	B1	16M	03
8	L/M	50M	02

REF. NO.	TITLE
C/ENOC/55/5N/5R-1/7/10/10/10-EXT/400V-SEC./001, NO. 400V LATOUT SECTION (TYPICAL)	
C/ENOC/55/5N/5R-1/7/10/10/10-EXT/1A/001, R1	LAYOUT PLAN (TYPICAL)
C/ENOC/55/5N/5R-1/7/10/10/10-EXT/1A/001, R2	
C/ENOC/55/5N/5R-1/7/10/10/10-EXT/1A/001, R2	GENERAL ARRANGEMENT DRAWING
TR-0-335-318-001	SINGLE LINE DIAGRAM FOR 400/220V

[illegible]

[illegible]



LEGEND TABLE

SYMBOL	DESCRIPTION
(Symbol)	SHIELDING
(Symbol)	GROUNDING
(Symbol)	INSULATION
(Symbol)	CONNECTION
(Symbol)	TERMINATION
(Symbol)	PROTECTION
(Symbol)	WARNING
(Symbol)	NOTES

NOTES

1. ALL DIMENSIONS ARE IN MM. UNLESS SPECIFIED OTHERWISE.
2. EXISTING CABLE ROUTES SHALL BE EXTENDED FOR 400V/220V TRANSFORMER BAYS UNDER DESIGN SCOPE.
3. OPENINGS FOR TANKS OR PIPES TO EQUIPMENT SHALL BE PROVIDED IN CABLE TRENCHES.
4. PNC PIPES SHALL BE 250MM BORE WITH FINISHED INSULATION LEVEL.
5. PNC PIPES SHALL BE LAYED IN MULTILAYER ON CABLE SUPPORT (ANGLES).
6. CABLE SUPPORT SHALL BE PROVIDED AT EVERY 100M INTERVAL.
7. CABLES MUST BE BURIED AT EVERY 100M INTERVAL FOR TANK CABLE SUPPORT.
8. TRENCH SPECIFICATION SHALL BE LAYED IN TOP TRENCHES AND BOTTOM TRENCHES, AS PER TECHNICAL SPECIFICATION.
9. BURIED CABLES SHALL BE DONE AS PER SPECIFICATION (INSTALLATION OF CABLES).
10. BURIED CABLES FOR LIFTING PURPOSES SHALL BE AS PER LIFTING LAYOUT.
11. BURIED CABLES SHALL BE LAYED IN TRENCHES BEFORE INSTALLATION OF CABLES.
12. FOR POWER & CONTROL, SEPARATE PIPES SHALL BE USED CONSIDERING AIR AND FOR EACH PIPE (E.G. 400V RATING CABLES).
13. INDICATE CABLES LAY IN PNC PIPES OF 50/100MM OUTER DIA AT DEPTH OF 300MM (MAX).
14. CABLE FROM EQUIPMENT TO CABLE TRENCH SHALL RUN IN PNC PIPES.
15. CABLES SHALL BE INDICATED IN THE RESPECTIVE CABLE DRAWINGS.
16. CABLES SHALL BE SECURELY FIRED AT BOTH ENDS, EITHER EMBEDDED IN CONCRETE OR PROPERLY CLAMPED.
17. AFTER LAYING THE CABLES THE ENDS OF PIPES SHALL BE FULLY SEALED TO PREVENT INGRESS OF WATER INSIDE THE PIPE.
18. CABLE TRENCH SHALL BE PROVIDED ON WATERSHED BOX SIDE OF EQUIPMENT.
19. PNC TO BE USED AS CABLE TRENCH FOR CABLE TRENCHES.
20. FOR EJECTION OF CABLE BACKS AT SITE.
21. CABLE BACK AND SUPPORTS SHALL BE TANKED AFTER INSTALLATION WITH 2 COATS OF WATER PROOF COAT OF ALUMINUM PAINT.
22. CABLE BACK SHALL BE DONE ORIGINATE IN A STAINLESS STEEL TRENCH/FOLLOWED BY TWO THINNING COATS OF ALUMINUM PAINT.
23. INDICATES BRICK WALL SHALL BE PROVIDED IN TRENCH WHERE FUTURE TRENCH/EQUIPMENT PIPE TERMINATED IN PRESENT SCOPE OF TRENCH.
24. SURFACE SHALL BE INDICATED BY REDUCED WHERE CABLE SHALL BE LAYED IN PNC PIPE.
25. CABLES SHALL BE LAYED IN TRENCHES AFTER INSTALLATION WITH 2 COATS OF WATER PROOF COAT OF ALUMINUM PAINT.
26. CABLES SHALL BE LAYED IN TRENCHES AFTER INSTALLATION WITH 2 COATS OF WATER PROOF COAT OF ALUMINUM PAINT.
27. FOR ALL CABLE WORKS EXECUTION POWER DRIP APPROVED/RELEASED PIPES SHALL BE FOLLOWED.
28. CABLES SHALL BE USED SHALL BE CLASS-A AS PER IS-4483 BY SURFACE CAP.
29. INDICATES CABLE SHALL BE LAYED IN TRENCHES AFTER INSTALLATION WITH 2 COATS OF WATER PROOF COAT OF ALUMINUM PAINT.
30. CABLES SHALL BE LAYED IN TRENCHES AFTER INSTALLATION WITH 2 COATS OF WATER PROOF COAT OF ALUMINUM PAINT.
31. CABLES SHALL BE LAYED IN TRENCHES AFTER INSTALLATION WITH 2 COATS OF WATER PROOF COAT OF ALUMINUM PAINT.
32. INDICATE PNC CABLE.

REFERENCE DWG :-

DWG. NO.	TITLE
TR-0-303-315-002	LAYOUT PLAN & SECTION ELEVATION FOR 400/220V TRANSFORMER BAY S/A EXTN.
TR-0-303-315-001	SINGLE LINE DIAGRAM FOR 400/220V TRANSFORMER BAY S/A EXTN.
TR-0-303-315-001	SWITCHBOARD CABLE TRENCH LAYOUT FOR 400/220V TRANSFORMER BAY S/A EXTN.

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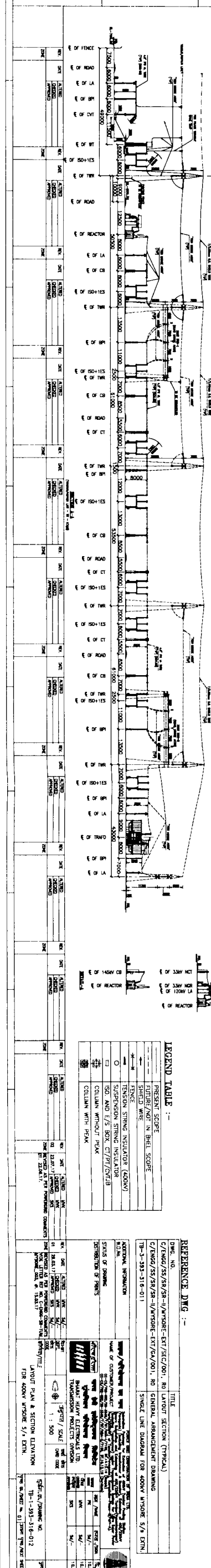
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ADDITIONAL INFORMATION		THIS IS THE COMPANY'S OF THIS TYPE OF THE COMPANY'S OF THIS	
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S. NO.	S/R DESIGNATION	S/R HT/SPAN	QTY.
1	TO	22M x 7.5M	02
2	TH	22M x 7.5M	01
3	CI	24M	02

LINE-8 (FUTURE)	LINE-3 (FUTURE)	LINE-1	LINE-2	BUS COUPLER	IBC	LINE-5	LINE-7	LINE-6 (FUTURE)	LINE-4 (FUTURE)	LINE-9 (FUTURE)
	IC1-2	IC1-1								



NATURAL FINISHANCE TABLE	400x4
PHASE TO PHASE (PP)	400x4 / 4200mm
PHASE TO EARTH (PE)	3500mm
SECTION CLEARANCE (CS)	6500mm
HEIGHT OF THEE CEMENT LINE OF FIRST LEVEL (M ₁)	8000mm
(FROM PLANT LEVEL)	

STRINGING DETAILS :-

1. JAW BUS & II	CONDUCTOR	N/S STRING
2. JAW BUS & JUMPING	GLAD MOOSE	
3. ALL EQUIPMENT INTERCONNECTION	GLAD MOOSE	DOUBLE TENSION
4. BAR CONDUCTOR SPACING THE GLAD	4.5" mm AL (GLAD) / N/A MOOSE	
5. BAR CONDUCTOR SPACING THE TWIN	150 mm	
6. LATHING	10.95MM DIA GS WIRE	

1.	NOMINAL SYSTEM VOLTAGE	400V
2.	HIGHEST SYSTEM VOLTAGE	420V
3.	RATED FREQUENCY	50Hz
4.	RATED SHORT TIME CURRENT FOR 1 SEC	400A
5.	RATED FULL WAVE WAVEFORM VOLTAGE	1.5500V
6.	IPDY AMPLITUDE WITH-STAND VOLTAGE	6.5000V (+ve & -ve)
7.	WINDING CAPACITANCE (25uV/MV)	10500uM
8.	SYSTEM NEUTRAL EARTHING	EFFECTIVELY GAPPED

MINIMUM CLEARANCE TABLE	400mm
PHASE TO PHASE (P-P)	4000/4200mm
PHASE TO EARTH (P-E)	3500mm
SECTION CLEARANCE (SC)	6500mm
HEIGHT OF TUBE CENTRE LINE OF FIRST LEVEL (MIN.) (FROM PLUMB LEVEL)	8000mm

MAIN BUS I & II	CONDUCTOR	INS. STRING
JACK BUS & JUMPERING	QUAD MOOSE	DOUBLE TENSION
ALL EQUIPMENT INTERCONNECTION	QUAD/TWIN MOOSE	DOUBLE TENSION
ALL EQUIPMENT INTERCONNECTION	4.5 IPS AL./QUAD/TWIN MOOSE	
SUB CONDUCTOR SPACING FOR QUAD	450 mm	-
SUB CONDUCTOR SPACING FOR TWIN	450 mm	-
EARTHING	10.93MM DIA CS WIRE	

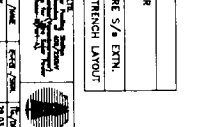
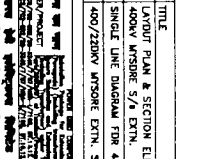
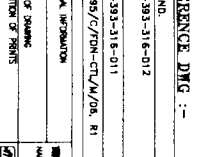
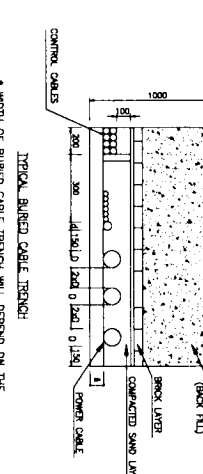
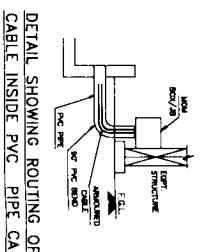
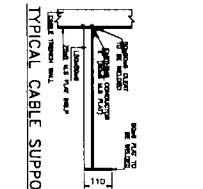
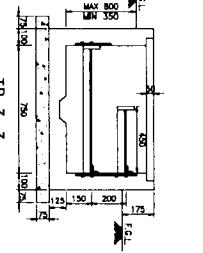
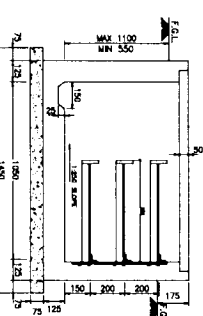
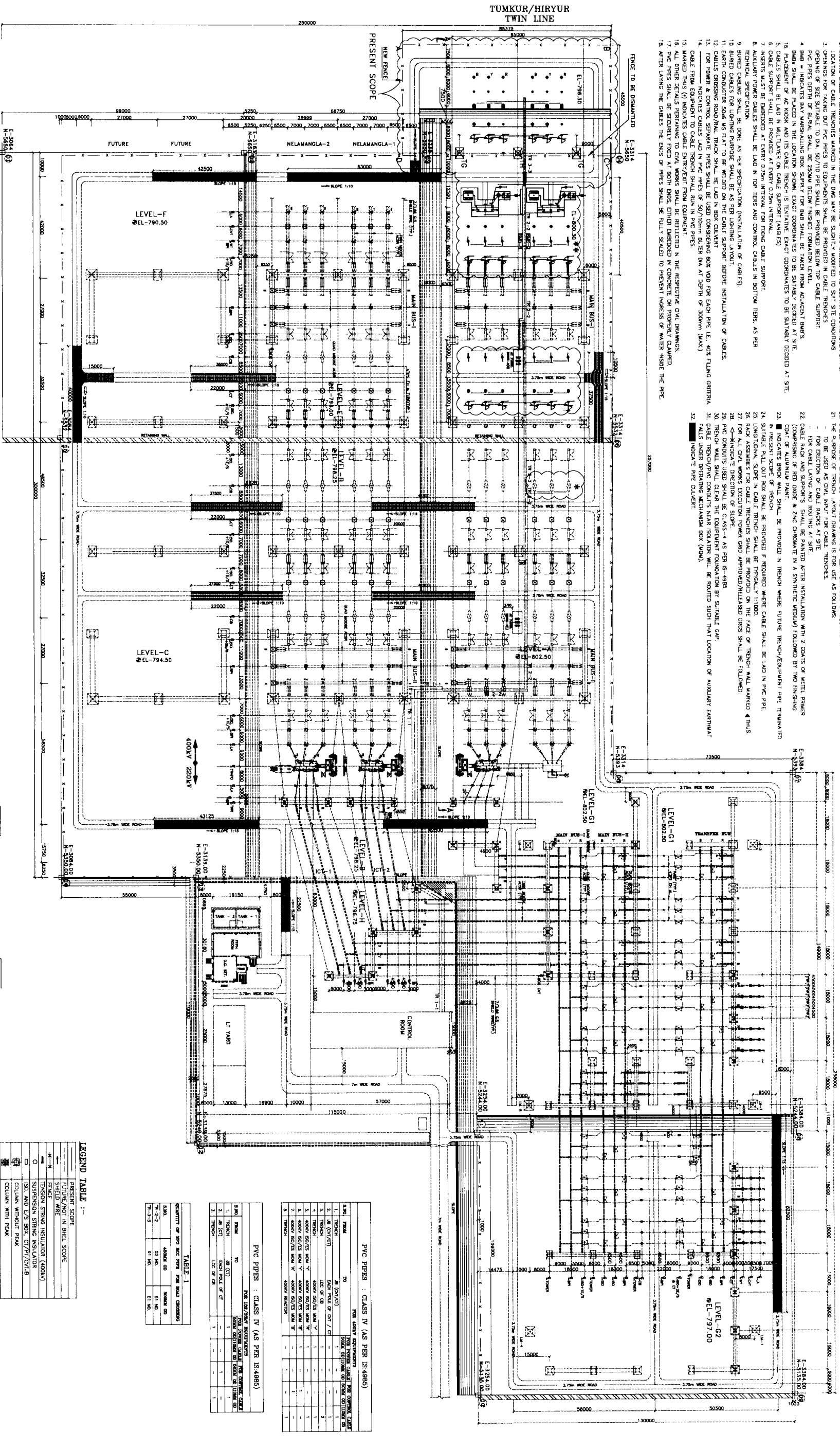
1. ALL DIMENSIONS ARE IN MM UNLESS SPECIFIED OTHERWISE.
2. (A) EXISTING THE CO SHALL BE REMOVED BY GR WITH THE LINE REACTOR.
3. THE PROPOSED AREA ABOVE IS TO BE EXCAVATED & LEVELLING.
4. IS IN THE SCOPE OF QUANTIFICATION UNDER PRESENT SCOPE.
5. EARTHMAINT TO BE Laid IN THE AREA MARKED ABOVE.
6. PLUMB LEVEL IS 300MM ABOVE FGL.
7. GRAVEL IS 100MM ABOVE 75MM THICK LAYER OF CEMENT CONCRETE.
8. GAVEL IS 100MM ABOVE 75MM THICK LAYER OF CEMENT CONCRETE FOR ALL OTHER CHANGES SHALL BE CASTERD)
9. FOR ALL OTHER CHANGES SHALL BE CASTERD)
10. LINE DUTY 200MM / 250A CONDUCTOR
- 11) MAIN BUS 100MM / 250A CONDUCTOR
- 12) EARTH WIRE 40MM / 250A CONDUCTOR
- 13) THE REDUCED CLEARANCES AS PER CLEARANCE TABLE ABOVE AND AS PER MAINTAINED (E. ROLE & OTHER STATUTORY REGULATION ETC SHALL BE MAINTAINED
- 14) SWAYED INSULATOR STRING FOR LINE TERMINATION & TENSION CLAMP FOR EARTH WIRE TERMINATION IS IN BHEL SCOPE.
- 15) SWITCHYARD LIGHTING SHALL BE PROVIDED ON GANTRIES.

[illegible]

NOTES:-

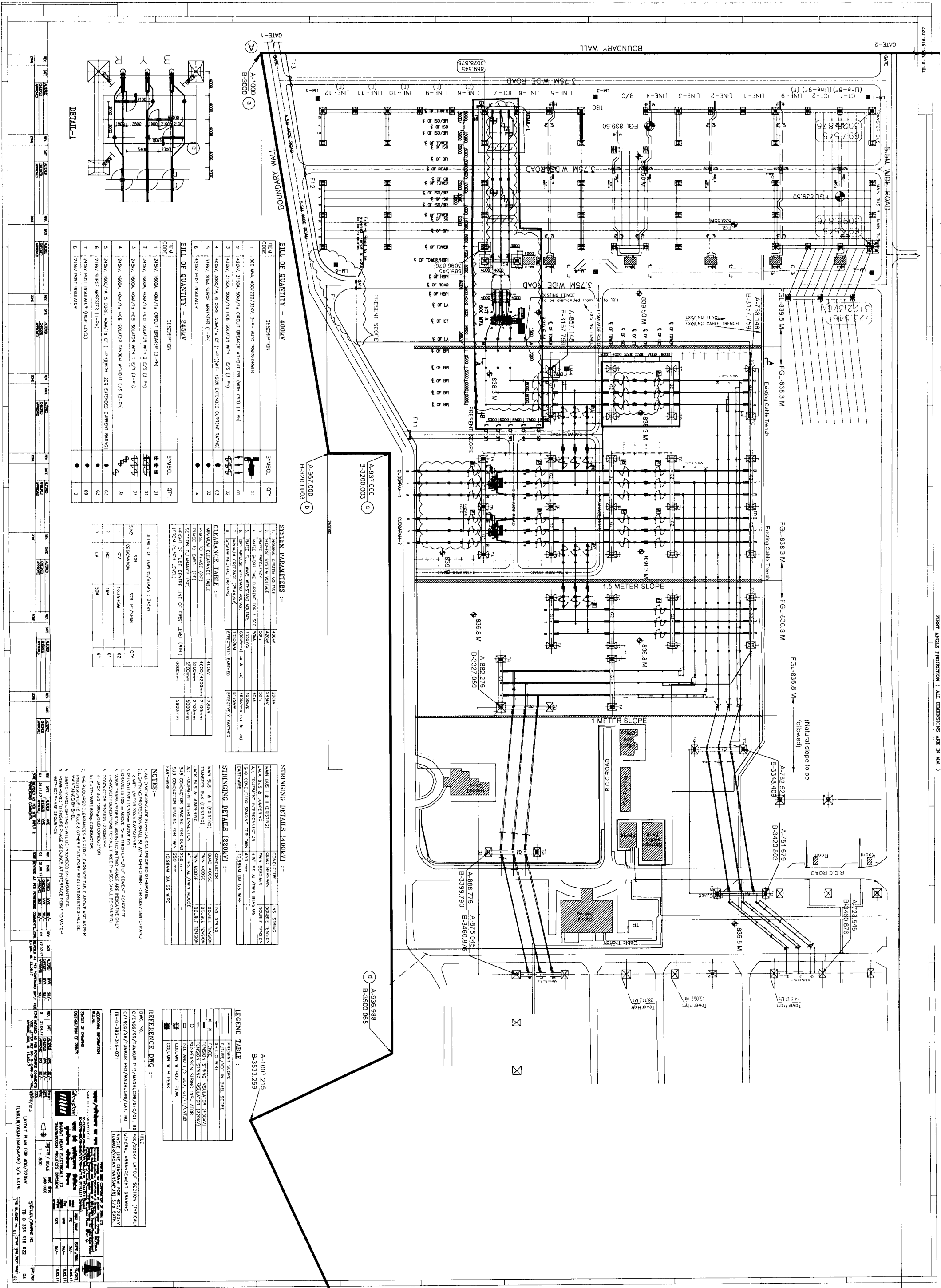
1. ALL DIMENSIONS ARE IN MM UNLESS SPECIFIED OTHERWISE.
2. EXISTING CABLE TRENCHES SHALL BE EXTENDED FOR LAYING OF NEW CABLES UP TO DOMAIN BUS REACTION BAYS.
3. LOCATION OF CABLE TRENCHES MARKED IN THE DWG MAY BE SLIGHTLY MODIFIED TO SUIT SITE CONDITIONS.
4. OPENINGS FOR TAKING OUT PVC PIPES TO EQUIPMENTS SHALL BE PROVIDED IN CABLE TRENCHES.
5. OPENING OF SIZE SUITABLE TO DIA. 50/110 PIPE SHALL BE PROVIDED BELOW TOP CABLE SUPPORT.
6. PVC PIPES DEPTH OF BURIAL SHALL BE 250MM BELOW FINISHED FORMATION LEVEL.
7. BAY # INDICATES BAY MARKING BOX SUPPLY FOR BAY SHALL BE TAKEN FROM ADJACENT BAYS.
8. BAY # SHALL BE PLACED IN THE CABLE TRENCH. EXACT COORDINATES TO BE SUITABLY DECIDED AT SITE.
9. PLACEMENT OF AC ROSS AND ITS CABLE TRENCH IS INDICATIVE. EXACT COORDINATES TO BE SUITABLY DECIDED AT SITE.
10. BURIED CABLES SHALL BE LAYED IN TOP TRENDS AND CONTROL CABLES IN BOTTOM TRENDS, AS PER TECHNICAL SPECIFICATION.
11. BURIED CABLES SHALL BE DONE AS PER SPECIFICATION (INSTALLATION OF CABLES).
12. BURIED CABLES FOR LIGHTING PURPOSES SHALL BE AS PER LIGHTING LAYOUT.
13. EARTH CONDUCTOR ROAD W/S FLAT TO BE WELDED ON THE CABLE SUPPORT BEFORE INSTALLATION OF CABLES.
14. CABLES CROSSING ROAD W/S FLAT SHALL BE LAD IN BOX CATERING BOX WOOD FOR EACH PIPE (IE. 40% TYPING CRITERIA).
15. FOR POWER & CONTROL CABLES, PIPES SHALL BE LAD IN BOX CATERING BOX WOOD FOR EACH PIPE (IE. 40% TYPING CRITERIA).
16. CABLE SUPPORT SHALL BE PROVIDED AT EVERY 0.7M INTERVAL FOR FIXING CABLE SUPPORT.
17. INSERTS MUST BE EMBEDDED AT EVERY 0.7M INTERVAL FOR FIXING CABLE SUPPORT.
18. AUXILIARY POWER CABLES SHALL BE LAD IN TOP TRENDS AND CONTROL CABLES IN BOTTOM TRENDS, AS PER TECHNICAL SPECIFICATION.
19. BURIED CABLES SHALL BE DONE AS PER SPECIFICATION (INSTALLATION OF CABLES).
20. BURIED CABLES FOR LIGHTING PURPOSES SHALL BE AS PER LIGHTING LAYOUT.
21. EARTH CONDUCTOR ROAD W/S FLAT TO BE WELDED ON THE CABLE SUPPORT BEFORE INSTALLATION OF CABLES.
22. CABLES CROSSING ROAD W/S FLAT SHALL BE LAD IN BOX CATERING BOX WOOD FOR EACH PIPE (IE. 40% TYPING CRITERIA).
23. FOR POWER & CONTROL CABLES, PIPES SHALL BE LAD IN BOX CATERING BOX WOOD FOR EACH PIPE (IE. 40% TYPING CRITERIA).
24. CABLE SUPPORT SHALL BE PROVIDED AT EVERY 0.7M INTERVAL FOR FIXING CABLE SUPPORT.
25. INSERTS MUST BE EMBEDDED AT EVERY 0.7M INTERVAL FOR FIXING CABLE SUPPORT.
26. AUXILIARY POWER CABLES SHALL BE LAD IN TOP TRENDS AND CONTROL CABLES IN BOTTOM TRENDS, AS PER TECHNICAL SPECIFICATION.
27. BURIED CABLES SHALL BE DONE AS PER SPECIFICATION (INSTALLATION OF CABLES).
28. BURIED CABLES FOR LIGHTING PURPOSES SHALL BE AS PER LIGHTING LAYOUT.
29. EARTH CONDUCTOR ROAD W/S FLAT TO BE WELDED ON THE CABLE SUPPORT BEFORE INSTALLATION OF CABLES.
30. CABLES CROSSING ROAD W/S FLAT SHALL BE LAD IN BOX CATERING BOX WOOD FOR EACH PIPE (IE. 40% TYPING CRITERIA).
31. FOR POWER & CONTROL CABLES, PIPES SHALL BE LAD IN BOX CATERING BOX WOOD FOR EACH PIPE (IE. 40% TYPING CRITERIA).
32. CABLE SUPPORT SHALL BE PROVIDED AT EVERY 0.7M INTERVAL FOR FIXING CABLE SUPPORT.
33. INSERTS MUST BE EMBEDDED AT EVERY 0.7M INTERVAL FOR FIXING CABLE SUPPORT.
34. AUXILIARY POWER CABLES SHALL BE LAD IN TOP TRENDS AND CONTROL CABLES IN BOTTOM TRENDS, AS PER TECHNICAL SPECIFICATION.

19. CONTROL CABLES & POWER CABLES MUST BE LAD IN SEPARATE PVC PIPES.
20. CABLE TRENCH SHALL BE PROVIDED IN MARKING BOX SIDE OF EQUIPMENT.
21. THE PURPOSE OF TRENCH LAYOUT DRAWING IS FOR USE AS FOLLOWS:-
22. FOR ERECTION OF CABLE TRENCHES.
23. FOR CABLE LAYING AND ROUTING AT SITE.
24. (COMPREHENSIVE OF RED DOTS & ZONE CHORDS IN A SYNCHRONIC MEDIUM) FOLLOWED BY TWO FINISHING.
25. INDICATES SINK MARK SHALL BE PROVIDED IN TRENCH WHERE FUTURE TRENCH/EQUIPMENT PIPE TERMINATED IN PRESENT SCOPE OF TRENCH.
26. STABLE PULL OUT BOX SHALL BE PROVIDED IF REQUIRED WHERE CABLE SHALL BE LAD IN PVC PIPE.
27. LONGITUDINAL SLOPE IN CABLE TRENCH SHALL BE PROXIMATELY 1:100.
28. RACK ASSEMBLY FOR CABLE TRENCHES SHALL BE PROVIDED ON THE FACE OF TRENCH WALL MARKED AS THUS.
29. FOR ALL CIVIL WORKS EXECUTION POWER GRID APPROVED/RELEASED DINGS SHALL BE FOLLOWED.
30. CABLES USED SHALL BE CLASS-4 AS PER IS-4885.
31. TRENCH WALL SHALL BE CASTED IN EQUIPMENT FOUNDATION BY SUITABLE CAP.
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BILL OF QUANTITY - 400KV

ITEM CODE	DESCRIPTION	SYMBOL	QTY
1	500 VVA 400/220/11KV, 3-20 AUTO TRANSFORMER		01
2	420KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)		02
3	420KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)		02
4	420KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)		02
5	420KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)		02
6	420KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)		02
7	420KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)		02
8	420KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)		02
9	420KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)		02
10	420KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)		02
11	420KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)		02
12	420KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)		02

BILL OF QUANTITY - 24KV

ITEM CODE	DESCRIPTION	SYMBOL	QTY
1	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01
2	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01
3	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01
4	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01
5	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01
6	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01
7	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01
8	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01
9	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01
10	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01
11	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01
12	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)		01

SYSTEM PARAMETERS :-

1	NOMINAL SYSTEM VOLTAGE	400KV
2	HIGHEST SYSTEM VOLTAGE	420KV
3	DESIGN PROTECTIVE CURRENT (100 A SEC)	500A
4	DESIGN PROTECTIVE CURRENT (100 A SEC)	500A
5	DESIGN PROTECTIVE CURRENT (100 A SEC)	500A
6	DESIGN PROTECTIVE CURRENT (100 A SEC)	500A
7	DESIGN PROTECTIVE CURRENT (100 A SEC)	500A
8	DESIGN PROTECTIVE CURRENT (100 A SEC)	500A
9	DESIGN PROTECTIVE CURRENT (100 A SEC)	500A
10	DESIGN PROTECTIVE CURRENT (100 A SEC)	500A
11	DESIGN PROTECTIVE CURRENT (100 A SEC)	500A
12	DESIGN PROTECTIVE CURRENT (100 A SEC)	500A

CLEARANCE TABLE :-

1	MINIMUM CLEARANCE (mm)	400KV
2	MINIMUM CLEARANCE (mm)	420KV
3	MINIMUM CLEARANCE (mm)	420KV
4	MINIMUM CLEARANCE (mm)	420KV
5	MINIMUM CLEARANCE (mm)	420KV
6	MINIMUM CLEARANCE (mm)	420KV
7	MINIMUM CLEARANCE (mm)	420KV
8	MINIMUM CLEARANCE (mm)	420KV
9	MINIMUM CLEARANCE (mm)	420KV
10	MINIMUM CLEARANCE (mm)	420KV
11	MINIMUM CLEARANCE (mm)	420KV
12	MINIMUM CLEARANCE (mm)	420KV

DETAILS OF TOWERS/BEAMS :- 24KV

1	SECTION	STR. HT/SPAN	QTY
1	CTA	16.2M/34M	02
2	SC	16M	01
3	SW	50M	01

STRINGING DETAILS (400KV) :-

MAIN BUS I & II (EXISTING)	CONDUCTOR	MS STRING
JACK BUS & JUMPING	QUAD BERSAMS	DOUBLE TENSION
A/C EQUIPMENT INTERCONNECTION	TWIN BERSAMS	
SUB CONDUCTOR SPACING FOR WIN	4.5" MS A /TWIN BERSAMS	
EARTHWARE	450 mm	
	10.8MM DIA GS WIRE	

STRINGING DETAILS (24KV) :-

1	CONDUCTOR	MS STRING
2	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)	DOUBLE TENSION
3	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)	DOUBLE TENSION
4	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)	DOUBLE TENSION
5	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)	DOUBLE TENSION
6	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)	DOUBLE TENSION
7	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)	DOUBLE TENSION
8	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)	DOUBLE TENSION
9	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)	DOUBLE TENSION
10	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)	DOUBLE TENSION
11	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)	DOUBLE TENSION
12	24KV, 1600A, 40MVA, 1/2 CIRCUIT BREAKER (3-20)	DOUBLE TENSION

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS SPECIFIED OTHERWISE.
2. LOCATION OF TOWERS/BEAMS SHALL BE WITH SUFFICIENT CLEARANCE FROM ALL OBSTACLES.
3. PLY-LEVELS IS TO BE MAINTAINED AS PER SPECIFICATION.
4. WAVE TOWERS/BEAMS MOVEMENT IN TWO PHASES ARE INDICATED ONLY.
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11. WAVE TOWERS/BEAMS MOVEMENT IN TWO PHASES ARE INDICATED ONLY.
12. WAVE TOWERS/BEAMS MOVEMENT IN TWO PHASES ARE INDICATED ONLY.

LEGEND TABLE :-

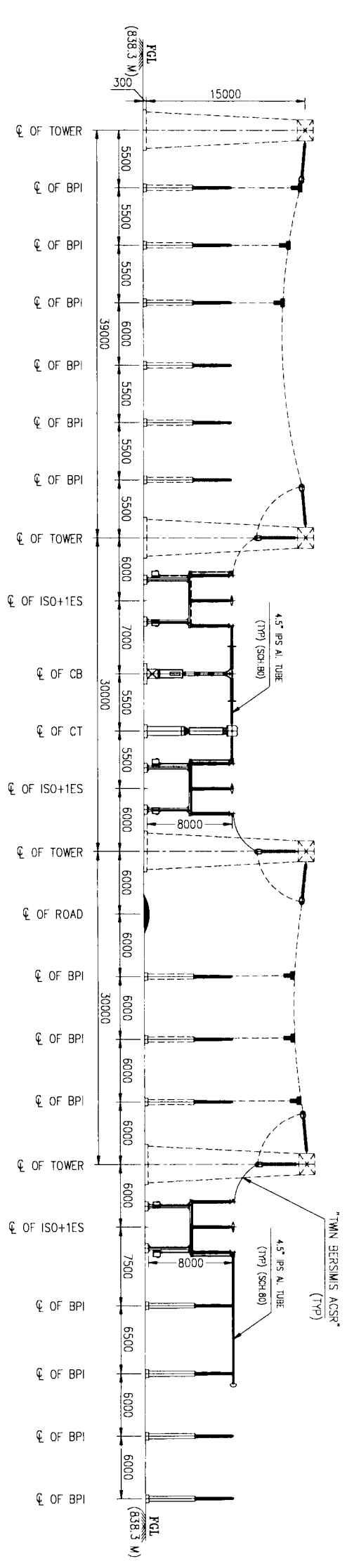
1	PRESENT SCOPE
1	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
2	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
3	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
4	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
5	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
6	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
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9	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
10	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
11	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
12	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)

REFERENCE DWG :-

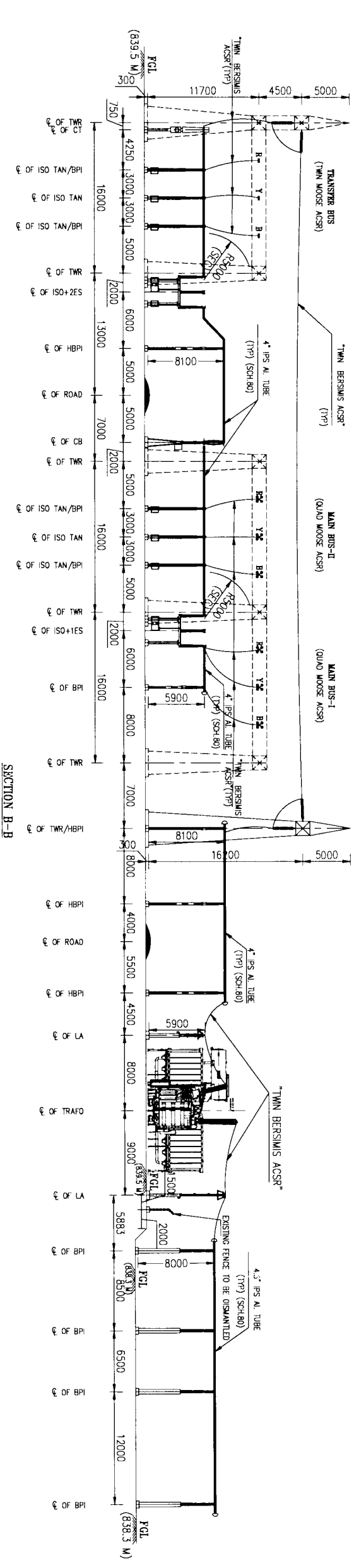
1	TITLE
1	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
2	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
3	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
4	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
5	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
6	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
7	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
8	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
9	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
10	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
11	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
12	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)

REVISION

1	REVISION
1	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
2	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
3	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
4	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
5	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
6	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
7	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
8	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
9	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
10	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
11	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)
12	400KV, 1150A, 30MVA, 1/2 HOB ISOLATOR WITH 1 E/S (3-20)



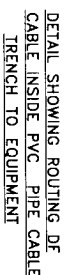
SECTION A-A
(400KV => FUTURE - THE - 107#)
(220KV => 107#)



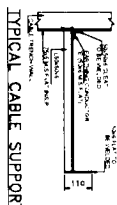
SECTION B-B
(220KV => 107#)
(400KV => FUTURE - THE - 107#)

INVENTORY No.		SON. & DATE		REF. DRG. No.		COMPUTER DRG. PATH NAME	
16	15	14	13	12	11	10	9
8	7	6	5	4	3	2	1
REV	DATE	BY	CHKD	DATE	BY	CHKD	DATE
1	10/10/17	WJ	WJ	10/10/17	WJ	WJ	10/10/17
2	11/11/17	WJ	WJ	11/11/17	WJ	WJ	11/11/17
3	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
4	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
5	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
6	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
7	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
8	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
9	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
10	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
11	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
12	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
13	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
14	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
15	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17
16	12/20/17	WJ	WJ	12/20/17	WJ	WJ	12/20/17

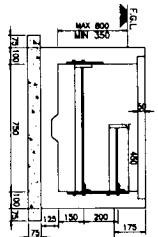
OPTIONAL INFORMATION	
TUN. CHINA ROAD	
SECTION ELEVATION FOR 400/220KV	
TUN. CHINA ROAD S/S 4/17	
18-0-283-316-022	
04	



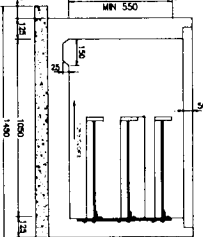
DETAIL SHOWING ROUTING OF
CABLE INSIDE PVC PIPE CABLE
TRENCH TO EQUIPMENT



TYPICAL CABLE SUPPORT



TR 3-3



IR 2-

_____	PARTIAL SCOPE
_____	CUTTING AND IN BULK SCOPE
_____	SHIELD WIRE
—	POLE
—	TENSION STRING INSULATOR (400V)
—	TENSION STRONG INSULATOR (220KV)
○	SUSPENSION STRING INSULATOR
□	ISO. AND E/S BOX. CT/PT/CT/AB
□	COLUMN WITHOUT PEAK
■	COLUMN WITH PEAK

LEGEND TABLE :-

DMG :-

DWG. NO.	TITLE
TS-0-393-316-022	LAYOUT PLAN & SECTION ELEVATION FOR 400/220V TUMBUKURU(VAANINNESHPAN) 5/5 EXTN.
TS-0-393-316-021	SINCE ION DIAGRAM FOR 400/220V TUMBUKURU(VAANINNESHPAN) 5/5 EXTN.
PLT 195/c/DM-cl/L/M/06, 41	400/220V WIRELESS EXTN. 5/5 CABLE TRENCH LAYOUT
TELECA 81500635	400V CABLE TRENCH LAYOUT

TELE 615006XX

* WIDTH OF BURIED CABLE TRENCH WILL DEPEND ON THE NO. OF CABLES FINALISED AS PER CABLE SCHEDULE.

TYPICAL BURIED CABLE TRENCH

PVC PRESS : CLASS IV (AS PER IS-4885)			
PVC PRESS : CLASS IV (AS PER IS-4885)			
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PVC PPES : CLASS IV (AS PER IS:4985)

6.	400KV 150/15 MDA Y	400KV 150/15 MDA Y	1	-	-
7.	400KV 150/15 MDA Y	400KV 150/15 MDA Y	-	1	-
8.	TRENCH	500KV TRANS.	-	1	2

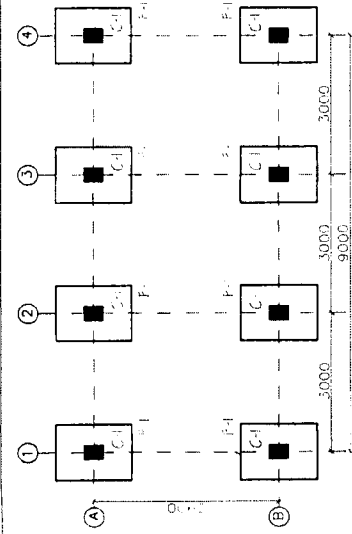
7.	400KV 150/135 MOM "R"	400KV 150/135 MOM "B"	-	1
8.	TRENCH	500KV TRANS	-	1

THE BODY AND FITTINGS		
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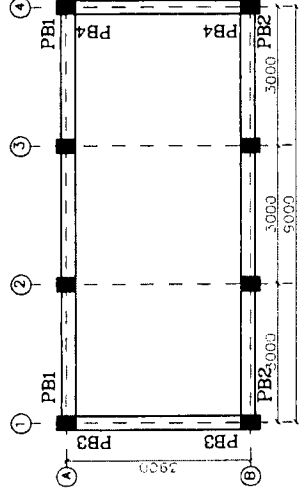
PVC PIPES • CLASS IV (AS PER IS-4085)

REV	DATE	ALTERED ORDER APPROVED	REV	DATE	ALTERED ORDER APPROVED
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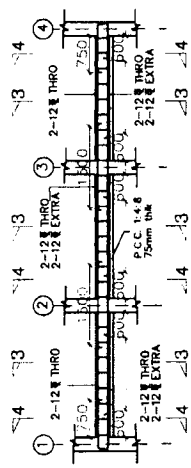
REV.	DATE	REV.	DATE
PAID		PAID	
CHECKED		CHECKED	



FOUNDATION PLAN

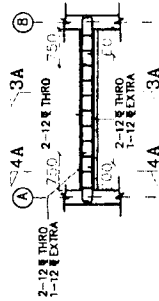


PLINTH BEAM PLAN



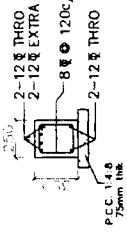
ROOF BEAM PLAN

PB1 & PB2 (250 X 350)
ON GRID A & B

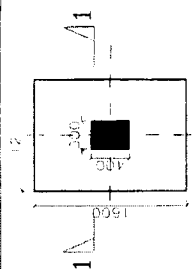


BEAM SECTION AT 3-3

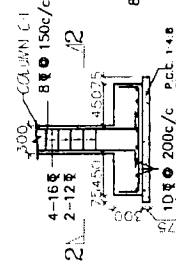
PB3 & PB4 (250 X 350)
ON GRID 1&4



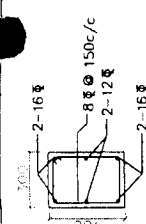
BEAM SECTION AT 4-4



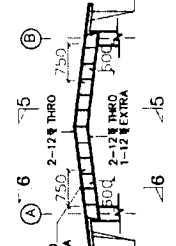
FOOTING F-1
TYP.



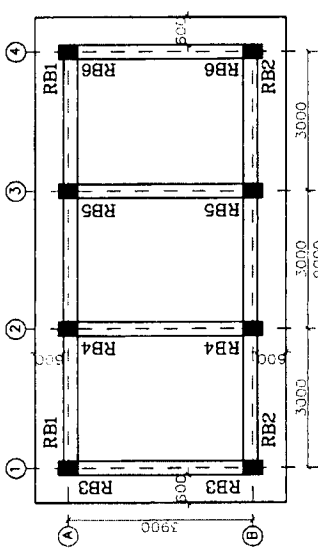
FOOTING F-2
TYP.



COLUMN SECTION AT 2-2
TYP.

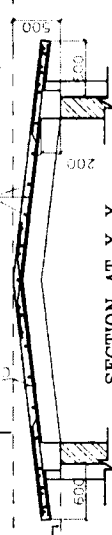


COLUMN SECTION AT 1-1
TYP.

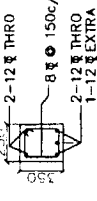


REINFORCEMENT ROOF PLAN
OF TOP SURFACE SLAB

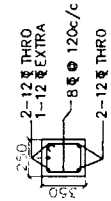
SECTION AT X-X



SECTION AT X-X

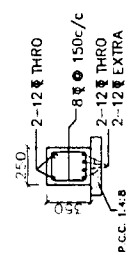


BEAM SECTION AT 5-5

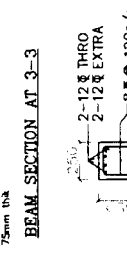


BEAM SECTION AT 6-6

PB1 & RB2 (250 X 350)
ON GRID A & B



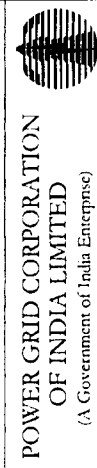
BEAM SECTION AT 3A-3A



BEAM SECTION AT 4A-4A

- NOTES:-
1. ALL LINEAR DIMENSIONS ARE IN MM AND LEVELS IN METERS.
 2. THIS DRAWING IS NOT TO BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
 3. ± 0.00 CORRESPONDS TO FINISHED GROUND LEVEL (F.G.L.)
 4. ALL R.C.C. USED SHALL BE OF GRADE AS PER B.P.S.
 5. ALL R/F STEEL SHALL BE HYSD CONFORMING TO IS 1786.
 6. ∇ M/BARS AS PER B.P.S. (EQUIVALENT GRADE)
 7. LAYERS FOR BEAMS SHALL BE 25mm FOR SLAB, 50mm FOR COLUMN.
 8. LAP LENGTH FOR R/F BARS SHALL BE 47 X DIA OF BAR.
 9. LAP SHALL NOT BE PROVIDED WITHIN A JOINT, OR WITHIN A DISTANCE 2 X DEPTH FROM THE EACH JOINT FACE, OR 1/4 OF MEMBER LENGTH FROM JOINT FACE.
 10. SPACING OF STRIPS PROVIDED OVER THE ENTIRE SPOLE.
 11. ALL FOUNDATION SHALL BE TAKEN AT LEAST 500MM BELOW VERGIN BACK FILLED WITH P.C.C. (1:4:8)
 12. REINFORCEMENT DETAILING SHALL BE AS PER SP - 34 AND IS 13920 LATEST.
 13. NET SAFE BEARING CAPACITY AT A DEPTH OF M. BELOW FGL IS ASSUMED AS 91/M2.
 14. THE FOUNDATION LENGTH = 47 DIAMETER OF BAR.
 15. THE FOUNDATION SHOULD REST MINIMUM 500MM IN VERGIN SOLD (SIZE 50mm TO 150mm) WITH INTERSTICES FILLED WITH SAND. STONE SHALL BE COMPACTED IN LAYERS OF 300mm AS PER CPWD SPEC.
 16. STANDARD PANEL ROOM IS MODULAR STRUCTURE OF 3M LENGTH BE CARRIED OUT IN MULTIPLES OF 3M LENGTH KEEPING WIDTH 3.9M AS CONSTANT AS PER REQUIREMENT OF SITE SPECIFIED IN LOA/ LAYOUT APPROVED BY S/S ENGG.

RELEASED FOR TENDER/CONSTRUCTION



POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

PROJ-11	765/400/220 KV SUB STATION
1111	STANDARD SWITCHYARD PANEL ROOM
DRAWING NO.	G.A. AND RCC DETAIL OF PANEL ROOM
	C-ENGG-STD-SPR-STR-3011
SCALE	NTS
REV	0

THIS DRAWING HAS BEEN REPRODUCED FROM EARLIER
APPROVED DRAWING NO. C-ENGG-STD-SPR-STR-3011

REV.	DESCRIPTION	CIVIL	ELEC.	REVO.	REVO.	APPO.	DATE

CLEARED BY

SECTION -2

GENERAL TECHNICAL REQUIREMENTS

2.0 GENERAL :

2.0.1 The lighting System design shall comply with acceptable norms and the best engineering practices. The lighting shall be designed to provide uniform illumination with minimum glare. The lighting system shall meet all the statutory requirements, local rules etc.

2.0.2 Feeders required for lighting shall be given from Main LVAC /DC boards. Further distribution using lighting DB's panels for Illumination shall be in Illumination contractor scope. Laying & termination of cables from LVAC /DC boards onwards shall be in illumination contractor scope.

2.0.3 APPLICABLE CODES AND STANDARDS

All material / work shall conform to the following standards & codes unless otherwise stated. All standards and codes of practice referred to herein shall be the latest edition including all applicable official amendments & revisions as on date of bid opening. In case of conflict between this specification and those (codes, standards etc) referred to herein, the former shall prevail.

(i)	IS:1913	General and safety requirements for electric light fittings
(ii)	IS:418	Tungsten filament lamp for domestic and similar general lighting purposes
(iii)	IS:10322	Luminaires
(iv)	IS:10276	Edison Screw lamp holders
(v)	IS:2418	Tubular fluorescent lamps
(vi)	IS:9974	High pressure sodium Vapour lamps
(vii)	IS:9900	High Pressure mercury vapour lamps.
(viii)	IS:6616	Ballasts for high pressure mercury Vapour lamps
(ix)	IS:1258	Specification for bayonet lamp holders
(x)	IS:3323	Bi-pin lamp holders for tubular fluorescent lamps
(xi)	IS:13021	AC Supplied electronic ballasts for tubular fluorescent lamps
(xii)	IS:1534	Ballasts for use in fluorescent lighting fittings
(xiii)	IS:1569	Capacitors for use in tubular fluorescent high pressure mercury vapour and low pressure sodium Vapour discharge lamp circuit.
(xiv)	IS:2215	Starters for fluorescent lamps
(xv)	IS:3324	Holders for starters for tubular fluorescent lamps
(xvi)	IS:418	GLS lamps
(xvii)	IS:13021	AC supplied electronic ballasts for tubular fluorescent lamps
(xviii)	IS:2713	Tubular steel poles
(xix)	IS:280	MS Wire for general Engg. Purpose.

2.0.4.1 Conduits, Pipes and Accessories

(i)	IS:9537	Rigid Steel conduit for electrical wiring
(ii)	IS:3480	Flexible steel conduits for electrical wiring
(iii)	IS:2667	Fitting for rigid steel conduits for electrical wiring
(iv)	IS:3837	Accessories for rigid steel conduits for electrical wiring.
(v)	IS:4649	Adaptors for flexible steel conduits

2.0.4.2 Lighting panels, Switch boxes, receptacles and junction boxes.

(i)	IS:13947	Specification for LV switchgear and control gear (Parts 1to 5)
(ii)	IS:8828	Circuit breakers for over current protection for house hold and similar installations.
(iii)	IS:5	Colours for ready mixed paints and enamels
(iv)	IS:2551	Danger notice plates
(v)	IS:5133	Steel and cast iron boxes
(vi)	IS:2629	Recommend practice for hot dip galvanizing of iron & steel.
(vii)	IS:3854	Switches for domestic and similar purposes
(viii)	IS:6875	Control switches (Switching devices for Control and auxiliary Circuits including contactor relays) for Voltages upto and including 1000V AC and 1200V DC.
(ix)	IS:13703	Low voltage fuses for voltages not exceeding 1000V AC or 1500V DC
(x)	IS:9224	HRC Cartridge fuse links for voltage above 650V(Part2)
(xi)	IS:5082	Wrought aluminum and Al. alloys, bars, rods, tubes and section for electrical purposes.
(xii)	IS:8623	Factory built assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200V DC.
(xiii)	IS:1248	Direct acting electrical indicating instruments .
(xiv)	IS:1293	Plugs & socket outlets of rated voltage upto and including 250 Volts & rated current upto and including 16 amps

2.0.4.3 Lighting Wires / Cables

(i)	IS:694	PVC Insulated cables for working voltages upto and including 1100V.
(ii)	IS:3961	Recommended current ratings for cables (PVC Insulated and PVC sheathed heavy duty cables and light duty cables)
(iii)	IS:8130	Conductors for insulated electric cables and flexible cords.
(iv)	IS:10810	Methods of tests for Cables

2.0.4.4 Electrical Installation & Miscellaneous :

(i)	IS:2062	Steel for general structural purposes.
(ii)	IS:6665	Code of practice for industrial lighting.
(iii)	IS:374	Electric ceiling fans & regulators
(iv)	IS:5216	Recommendations on safety procedures and practices in electrical work.
(v)	IS:732	Code of practice for electrical wiring installation (System voltage not exceeding 650 Volts)
(vi)	IS:1255	Code of practice for installation and maintenance of power cables upto and including 33kV rating.
(vii)	IS:3043	Code of practice for earthing.
(viii)	IS:3646	Code of practice of Interior Illumination.
(ix)	IS:1944	Code of practice for lighting of public through fares.
(x)	IS:5571	Guide for selection of electrical equipment for hazardous areas.
(xi)	IS:800	Code of practice for use of structural steel in general building construction
(xii)	IS:2633	Methods of testing uniformity of coating on Zinc coated articles.
(xiii)	IS:6005	Code of Practice for phosphating iron and steel.
(xiv)	IS:371	Ceiling roses
(xv)	BS:6121	Mechanical cable glands
(xvi)	IS:6631	Specification for Steel pipes
(xvii)		INDIAN ELECTRICITY ACT
(xviii)		INDIAN ELECTRICITY RULES
(xix)		NATIONAL ELECTRICAL CODE

2.1 TESTS :

- 2.1.1.1** All equipments to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last five years from the date of bid opening. These reports should be for the tests 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.
- 2.1.1.2** In case the Contractor is not able to submit report of the type test (s) conducted within last five year from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the BHEL / Owner and submit the reports for approval.
- 2.1.1.3** 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.

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

2.1.3 Type test reports of the following items as per relevant standards shall be submitted for approval.- **for the items under scope of supply**

SI.NO.	DESCRIPTION
i.	Lighting fixtures of each type.
ii.	Lamps of each type and rating (life cycle and rating test only)
iii.	Lighting panel of each type (Degree of Protection)
iv.	Junction Box of each type (Degree of protection)
v.	Receptacles of each rating.
vi.	M.C.B. of each rating.
vii.	Lighting transformer
viii.	Ballasts

2.1.4 Acceptance Test and Routine Test :

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

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

2.1.5 Galvanizing Tests :

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

2.1.5.2 In addition following test shall be conducted as acceptance tests.

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

- (c) In addition the plating thickness shall be determined microscopically / chemically or electronically.

2.1.6 COMMISSIONING CHECKS :

- 2.1.6.1** On completion of Installation work the Contractor shall request the Project manager for inspection and test with minimum of fourteen (14) days advance notice.
- 2.1.6.2** The Project Manager shall arrange for join inspection of the installation for completeness and correctness of the work. Any defect pointed out during such inspection shall be promptly rectified by the Contractor.
- 2.1.6.3** The installation shall be then tested and commissioned in presence of the Project Manager.
- 2.1.6.4** The contractor shall provide all, men material and equipment required to carry out the tests.
- 2.1.6.5** All rectifications, repair or adjustment work found necessary during inspection, testing and commissioning shall be carried out by the Contractor without any extra cost.
- 2.1.6.6** 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
- 2.1.6.7** 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.
- 2.1.6.8** Lux level measurement to prove guranteed Illumination levels. The contractor shall submit a document on methodology of measurement for approval of BHEL / ultimate customer . This will become basis for measurements .

2.2 QUALITY PLAN :

Bidder shall submit immediately after award of Contract Manufacturing Quality plan & field Quality plan in prescribed format for approval of BHEL & customer. These approved Quality plans shall be followed for manufacture and ETC. Where standard quality plans of BHEL or customer are available , these shall be followed after written consent of BHEL/ Customer.

2.3 HANDING & TAKINGOVER :

It is the responsibility of bidder to handover the complete system to BHEL/ ultimate customer. Bidder shall assist BHEL to handover the system supplied by them to ultimate customer.

2.4 DOCUMENTATION :

2.4.1. Information / documents to be submitted by the bidder at tender stage shall be as follows :

- (a) Check list
- (b) Technical offer with equipment details & the makes, detailed unpriced schedule of equipment / material & spares .
- (b) Guaranteed technical particulars.
- (c) Activity Schedule.
- (d) Catalogues & technical details of equipment / material offered.

2.4.2. Information / documents to be submitted by the Contractor at contract stage shall be as follows :

- (a) Type test reports
- (b) Manufacturing Quality plan. Where standard Quality plan of BHEL / Customer is available, this shall be followed.
- (c) Field Quality plan for receipt, storage, installation, testing & commissioning with details of tests to be conducted and acceptance values .
- (d) Outline and general assembly drawings of equipment, lighting layout conduit layout, wiring scheme, Catalogues of equipment, fixing details etc.
- (e) Detailed photometric data of luminaires .
- (f) Operation & maintenance manuals

(e) End documentation.

For approval 4 copies to be submitted and after approval 10 copies to be submitted unless otherwise specified elsewhere.

ACTIVITY SHEDULE
(TO BE FILLED BY THE BIDDER
AND RETURNED WITH THE OFER)

Tender enquiry no.:

Sl. no	Activity	Activity Time in weeks	Cumulative Time in Weeks from LOI / PO Date	Remarks if any
1.	Submission of documents / data for approval.			
2.	Approval of documents in Cat-I from BHEL/ Customer *			
3.	Manufacturing time			
4.	Inspection call			
5.	Customer inspection & dispatch clearance			
6.	Transportation to destination			
7.	ETC			

- 1) * Supplier must ensure the completeness and correctness of the requisite documents before submission for approval. Delay in approval on account of incomplete/ inadequate information shall be the responsibility of the contractor. CAT-I approval denotes final approval after successful incorporation of all comments made by BHEL/ ultimate customer on previously submitted versions of drawings documents.
- 2) Inspection call should be given in the prescribed format only. Inspection calls in any format, other than the prescribed format shall not be entertained.
- 3) Qty to be offered for inspection should be in accordance within delivery schedule. BHEL reserves the right not to entertain multiple inspection calls and delay on this account shall be the responsibility of the contractor.

Place

Signature of the authorized representative of Bidder

Name _____

Date

Designation _____

Company Seal _____

SECTION - 4**GUARANTEED TECHNICAL PARTICULARS**

(A)	Lighting Fixtures & Accessories (Data to be submitted separately for each type and Size)	
1.	Manufacture's Name and country of manufacture a) Fixture b) Accessories	
2.	Applicable Standards for a) Fixture b) Accessories	
3.	Manufacturer's type and Catalogue no. for a) Fixture b) Accessories	
4.	Nominal working Voltage (Volts)	
5.	Maximum permissible supply Voltage Variation for satisfactory operation of : a) Fixture (+ / -) b) Accessories (+ / -)	
6.	Power factor at nominal working Voltage and frequency	
7.	Full load input current at Nominal working voltage (Amps)	
8.	Power loss per ballast at nominal working voltage and frequency (Watts)	
9.	Maximum hot spot temperature of ballast case (°C)	
10.	Maximum average ballast winding temperature (°C)	
11.	Ambient temperature within the fitting in continuous operation at the design ambient air temperature (°C)	
12.	Insulation class of ballast winding (°C)	
13.	Average life expectancy of : a) Ballasts b) Capacitors c) Lamps	
14.	Lamp output at the design temperature a) After 100 burning hours (lumens) b) After 1000 burning hours (lumens)	

15.	Lamp output at the end of the expected Life period (lumens)	
16.	Average light output of the fitting as a percentage of lamp output. a) Downwards (%) b) Upwards (%)	
17.	Beam angle for flood lights in a) Horizontal plane (Degrees) b) Vertical plane (Degrees)	
18.	Cable / conduit entry size	
19.	Earthing terminal a) Material b) Size and type of cable	
20.	Weights of Fixtures (Kg.)	
21.	a) Starting Current & PF for lamp (Amps) b) Operating current (Amps) c) Time Vs mains current & PF Characteristics during starting to be enclosed. d) Reference cat. No.	
B.	Junction Boxes (for each type and size)	
1.	Manufacturer's name and country of manufacture	
2.	Manufacturer's type designation	
3.	Material Specification	
4.	Type of enclosure	
5.	Terminals a) Make b) Current rating (Amps) c) Voltage rating (Volts) d) Stud type (yes /no) e) Provision of insulated Barriers (yes /no)	
6.	Whether descriptive pamphlet is enclosed (yes/no)	
C.	Lighting Panels (For each type & size)	
1.	General	
	a) Manufacture's name and country of manufacture	
	b) Indoor /outdoor application	
	c) Design ambient air temp (°C)	
	d) Thickness of sheet steel(mm)	
	e) Degree of protection provided	

	(as per IS:2147 or equivalent)	
	f) Bill of material for various equipment giving make, type, rating etc enclosed.	
	g) Colour of finish paint i) Outside ii) Inside h) Busbar i) Material ii) Temp. rise at rated current over specified ambient (50 ° C) iii) Continuous current rating at 50 ° C ambient temp. iv) Whether suitable for one second current rating of 5 kA, AC or 4kA D.C as applicable . v) Cross Section vi) Applicable Standard	
	l) Control Wing i) Material of conductor ii) Size of conductor /dia of wire (mm ²)	
	j) Conductor - Solid / Stranded	
	k) Terminal Block i) Make ii) Current rating a) Power terminals (Amps) b) Other terminals (Amps)	
	l) All tests as specified in specifications will be carried out (yes/no)	
2.	Air Break Switches (For each type & size) a) Manufacturer's name and country of manufacture b) Manufacturer's type, description c) Applicable Standard d) Rated voltage (Volts) & Frequency (Hz) e) Rated current (Amps) f) Rated Breaking Current (Amps) g) Maximum through fault current withstand . Derating factor for use under site ambient conditions h) Temperature rise of contacts when carrying continuous rated current under site conditions (°C)	

3.	Fuses (For each type & size) a) Manufacturer's name and country of manufacture b) Manufacture's type, description c) Applicable Standard d) Rated Voltage (Volts)	
	e) Rated current (Amps) f) Whether fuse is mounted on an insulated carrier (yes / no) g) Whether fuse carrier has an aperture for fuse failure indication(yes/no) h) Category of duty (IS:2208) i) Rupturing capacities (Prospective current)(kA) j) Maximum let through current for 1 sec. (kA) k) Whether time/ current characteristics are enclosed (Yes/No.)	
4.	Miniature Circuit Breakers (For each type and rating) a) Manufacturer's name and country of manufacture b) Type c) Rated voltage d) No. of poles e) Frequency f) Current Rating i) Continuous at 50°C ambient (Amps) g) Breaking Capacity (Single pole/Double pole / Tripple pole) i) Symmetrical (kArms) ii) Asymmetrical(kArms) h) Total interrupting Cycle time i) Type of SC Tripping j) Type of overload (thermal/magnetic) k) Terminal Suitable for cable size l) Upto what fault current discrimination between incomer fuse & M.C.B will be obtained m) Miniature breaker conform to	
5.	Contactors for each type(DC/AC) & Size a) Manufacturer's name and Country of manufacture b) Rated voltage & permissible Variation(Volts)	

	c) Rated Burden (kA) d) Rated current (thermal) of main contacts e) No. & type of Aux. Contacts (if any) f) Rated Voltage of coil (Volts) g) Pick up voltage h) Rated duty class i) Drop off voltage j) Applicable standard	
D)	Lighting Poles (For each type and size)	
1	Manufacturer's name and country of Manufacturer	
2.	Standards applicable	
3.	Dimensions	
4.	Painting / galvanisation details	
5.	Whether descriptive Pamphlet is enclosed ?	
E)	Lighting Wires (For each type and Size)	
1.	Manufacturer's name and country of Manufacturer	
2.	Standard applicable	
3.	Rated Voltage (Volts)	
4.	Continuous current rating when laid in conduit in an ambient temperature of 50°C (Amps)	
5.	Conductor	
	a) Material	
	b) Nominal Cross sectional area	
	c) Number and diameter of wires	
6.	Insulation	
	a) Composition of insulation	
	b) Thickness of insulation	
	c) Tolerance on thickness of insulation	
	d) Specific insulation resistance at 60 deg.C.	
7.	Colors scheme for identification of wires	
8.	Whether descriptive Pamphlet is enclosed ?	
G.	Painting , Prime , Finish Coat	
1.	Paints (For each type)	
	a) Manufacturer's name and country of manufacture	
	b) Manufacturer's type designation/ brand name	

	c) Shade	
2.	Number of coats provided & Microns	
3.	Applicable Standards	

SECTION - 5**CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER RETURN THIS
CHECKLIST AS PART OF THE OFFER DULY SIGNED****PLEASE NOTE:**

a) The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.

Hence bidder shall ensure the completeness of their offer in this regard.

Please mark "YES" if the specified requirement is met or put a mark "NO" if the specified requirement is not met and give reason in column 5.

BHEL Enquiry no :

Bidder offer reference :

EQUIPMENT: Illumination System

Sl.no	Parameter	Data	Bidder's conformation	Reason for non-compliance
(1)	(2)	(3)	(4)	(5)
1.	Provision of illumination for specified areas as per spec.		YES / NO	
2.	Guaranteeing the illumination levels specified as per spec.		YES / NO	
3.	Type of lighting luminaries included as per spec.		YES / NO	
4.	Lighting DBs & LPs included as per spec.		YES / NO	
5.	Lighting transformer included company with specification requirements		YES / NO	
6.	Lighting poles included as per spec.		YES / NO	
7.	Sockets, Plugs & other items included as per spec.		YES / NO	
8.	ETC of Package included in the offer		YES / NO	
9.	Supply & ETC of all wires / Cables / earthing material required for the package other than the items supplied by BHEL included in the package.		YES / NO	
10.	ETC of BHEL supplied Cables included in the offer		YES / NO	
11.	ETC of BHEL supplied earthing strip included in the offer		YES / NO	
12.	Additional flood light luminaries in switchyard for maintenance of equipment specified in specification		YES / NO	

	included in offer.			
13.	Type and lumen output of lamps included in the offer are as per specification.		YES / NO	
14.	Whether any new item other than the BOQ given required to meet the specification requirement.		YES / NO	
15.	If new item is required whether these are listed with quantities in the offer		YES / NO	
16.	Equipment included suitable for operation on voltage & frequency Variation limits specified in the specification without effecting their performance		YES / NO	
17.	Power factor of lamp circuit is as per specification		YES / NO	
18.	Fully filled in GTP enclosed		YES / NO	
19.	Auto change over arrangement for emergency AC/ emergency DC included in EAC & DC boards		YES / NO	
20.	Auto switching arrangement for outdoor flood lighting / street lighting through Timer / Photo cell included		YES / NO	
21.	Spares included in the offer (a) Mandatory (b) Commissioning		YES / NO YES / NO	
22.	Activity Schedule enclosed		YES / NO	
23.	Type test reports	Type test reports furnished shall be in line with clause 1.4 (Section-1) & 4.4.7 (Annexure-3 of Section-1)	Yes	
24.	Type test	If type test reports are not acceptable to PGCIL /BHEL then above tests shall be conducted by the bidder free of cost	Yes	
25.	Bidder to confirm that it will offer approved make of components & fitments at Contract stage. In case the offered make is not approved by the	Yes	Yes/No	

Bharat Heavy Electricals Limited

Doc No. TB-393-316-012

POWERGRID's Substation Package for Extension of 400kV Tumkur Pooling station

Rev. 00

(Pavagada) (including transformer & Reactor), Extension of 400/220kV Mysore Substation and Extension of 400/220kV Tumkur (Vasantnarsapur) (including Transformer) under Transmission System for Ultra Mega Solar Power Part at Tumkur (Pavagada), Karnataka-Phase-II

Technical Specification for Illumination System

	Customer, then alternate make shall be supplied without any commercial implication to BHEL.			
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Bidder's

Sign :

Date :

Name :

Design :

SECTION - 6
SCHEDULE OF TECHNICAL DEVIATIONS

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

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