BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

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				GROUP	TBEM	W.O. No	
CUSTOMER	UTTAR PRADESH POWER TRANSMISSION CO. LTD.						
PROJECTS	400/220/132 KV GIS s/s at Shamli						

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SECTION-1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 The illumination System is required for the following project.

Name of the Customer/ UPPTCL	:	**UTTAR PRADESH TRANSMISSION CORPORATION LTD. (UPPTCL)**
Name of Main Contractor	:	**Bharat Heavy Electricals Limited**
Name of the Project	:	**CONSTRUCTION OF 400/220/132 KV GIS SUBSTATION SHAMLI**

Refer Section - 3 for Project Details and General Specifications

1.1 SCOPE

This specification covers the specific technical requirements of Illumination System Comprising

a) Design, engineering, manufacture, Supply, testing at works, packing and dispatch of equipment & material to site.
b) Supervision of Erection, testing, commissioning.
c) Lux level demo for all areas
d) Storage space shall be provided by BHEL.

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

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

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

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

E. 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.

F. 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.

The Illumination System shall be provided for the following areas:

- ❑ Switchyard Control Room cum Administrative Office Building
- ❑ 400kV GIS Building
- ❑ 220kV GIS Building
- ❑ 132kV GIS Building
- ❑ DG Set area lighting
- ❑ LT Transformer Yard area
- ❑ Illumination around CRB & GIS Buildings
- ❑ Outdoor lighting (flood lights) of switchyard
- ❑ Street lighting for switchyard
- ❑ Fire Fighting Pump House
- ❑ Closed store building
- ❑ Indoor lighting for 10 cars parking shed

For all roads under present scope inside the fence area, LED lamp based street lighting is envisaged.
The roads & the area of the outdoor switchyard to be illuminated are as per enclosed drawing, list as below.

Sl. No.	**BHEL Drg. No.**	**Drawing Title**
1.	TB-0-406-510-002	Plan & section Layout drawing for 400/220/132kV GIS s/s at Shamli
2.	TB-1-406-607-640-1,2&3	400 kV GIS Building, Architectural Plan, Sections & Elevations
3.	TB-1-406-607-651-1,2&3	220 kV GIS Building, Architectural Plan, Sections & Elevations
4.	TB-1-406-607-661-1,2&3	132 kV GIS Building, Architectural Plan, Sections & Elevations
5.	TB-1-406-607-620-1,2&3	Control Room Building, Architectural Plan, Sections & Elevations
6.	TB-3-406-607-671& 672	Store Shed Building, Architectural Plan, Sections & Elevations
7.		Fire Fighting Pump House
8.	ATV-BHEL-UPPTCL-S-L-101	Conduit layout drg of Control Room Building

Typical dimensions of indoor 10 cars parking shed: - Length =27m; Width =6 m and height = 3m.

2.0 DESIGN CRITERIA

2.1 The illumination System for outdoor Switchyard shall comprise of:

- ❑ Normal AC lighting
- ❑ Emergency AC Lighting

The illumination System for Control room and other buildings shall comprise of:

- ❑ Normal AC Lighting
- ❑ Emergency AC Lighting
- ❑ Emergency DC Lighting

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

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

Sl.No.	Area	Average Lux level	Uniformity
1.	Control & Relay panel Room	350	0.8
2.	GIS BUILDINGS	200	0.7
3.	Offices	300	0.8
4.	Indoor areas other	150	0.7
5.	Switchyard general excluding transformers	20	
6.	Switchyard Strategic equipment (transformer area)	50	

The outdoor switchyard shall be illuminated using LED flood lights as per BOQ has been given in specification.

2.3 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.

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

2.5 The minimum lux level to average lux level ratio should not be less than 0.3 (i.e Emin/Eav> 0.3). The maintenance factor for indoor illumination design shall be considered as 0.8.

2.6 Maintenance factor for outdoor shall be 0.65

2.7 The contractor shall submit detailed calculation for reaching the above Lux level for Employer's approval during detailed engineering.

2.8 After placement of order, the bidder has to design the system as per relevant standards/codes to the satisfaction of BHEL/UPPTCL

2.9 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.

2.10 Tentative quantities are mentioned in BOQ. Actual quantities to be supplied shall be as per the quantities approved based on design drawings.

2.11 Occupancy sensors shall be provided in rooms as per section 2.

2.12 Temperature Transducer - Each switch-yard panel room shall be provided with temperature transducer to monitor the temperature of the panel room. The Temperature transducer shall have the following specification:

- Sensor: Air temperature sensor (indoor use)
- Output: 4 to 20mA
- Temperature range: -5°C to 60°C
- Resolution: 0.1°C
- Accuracy: 0.5°C or better

3.0 SCOPE OF SUPPLIES & SERVICES

(i) System Design Engineering is included in vendor's scope, which includes design of complete lighting system for indoor and outdoor areas. Please refer the list of reference drawings as per annexure for the tentative areas to be covered by the lighting system. The aspect of engineering covers preparation of

- electrical distribution and control schemes,
- quantity estimation for both indoor & outdoor
- lighting layout drawings for outdoor yard
- Street lighting layout
- lighting layout for buildings
- conduit layout drawings lighting system,
- conduit layout drg for split AC, telephone points, firefighting system
- wiring schemes upto luminaires,
- cable schedules

and all associated design work not specifically mentioned in the specification. The quantity estimation to include all items required for the complete lighting system viz. lighting fixtures, lamps, Lighting DBs, Welding DBs, lighting panels, conduits, PVC wires, mounting hardware etc. complete in all respect.

Bidder to prepare boq for point wiring material (separate for each building/area) and other accessories and submit for Approval. Cost for design deemed to be included in equipment prices.

BHEL has executed conduit work in slabs/roof in control room building as per "*conduit layout drawing for control room building - ATV-BHEL-UPPTCL-S-L-101".* Hence bidder shall not consider the conduit requirement for slabs in control room buildings. Bidder to consider other conduit requirement in control room building and bidder shall design the illumination system in line with the above conduit layout.

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

(iii) Further, in case any type of luminaire/ panels etc not included below but are required for meeting the technical specification shall be specifically brought out in the offer/shall be supplied.

(iv) Bidder shall indicate in his offer, catalogue nos. of all equipment offered.

(v) Earthing of Junction box & Lighting Panels etc is to be done by 50X6 mm GS Flat.

(vi) Earthing of Lighting Poles (for lighting poles outside switchyard) is to be done by 20 mm dia 3000 mm long rod electrode. Rod electrode to be supplied by bidder.

(vii) Supply of necessary wire/cable for consumption within the street light pole assembly, such as pole mounted JB to respective light fittings etc. shall be in bidder's scope.

(viii) All lighting panels, junction boxes, receptacles fixtures, conduits etc. shall be grounded in compliance with the provision of I.E. rules.

(ix) Supply of all other items such as wires, steel wire, lugs, Cable glands, earthing material etc. required to complete the works are in bidder's scope.

(x) The equipment / services to be furnished for Substations under this contract are detailed hereunder and shall be read in conjunction with other clauses of this specification. All such items though not specifically mentioned but required to meet specification and for safe and satisfactory operation of equipment/ system will also be treated as included and the same shall be supplied at NO EXTRA COST to Purchaser. Further, in case any item not included below but are required to meet the technical

specification, to be brought out by bidder at tender stage itself. Such items may be mentioned and included under separate head in the table below.

(xi) **Supervision of** Erection & Commissioning of conduits & wiring points for

- Lighting system,
- Split AC,
- Firefighting system
- telephone points

(xii) Civil design for lighting mast / pole is included in bidder's scope

(xiii) Design rectification engineering (if any) is included in vendor's scope. In case of revised inputs or site feedback, preparation and submission of revised engineering outputs shall also be in the scope of vendor.

(xiv) Although Erection and Commissioning is not included in vendor's scope, the vendor shall be fully responsible for establishing the correctness of engineering and equipment at site.

(xv) Review of sub-vendor's documents by the purchaser shall not relieve the vendor from the responsibility of design & supply.

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

(xvii) Lighting Panel/ Junction Box: The bidder shall supply junction boxes complete with terminals as required. The supports, brackets, bolts, nuts, screws etc. required for erection are also included in scope of the bidder.

(xviii) Junction boxes shall be provided with two earthing terminals suitable for 8 swg GI earthing wires.

(xix) The continuous conductor of specified GI wire shall be run all along each conduit run. The conductor shall be connected to each panel ground bus. All junction boxes, receptacles, switches, lighting fixtures etc. shall be connected to specified GI wire. Supply of GI ground wire shall be included in bidder's scope.

(xx) Supply of all other items such as wires, steel wire, lugs, cable glands, earthing material etc. required to complete the work is in bidder's scope.

(xxi) Cable gland plate thickness in all the panels shall be minimum 3.0 mm.

(xxii) The documents shall be in English language and MKS system of units.

(xxiii) All accessories shall be wired upto a terminal block or a separate weather proof metallic terminal box suitable for 2.5 sq. mm. copper wire termination.

(xxiv) Single line diagrams of power distribution upto Lighting Panels. Separate drawing for complete lighting distribution shall also be prepared by vendor.

(xxv) Preparation of **As-Built drawings** and submission of the same in hard copy 5 sets & in CD ROM – 2 numbers.

(xxvi) Conducting of lux level measurement as per approved designs to the satisfaction of owner / purchaser shall be under bidder's scope.

(xxvii) Bidder shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The bidder shall furnish a list of Commissioning spares that will be provided by him. The unused commissioning spares shall be returnable to the bidder.

4.0 EXCLUSIONS / BHEL ISSUED ITEMS FOR ILLUMINATION:

Following items are supplied by BHEL for illumination system. Remaining all items required for successful completion of illumination system is under scope of bidder. Bidder to however submit estimate and calculation sheet BHEL supplied item during contract stage.

- 415V Main Lighting Distribution Board,
- 415V AC Emergency Lighting Distribution Board
- Lighting Transformers for MLDB & ELDB
- Multicore armoured power & control cables
- 75x12, 50x6, 25x6 mm GI flat for earthing works, however GI flat of size less than 50X6 shall be supplied by bidder.
- 110/50mm GI/ PVC pipe for cabling works
- 40mm dia MS rod for earthing works
- supply of telephone set and paired cables

5.0 BILL OF QUANTITY – refer attached Annexure-BOQ

6.0 TECHNICAL QUALIFYING REQUIREMENT

Technical qualifying requirement shall be as per "**Annexure-QR"** attached.

7.0 TYPE TESTING

All supply items i.e. Luminaries, Lighting Panels, Junction box, Receptacles are to comply type test requirement as per relevant IS / IEC / Specification.

The bidder to submit the type tests reports for the tests conducted on the equipment identical or similar to those to be supplied under this contract and the test(s) should have been conducted **at an independent laboratory** (NABL approved) after 07.09.2013. If any type test report is

found to be technically unacceptable, such type test(s) shall be conducted by the bidder without any cost and delivery implication to BHEL/UPPTCL at an independent lab approved by customer.

All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bidder's scope.

Additional Type test certificate on equipment, if any, shall be furnished, else the equipment shall have to be type tested, free of cost, to prove design. Items like ceiling fans, Emergency Lighting unit, flexible conduit, earthing wire & flat, 24V supply module, ladder, switch boxes, exit sign, structural steel shall be cleared based on Certificate of Compliance.

8.0 QUALITY PLAN

The successful bidder shall submit the QP for BHEL/ UPPTCL approval. In case bidder has reference QP agreed with UPPTCL, same can be submitted for this specific project after award of contract for BHEL/ UPPTCL approval. There shall be no commercial implication to BHEL on account of QP approval.

All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan. The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification. Charges for all these tests for all the equipment & components shall be deemed to be included in the bid price.

9.0 INSPECTION & TESTING

Before being fitted on the equipment, all components shall be subjected to routine tests at the bidder's factory, provided by the relevant IEC/IS standards. A detailed test report proving the successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on each item in accordance with the applicable IEC/IS and the material shall be offered for final inspection by BHEL/UPPTCL in accordance with agreed quality plan with 3 weeks' advance information. The charges for these shall be deemed to be included in the equipment price.

10.0 PACKING

The material shall be packed in such a way to ensure protection against damage during transit, storage for prolonged periods (at least 1 year) at site.

Annexure-QR

TECHNICAL QUALIFYING REQUIREMENT

(1) The bidder should have experience of design & supply of Illumination System for at least one project of State Electricity Boards/ Central Utilities/State or Central Transmission Utilities/ Industrial Installations.

Documents to be submitted for Technical Requirements:

a) Proof of design, by submitting the approved design documents and drawings of both indoor & outdoor areas.
b) Purchase Order copy defining the scope & value.

(2) **OPERATIONAL EXPERIENCE**

Offered equipment/ system should have given three years proven *trouble free operational service*** in tropical climate. However, in case of equipment manufactured in India under valid foreign collaboration, operating experience in tropical climate of offered collaborator's equipment, shall also be acceptable provided copy of valid collaboration agreement for the offered equipment is submitted with the proposal. Further in case of offer of imported equipment, three year operating experience shall be considered in respect of those areas only which are similar to the tropical conditions prevailing in India.

(3) **MANUFACTURING EXPERINCE**

The indigenous manufacturers or their foreign collaborator must have manufactured at least 20% of the specified quantities of main item of identical or similar equipment.

(4) **TESTING FACILITIES:**

The manufacturer must have all necessary facilities at their works for carrying out such routine and acceptance tests as prescribed in the relevant ISS/IEC and any other routine and acceptance test as specified in the specification. Documentary evidence of existence of such facilities will be submitted along with the proposal.

(5) **TYPE TEST FOR INDIGENOUS OR FULLY IMPORTED EQUPMENTS:**

The offered equipment must have been fully type tested as per relevant ISS and/or any other specified international standards, during the last 5 years period to be reckoned from the 0**7.09.18**. Photo copy of such type test reports/ certificates must be submitted along with the proposal. The test certificates of proto type manufactured and tested by foreign collaborators of the tenderers at their works shall not be acceptable for indigenously manufactured equipment.

** **Trouble Free operation** means certificate issued by the Employer/ Utility certifying the operation without any adverse remark.

BOQ for supply and supervision of Erection Testing & Commissioning (ETC) Works
Customer : UPPTCL
Project / Site : 400/220/132kV s/s at Shamli **ANNEXURE-BOQ**

Sl. No.		Item Description	Unit	Main Quantity	Spare	Total qty
		SUPPLY		(A)		
A		**Illumination System: Outdoor Switchyard and Street Lighting at 400/220/132 kV S/S**				
		Lighting Panel				
1	**Supply**	Lighting Panel (Outdoor) Type **ACP-2** as per technical specification.	Nos.	6		6
2	**Supply**	Lighting Panel (Outdoor) Type **ACP-3** as per technical specification	Nos.	2		2
3	**Supply**	Sub-lighting panel (outdoor) Type **SLP** as per technical specification	Nos.	4		4
		Lighting fixtures and Receptacles				
4	**Supply**	LED flood lighting fixtures- **type " FL2"** as per technical specification	Nos.	160	8	168
5	**Supply**	LED flood lighting fixtures- **type " FL1"** as per technical specification	Nos.	36	2	38
6	**Supply**	63A, 415V : Interlocked switch socket outdoor Receptacle **(Type RP)** complete in all aspect except cable.	Nos.	3		3
7	**Supply**	15A, 240V: Outdoor Receptacle 2 pole, 3-pin type **(Type RO)** complete in all aspect except cable.	Nos.	3		3
8	**Supply**	**Type L1** Street Lighting Pole of 6 meter - for SL-L1 type fixture	Nos.	60		60
9	**Supply**	**Type D1** Post top lantern pole of 4 meter - for SL-D1 type fixture	Nos.	4		4
10	**Supply**	3m , 20mm dia ms rod electrode	Nos.	65		65
11	**Supply**	Street lighting Fixture type " **SL-L1**" including junction box and wire	Nos.	60	3	63
12	**Supply**	Street lighting Fixture type " **SL-D1**" including junction box and wire	Nos.	4		4
13	**Supply**	Street lighting pole, **13 m high** including junction box and wire	Nos.	2		2
14	**Supply**	High beam fixtures on swivel support	Nos.	3	1	4
15	**Supply**	Outdoor Power Receptacle for Oil Filtration Unit **(250A)**	Nos.	2		2
16	**Supply**	30 m high lighting mast with lantern carriage (double drum winch type) including junction box , suitable for mounting 12 luminaires	Nos.	3		3
17	**Supply**	Junction boxes for outdoor	Nos.	6		6
18	**Supply**	25x3 mm GI flat for earthing	m	200		200
B		**Illumination System: Indoor Systems**				
		Lighting Panel				
19	**Supply**	Lighting Panel (Indoor) Type **ACP-1** as per technical specification	Nos.	8		8
20	**Supply**	Lighting Panel (Indoor) Type **DCLP** as per technical specification	Nos.	4		4
		Lighting fixtures and Receptacles				
21	**Supply**	Recess mounted 2X2 LED Luminaire - **Type 'RSQ-1'**	Nos.	250	13	263
22	**Supply**	Reccessed mounted , circular LED downlight luminaire**, Type RC-I**	Nos.	5	1	6
23	**Supply**	Surface mounted , circular LED downlight luminaire**, Type SC-I**	Nos.	20	1	21
24	**Supply**	Surface mounted 2X2 LED Luminaire - **Type 'SSQ-1'**	Nos.	20	1	21
25	**Supply**	Recess mounted 4x1 feet LED panel , **Type RL-I**	nos.	4	1	5
26	**Supply**	Surface mounted linear LED Tube with box, **type SL-I**	nos.	220	11	231
27	**Supply**	LED Indoor high bay fittings **Type IHB**	Nos.	55	3	58
28	**Supply**	Portable emergency lights	Nos.	4	1	5
29	**Supply**	Fitting type **-IB**	Nos.	20	1	21
30	**Supply**	Fitting type **-IF**	Nos.	20	1	21
31	**Supply**	Fitting Type - **BL**	Nos.	5	1	6
32	**Supply**	Exit Sign Board	Nos.	10	1	11
33	**Supply**	DPMCB receptacles with 32A MCB for split AC supply	Nos.	40		40
34	**Supply**	Air Conditioning Supply Panel with 160A TP MCCB incommer & 12 Nos 32A DP MCB outgoing feeders	Nos.	5		5
35	**Supply**	Occupancy sensors and other accessories as required for control of lighting in the stairs area of control room cum administrative building as per specification	Nos.	16		16
36	**Supply**	Light level sensors and other accessories as required for control of lighting in the stairs area of control room cum administrative building as per specification	Nos.	18		18
37	**Supply**	32 A TP receptacles with MCB (3 phase)	Nos.	4		4

BOQ for supply and supervision of Erection Testing & Commissioning (ETC) Works
Customer : UPPTCL
Project / Site : 400/220/132kV s/s at Shamli **ANNEXURE-BOQ**

Sl. No.		Item Description	Unit	Main Quantity	Spare	Total qty
38	**Supply**	Temperature Transducer	Nos.	10		10
39	**Supply**	5A/15A receptacle **Type RI**	nos.	15		15
40	**Supply**	15A/240V Receptacle **type RO** (Industrial type)	nos.	15		15
41	**Supply**	63A/415V Receptacle **type RP** (industrial type)	nos.	2		2
42	**Supply**	Telephone points- single outlet telephone socket including cable/wire and	nos.	10		10
43	**Supply**	Telephone JB	Nos.	1		1
44	**Supply**	LAN points incudiung accessories	Nos.	5		5
45	**Supply**	LAN Cable	metres	300		300
46	**Supply**	Switchboards as per Technical specification	Lot	1		1
47	**Supply**	1400mm sweep Ceiling fan with electronic Step regulator	nos.	15		15
48	**Supply**	300 mm sweep Exhaust fans	nos.	6		6
49	**Supply**	400mm sweep wall mounted fan	nos.	5		5
		Misc. Items				
50	**Supply**	Self supported aluminium ladder as per technical specification.	Nos.	1		1
51	**Supply**	Cartwheel mounted aluminium ladder as per technical specification	Nos.	1		1
		Erection items				
52	**Supply**	**Erection items for indoor** like 3 way,G.I.,circular J.B.(20mm and 25mm),4 way,G.I.,circular J.B.(20mm and 25mm),90deg,G.I.,Inspection Bend (20mm and 25mm),90deg,G.I.,Normal Bend(20mm and 25mm),Heavy duty, Saddle with base(20mm and 25mm),Heavy duty, Saddle without base (20mm and 25mm),M4X25mm, steel screw with nut and washer,G.I. check nut/lock nut(20mm and 25mm),PVC Rawl plug,6mm,Wooden screw,35mm,Earth clip/clamp (20mm and 25mm),Cleat fabrication out of 25x6mm M.S. 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,25mm,PVC conduit,Coupling,Swing out braket,20mm,Heavy duty,ball socket,Machine screw(for fixing surface mounting fixtures on circular J.B.), PVC closure(20mm and 25mm),Reducer (20mm and 25mm). GI conduits , epoxy coated conduits for corrosive areas , 1.5, 2.5 , 4, 6 & 10 sq. mm wires, GI wire/ FRLSH cu wire for earthing etc to complete	lot	1		1
53	**Supply**	**Erection items for outdoor** like 20x1.5mm Aluminium flat, M12x40mm, G.I. Bolt with nut and washer for fixing outdoor lighting panels,M6x30mm, G.I. Bolt with nut and washer for fixing control gear boxes,M8x30mm, G.I. Bolt with nut and washer for fixing outdoor J.B.s,SLP, M10x35mm, G.I. Bolt with nut and washer for fixing outdoor lighting fixtures,G.I., 2.5 sqmm wire from STREET LIGHT POLE JB to fixture, Earth wire from J.B. to lighting fixtures,Mounting brackets for outdoor lighting fixtures, GI wire for earthing etc to complete	lot	1		1
		Services				
54	**Service**	SUPERVISION OF ERECTION TESTING AND COMMISSIONING	MANDAYS	150		150
55	**Service**	Lux level demonstration for outdoor	lot	1		1
56	**Service**	Lux level demonstration for buildings	lot	1		1

Remark -1: 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 ± 50% of total value during execution of contract . The quantity of individual items may however vary upto any extent

Remark -2: If extra items required for completion of Job but not covered above, shall be quoted separately as a list of items and same shall be submitted with the bid (price of supply to be quoted on Lumpsum basis).

Remark-3 : 1.5 sqmm FRLSH PVC insulated multistrand single core copper conductor cable shall be used as earth continuity conductor for light, fan, plug, call bell and switchboards etc.

Remark-4 : Any shortage in quantity of erection material (item no. 52, 53) to be completed by bidder free of cost.

Remark-5: No wiring material / erection items required for sprares.

Remark-6: Multiple visits are envisaged for supervision work

Remark-7: Rates qutoed for supervision include boarding, lodging & travel expenses.

SECTION –2A

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.

2.0.3 APPLICABLE CODES AND STANDRADS

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 after 07.09.2013, 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 contact 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.

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

2.3 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.

Section 2B

LIGHTING SYSTEM

LIGHTING SYSTEM

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3.0	Codes and Standards
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11.0	Terminal Blocks
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13.0	Lighting Panels (L.P.): (Indoor, Outdoor and Street Lighting Panels)
14.0	Lighting Panels (L.P.): (Indoor, Outdoor and Street Lighting Panels)
15.0	Main Bus Bars
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25.0	Ceiling & Wall Mounted Fans and Regulators
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TECHNICAL SPECIFICATION OF SUBSTATION LIGHTING SYSTEM

1.0 SCOPE OF WORK

1.1 The scope of work covers the complete designing, engineering, testing, supply, installation, testing and commissioning of complete lighting and illumination system of switchyard areas and buildings and covers following items of work. The successful bidder shall offer most cost effective lighting system deploying a combination of conventional and energy efficient lamps and luminaries depending on their utilization/functional requirements. The lux levels in various rooms/halls shall be governed as per the relevant IS/IEC.

i) Various lighting fixtures complete with lamps, supports and accessories as per the design submitted by the Contractor and approved by the UPPTCL.

ii) Lighting panels.

iii) Various receptacles and switchboards.

iv) Galvanized rigid steel conduits for lighting system, conduits and fixture supports, complete with all accessories including junction boxes and pull out boxes and associated civil works.

v) Lighting wires for wiring of all lighting fixtures, receptacles etc., from lighting panels/switch-boards.

vi) Outdoor Street lighting poles, including associated civil works.

vii) G.I. Earth wires/rods/flats for all lighting fixtures, receptacles and G1 conduit installation.

viii) Battery operated portable type fluorescent lamps and fixtures.

ix) Various Electrical Fixtures/ items for Control Room Building.

1.2 **The following specific areas are included in the scope of lighting:**

i) 4000 kV, 220 kV & 132 kV Switchyard areas

ii) Street lighting inside substation premises.

iii) GIS cum Control Room buildings,

iv) Control & Relay Panel Rooms,

v) Diesel Generator Room, and

vi) Other auxiliary buildings in the Substation etc.

1.3 The successful bidder shall furnish the power requirement (for both AC and DC) and conform the adequacy of the proposed station transformer / battery capacity.

1.4 The detailed drawings showing the lighting layout of the switchyard areas indicating lighting intensity in respective areas will be prepared by the Contractor

and shall be submitted for approval. The above layout drawings will include disposition and location of lighting poles, lighting fixtures, receptacles, switchboards, etc.

1.5 All the civil works like fixing of anchor bolts, breaking of floors/walls for fixing conduits/pipes/earth conductors, sealing of floor/wall openings after conduits, pipes, earth conductors have been put shall be carried out by the Contractor. Furthermore civil works associated with erection of lighting poles, including street lighting poles, lighting panels etc. Hardware required for fixing arrangement for various lighting fixtures are included in contractor's scope. The glands shall be of brass coated with tin/nickel. The lugs shall be tinned copper.

2.0 LAYING AND TERMINATION

i. Laying and termination of 415 V PVC armoured Aluminium Power Cables (2Cxl0 sq.mm) from lighting panel to the junction box and 415V PVC armoured power cables (3½ x l6sq.mm Al) from lighting panel to sub lighting panel in case of lighting mast and street lighting poles and power cables for looping from one pole to other shall be in the scope of the contractor.

ii. Power cables from the junction box at the bottom of substation column/ lighting pole to the lamp terminals shall be supplied and erected by the contractor. Laying and termination of power cable to the 63A, 3 phase power receptacle from AC distribution board and looping in and looping out from one receptacle to another is in the scope of the Contractor.

iii. The double compression glands and lugs required for termination of cables in receptacles & junction boxes, lighting panels, sub lighting panels, street lighting junction boxes and any other areas are in contractor's scope. The rates for these items have to be included in erection rates of respective items.

iv. Power cables mentioned in the above clause shall be laid through the available cable trenches to the maximum extent possible. Wherever cable trench is not available the cable shall be laid buried under ground. Gantry and lighting peak heights should be considered.

Each cable and conduit run shall be tagged with numbers that appear in the cable and conduit schedules. Cables and conduits shall be tagged at their entrance and or exit from any piece of equipment junction or pull box.

v. The tag shall be 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 shape for power cables and circular shape for control cables.

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

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

viii. The marker which is a concrete block shall project 150 mm above ground and shall be spaced at an interval of 10 meters and at every change of direction. It shall also be located on both sides of road or drain crossing.

ix. The contractor shall furnish and install all tags and markers stated above. The rates

for supply & erection of these tags and markers have to be included in the erection rates quoted for cable laying and termination.

2.1 Supply of the following cables for lighting system is in the scope of the contractor.

a) Power cables from lighting panel to the sub-lighting panel at the bottom of substation column / lighting pole and from sub lighting panel to the lamps at the top of the column /lighting pole.

b) Power cables from street lighting panel to street lighting poles, and power cables for looping from one pole to other pole.

c) Power cable from 415 Volt AC distribution board to 3 phase power receptacles rated 63 amp & looping from one power receptacle to the other.

d) Power cables from lighting panels to junction box at the bottom of the gantry.

e) Power cables from 415VAC distribution board to lighting/station transformer and lighting/station transformer to lighting panels.

3.0 CODES AND STANDARDS

The design, manufacture and performance of equipment shall comply with all currently applicable standards, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the Bidder of these responsibilities.

The equipment offered shall conform to latest applicable Indian standards mentioned elsewhere in the specification.

4.0 ILLUMINATION SYSTEM

4.1 Indoor Lighting

1. GIS Building:

The GIS Building main halls will be illuminated using enclosed type high bay, luminaries having 250 watt metal halide fixtures along with surface mounted 1 x 100 W GLS down lighters for emergency areas.

2. Control Room Building:

a) Control room area will be illuminated using mirror optics luminaries, which have superb glare control, the luminaries will have Cat II mirrors. Philips TBS 088 / 236 CS HF or equivalent.

b) In addition to mirror optics luminaries CFL down lighter with turbo louvers will be used. The luminaries would be suitable for 2XPL 16 Watt Lamp.

c) For non false ceiling areas.

The illumination will be carried out using 2x28 Watt lamps with industrial reflector Philips TMS 122 / 228 HF or equivalent.

d) DC Emergency Lighting in non false ceiling areas to be carried out with surface mounted down lighters.

e) For all areas necessary exit sign lights and minimum 4 nos portable emergency lights will be provided.

3. Following Average Lux Levels will be maintained:

		Lux	Uniformity
1.	Control Room	350 Lux	0.8
2.	Control & Relay Panel Rooms	350 Lux	0.8
3.	GIS Buildings	200 Lux	0.7
4.	Offices	300 Lux	0.8
5.	Indoor areas other	150 Lux	0.7

4. Control

Sufficient number of occupancy and light level sensors shall be provided subject to following minimum requirement:

S.No.	Area	No. of Occupancy Sensor	No. of Light Level Sensor
1.	Control Room/SCADA	1	1
2.	Control & Relay Panel Room	1	1
3.	Committee Room	1	1
4.	AE (Maintenance) Room	4	--
5.	AE (T&C) Room	4	--
6.	JE (Maintenance) Room	1	--
7.	Battery Room	1	1
8.	Electrical Lab	1	1
9.	Record Room	1	1
10.	Pantry Room	1	--
11.	400 kV GIS Hall	--	4
12.	220 kV GIS Hall	--	4
13.	132 kV GIS Hall	--	4

No occupancy sensor and light level sensors are envisaged for ACDB room, DCDB room, Lobby, Corridor, DG set and Fire fighting pump house building.

Each light level sensor shall be provided to measure and regulate lighting. The light level sensor shall be used to achieve bank switching.

Each occupancy sensor shall be used for indoor use with time delay programmable in the minimum range of 1 sec. to 2 Hour to control the illumination in the area.

4.2 Out Door Lighting

1. Main equipment, 50 lux

	Transformers, Other Equipments	
2.	Other locations including Roads	20 lux.

The minimum lux level to average lux level should not be less than 0.3 (i.e. Emin/ Eav > 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 can provide luminaries of 1x400 W/1x250 W and 2x400W/2x250 W flood light as per requirement.

In addition to the normal lighting provided in the switchyard area to maintain the desired lux levels, few high beam fixtures on swivel support shall be provided in strategic locations near equipments which shall be kept normally OFF and these shall be switched ON in case of maintenance work. The number of fixtures should be able to maintain minimum lux level requirement as per IS/IEC.

5.0 DESCRIPTION OF ITEMS

The Contractor shall supply and install the following equipment and accessories in accordance with the specification.

5.1 LIGHTING PANELS

5.1.1 OUTDOOR

415 AC lighting panel with 415V, 63A, 3 Phase 4 wire bus and one no. 63A, TPN, MCB with neutral unit as incomer and 20A, MCB as outgoing feeders, the details are as follows.

Type Of Panel	Description	Detail Of Outgoing Feeders
ACP-2	Outdoor	6 nos. 32A Tripple pole MCB with neutral suitable timer & contactor for automatic switching.
ACP-3	Outdoor	3 nos., 32A Tripple pole MCB with Neutral Lighting with suitable timer & contactor for automatic switching.

Note: The numbers of outgoing feeders indicated above are the minimum.

5.1.2 INDOOR

415 V Indoor AC lighting panel, 63A 3 phase 4 wire bus and one number 63 AMP TPN, MCB with 300ma 63 A, RCCB. Flush Mounted with per phase isolation and indication lamps din mounted. The DB will be flush mounted and double door type.

Type Of Panel	Description	Detail Of Outgoing Feeders
ACP-1	Indoor	18 nos. outgoing 16-32 Amp SP MCB

220V DC indoor type change over board and 220V DC 32A two wire bus and one 32A contactor backed up by 32A double pole MCB as incomer. The panel shall have local push button controls. Following are the various types of panels required with control timer.

Type Of Panel	Description	Detail Of Outgoing Feeders
DCP	Indoor	6 Nos. ,16A DP MCB Unit.

5.3 SUB-LIGHTING PANELS

Type Of Panel	Description	Detail Of Outgoing Feeders
SLP	Outdoor	4 pole 32A Isolator suitable for 415V, 50 cycles AC Supply, with LILO Facility using 8 nos. terminal blocks suitable for cable upto 16m sq cable Enclosure shall be suitable for outdoor use with IP-55 degree of protection as per IS:13947 (Part-I)

5.4 LIGHTING FIXTURES

Please refer Annexure-1

5.5 RECEPTACLES

Type Of Receptacles	Description	Detail Of Outgoing Feeders
RO	Outdoor	15A, 240V, Outdoor Receptacle 2 Pole, 3 pin type
RP	Outdoor	63A, 415V, Interlocked switch socket, outdoor receptacle
RI	Indoor	5/15A, 240V Indoor receptacle 3-in type (Modular)

5.6 SWITCH BOARDS

Modular type switches, 5/15 Amp. Receptacles

5.7 CONDUITS AND ACCESSORIES

Galvanised Rigid Steel or Rigid PVC conduits of 20mm/25mm/32mm/40mm dia for Lighting and Telephone wiring.

5.8 JUNCTION BOXES with 5 nos. of terminal blocks

5.9 LIGHTING POLES – Adequate nos. of lighting pole shall be provided.

5.10 CEILING FANS – 1400mm Sweep with Electronic regulator

5.11 MAINTENANCE EQUIPMENT

i) A type Aluminium ladder of 3 mtr. vertical height.
ii) Cartwheel mounted aluminium ladder Vertical Height 7.5 Mtrs. when extended.

6.0 LIGHTING SYSTEM DESCRIPTION

The lighting system shall comprise of the following:

6.1 a) AC NORMAL LIGHTING

i. AC lights shall be connected to AC lighting panels. Lighting panels will be fed from Main Lighting Distribution Boards.

ii. The lamps & luminaries for outdoor lighting shall be mounted on columns and lighting poles. The lighting poles shall be supplied and erected by the Contractor. Lighting poles as per the requirement are to be designed, fabricated, galvanized, supplied and erected by the Contractor to meet the specified Flux levels in the switchyard.

iii. All the lamps & luminaries mounted on substation columnsl lighting pole shall be fed from the sub-lighting panel to be mounted near the structure. Sub-lighting panel shall be connected to the outdoor lighting panels.

iv. Lamps & Luminaries mounted on the substation columns shall be fed from the outdoor lighting panels through junction box.

v. Power receptacles of 15 Amp in the outdoor area shall also be fed from outdoor lighting panels.

vi. Power receptacles of 63 Amp in the outdoor area will be fed from Lighting Distribution Board to be supplied.

vii. Street lighting poles shall be supplied power from street lighting panels, street lighting panels shall be fed from the lighting distribution board.

viii. Indoor lamps & luminaries, power receptacles fans etc., shall be supplied power from indoor lighting panels that in turn shall be connected to the Lighting Distribution Board.

ix The Contractor shall determine the quantity of rating of lamps & luminaries for both indoor and outdoor area, quantity of outdoor & indoor lighting panels, sub lighting panels and street lighting panels to meet the illumination level requirement and other specified technical requirements as per bidding documents as per Purchaser' s approval of design and drawings furnished by the Contractor.

b) AC EMERGENCY LIGHTING

This system will be available in GIS cum control room building, battery room, DG Set & switchyard. AC lighting load will be connected to this system which will be normally 'ON'. The lighting panels of this system will be connected to the Emergency lighting board which is fed from diesel generator during the emergency. 25% ~~50%~~ of lighting fixtures shall be connected on AC emergency lighting.

c) DC EMERGENCY LIGHTING

A few D.C. emergency lighting fixtures operated on the D.C. system will be provided in the strategic locations so that the operating personnel can safely find their way even during emergency of a total A.C. failure. These lights will be normally 'OFF' and will be switched 'ON' automatically when under voltage occurs in the A.C. main lighting distribution board. GLS lamp down lighters in false ceiling area and Bulkhead fixtures in non false ceiling area to be used.

d) PORTABLE FIXTURES:

Three numbers of battery operated, portables fixtures will be provided in the Control room building and Outdoor DG Set .

These fixtures will be provided at important locations in the above mentioned areas.

6.2 DRAWING AND DOCUMENTS:

The Bidder shall submit in triplicate along with the bid the following:

i) Complete technical literature supported by catalogues and type test certificates for:

a) Lighting fixtures and accessories like lamp holders, starter holders, ballasts, starters, capacitors, fuses etc.

b) Lamps

c) Receptacles & plug

d) Switch & Switch boards

e) Conduits and conduit accessories

f) Junction boxes

g) Pull out boxes

h) Lighting panel including switch fuse unit, MCB, Contactor, Push Buttons, auxiliary relays.

i) Lighting poles and fixing arrangement on columns

j) Ladders

ii) For lighting fixtures the literature shall indicate terminal arrangement, internal wiring and dimensional details.

iii) Light distribution diagram, light absorption factors, coefficient of utilization charts, ISO-lux diagram (for street light fittings), aiming angle vis beam spot area charts

(for flood lights).

iv) For lamps - the literature shall indicate lumen output, lumen output depreciation curve, lamp life, supply voltage variation *vis* lamp life, ambient temperature vis lamp life.

v) For lighting panels - the literature shall indicate plan, front view, inside view, terminal blades, schematic wiring drawing, bill of material listing out make, type, rating etc., of various equipment mounted in the panel.

vi) An illustration on design procedure for illumination of outdoor switchyard and control room considering the characteristics of offered luminaries and lamps, working table height, height of flood light etc restricting nominal vision angle of 8 deg.

The following design/drawings shall be submitted by the Contractor for approval of the Purchaser.

i) Detailed lighting design calculations for the lighting areas and lighting loads.
ii) Lighting layout and details of switchyard and control room building.
iii) Lighting Fixtures & Accessories

a) Description and illustrative literature givmg data of fixtures, components, method of assembly and compliance of the fixture with the requirements of this specification.

b) General arrangement drawings of fixtures showing outline dimensions, fixing details, cable entry location and earthing terrninallocation.

c) Performance data and curves showing light distribution and efficiency.

d) Lighting fixtures layout drawing for all the buildings, switchyard and streetlights showing wiring diagram from lighting panels to fixtures.

e) Conduit layout drawings.

iv) Lighting panels

a) Bill of material

b) Panel drawing showing fixing arrangement, front view, inside view showing the mounting arrangement of various equipments.

c) Schematic diagram

d) Panel internal wiring diagram for information only.

The correctness of this drawing shall be the responsibility of the Contractor. The Contractor shall submit two copies of all the drawings / documents to be approved by the Purchaser. One print of such drawings/documents will be returned to the Contractor marked approved/approved with corrections. After final approval of the drawing the Contractor shall furnish to the Purchaser six prints and one reprocfucible (soft copy) original of the drawings after incorporating all corrections.

All manufacturing and fabrication work in connection with the equipment prior to the approval of drawings shall be at the Contractor's risk. The Contractor may make any change in the designs which are necessary to make the equipment

conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. However, approval does not release the Contractor of any of his responsibilities and liabilities under the Contract.

The Contractor shall furnish with the Contract time schedule for furnishing the drawings / documents to be approved by the Purchaser, keeping in view the overall Contract completion date.

The Contractor after the installation of lighting equipment and others shall furnish marked up copies of all as built drawings to the Purchaser for affecting any changes in the original. This work shall be done immediately after the installation of lighting system equipment in a particular area is completed. Prices quoted by the Bidder shall be including the cost of furnishing these drawings.

7.0 LIGHTING FIXTURES AND ACCESSORIES

a) **General**

All lighting fixtures and accessories shall be designed for continuous operation under atmospheric conditions existing at site, without reduction in the life or without any deterioration of materials, internal wiring.

b) **Temperature Rise**

All lighting fixtures and accessories shall be designed to have a low temperature rise according to the relevant Indian Standards. The design ambient temperature shall be taken as 50 deg.C.

c) **Supply Voltage**

Lighting fixtures and accessories meant for 240V A.C. operation shall be suitable for operation on 240V A.C. 50Hz, supply voltage variation of ± 10%, frequency variation of ± 5% and combined voltage and frequency variation of ± 10%.

Lighting fixture and accessories meant for 220V DC operation shall be suitable for operation on 220V DC with variation between 198 to 242 Volts.

d) **Lighting Fixtures**

i) The lighting fixtures shall be Philips or Bajaj or Crompton Greaves make only except for fixtures type 'DSM' & 'HL' for which make has been specified elsewhere in this section. The different types of lighting fixtures are also indicated elsewhere in this Section.

ii) All fixtures shall be designed for minimum glare. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection.

iii) All lighting fixtures shall be complete with fluorescent tubes / incandesent lamps/mercury vapour/sodium vapour lamps as specified and shall be suitably wired up.

iv) All flourescent lamp fixture shall be complete with all accessories like ballasts, power factor improvement capacitors, lamps, starters, holders etc.

v) High beam fixtures shall be suitable for pendant mounting and flood lights shall have suitable base plate / frame for mounting on steel structural member. Hook mounted high beam fixtures are not acceptable.

vi) Each fixture (other than bulk head fixtures) shall have terminal blocks suitable for 2.5 mm sq. stranded flexible copper conductor. The internal wiring should be completed by the manufacturers and terminated on the above terminal blocks.

vii) The Contractor shall specifically furnish details of internal size of wires, type of insulation including other technical particulars and indigenous availability.

viii) In certain cases the fluorescent fixtures, which are located adjacent to each other, shall require adequate terminals to facilitate loop-in-loop-out connections of 2.5 mm sq. stranded copper conductor. The above shall be ascertained by the Contractor at the time of erection.

ix) Each lighting fixture shall be provided with an earthing terminal suitable for connection to 16 SWG GI earthing conductors.

x) All metal or metal enclosed parts of the housing shall be suitably constructed so as to ensure satisfactory earthing continuity throughout the fixture up to the earthing terminal.

xi) The mounting facility and conduit knock-outs for the fixtures shall be as specified and shall be suitable for 20 mm conduit entry.

xii) On completion of the manufacture, all surfaces of the fixtures shall be thoroughly cleaned and degreased. The fixtures shall be free from scale, rust, sharp edges and bums.

xiii) All enamel finishing shall have a minimum thickness of 2 mils for outside surface and 1.5 mils for inside surface. The finish shall be nonporous and free from blemishes, blisters and fading.

xiv) The housing shall be stove-enameled or vitreous enameled or anodized aluminum as indicated in the specification of the relevant fixture.

xv) The surface shall be scratch resistant and shall show no sign of cracking or flaking when bent through 90 deg. over 112 inch dia mandrel.

xvi) All light reflecting surfaces shall have optimum light reflecting co-efficient such as to ensure the overall light output as specified by the manufacturer.

xvii) The diffusing louvers used in the fluorescent fixtures specified (as applicable) shall be made of high impact Polystyrene sheet and shall have no yellowing property over prolonged use.

xviii) For certain areas the fixtures offered shall be suitable for provision of vibration dampers, if required during installation to enable the lamps to perform the full lamp life. The Contractor shall indicate the cost of such dampers separately.

xix) Height of fixtures should be such that it is easy to replace the lamps with normal ladder/stool. In case the ceiling height is very high, the fixtures may be placed on the walls for ground lighting.

e) ACCESSORIES

i) Reflectors:

The reflectors shall be manufactured from sheet steel or alumunium as applicable of not less than 22 SWG thickness. They shall be securely fixed in the captive type.

ii) Lamp holders and Starter Holders

(a) Lamp holders/starter holders for fluorescent tubes shall be of the spring loaded, low contact resistance, bi-pin rotor type, resistant to wear and suitable for operation at the specified temperature, without deterioration in insulation value, contact resistance or retention of the lamp/starter. They shall hold the lamp/starter in position under normal condition of shock and vibration.

(b) Lamp holders/starter for incandescent lamps and HPMV/HPSV lamps shall be of screwed type, manufactured in accordance with relevant standard and designed to give long and satisfactory service.

iii) Ballasts

a) The Ballasts shall be designed, manufactured and supplied in accordance with relevant standard and function satisfactorily under site condition specified. The ballasts shall be designed to have a long service life and low power loss.

b) Ballasts shall be mounted using self locking anti-vibration fixing and shall be easy to remove without dismantling the fixtures. They shall be totally enclosed units.

c) The wire-wound ballasts shall be of the inductive, heavy duty type, filled with thermosetting insulating moisture repellent polyester compound filled under pressure or vacuum. The ballast wiring shall be of copper wire. They shall be free from hum. Ballasts which produce humming sound shall be replaced free of cost by the Contractor. Ballasts for high pressure mercury vapour/ HPSV lamps shall be provided with suitable tappings to set the voltage within the range specified. End connections and taps shall be brought out in a suitable terminal block, rigidly fixed to the ballast enclosure.

d) Separate ballast for each lamp shall be provided in case of multi-lamp fixtures.

e) The Contractor has to submit G.A. and wiring diagram with all terminal details for Purchaser's approval.

iv) Startes:

Starters shall have bimetallic electrodes and high mechanical strength. Starters shall be replaceable without disturbing the reflector or lamps and without the use of any tool. Starters shall have brass contacts and radio interference suppressing capacitor.

v) Capacitors

a) The capacitors shall be suitable for operation at supply voltage as specified and shall have a value of capacitance so as to correct the power factors of its corresponding lamp circuit to the extent of 0.98 lag.

c) The capacitors shall be hermetically sealed in a metal enclosure.

vi) Lamps

a) General Lighting Services (GLS) lamps shall be provided with screwed caps and shall be of 'clear' type unless otherwise specified.

b) The fluorescent lamps shall be 'Day-light-colour' type unless otherwise specified and shall also be provided with features to avoid blackening of lamps ends.

c) Mercury vapour lamps, sodium vapour lamps shall be colour corrected type, with screwed caps.

d) The lamps shall be suitable for use in any position. Restrictions, if any, shall be clearly stated.

e) The lamps shall be capable of withstanding small vibrations and the connections at lead-in wires and filaments/electrodes shall not break under such circumstances.

f) The Contractor shall supply and install all the above type of lamps. The cost of the lamps shall be included in that of the lighting fixture as specified.

g) The Bidder shall furnish typical wiring diagram for Fluorescent, HPMV & HPSV fitting including all accessories. The diagram shall include technical details of accessories i.e. starters, chokes, capacitors etc.

h) Flexible conduits if required, for any fixture shall be deemed to be included in Contractor's scope.

vii) RECEPTACLES

a) All receptacles shall be of cast steel/aluminium, heavy duty type, suitable for fixing on wall/column and complete with individual switch.

b) In general the receptacles to be installed are of the following types

i) **Type RO** -15A, 240V, 2 pole, 3 pin type with third pin grounded, metal clad with gasket having cable gland entry suitable for 2Cx6 sq.mm. PVC/aluminium armoured cable and a metallic cover tied to it with a metallic chain and suitable for installation in moist location and or outdoor. The switch shall be of rotary type. Receptacles shall be housed in an enclosure made out of 2 mm thick Gl sheet with hinged doors with padlocking arrangements. Door shall be lined with good quality gasketing. This shall conform to IP-55.

ii) **Type RI** - The 5/15 amp 6 pin receptacles with switches will be of Modular type with flush type switches and electroplated metal enclosures of approved make

iii) **Type RP -** 63A, 415V, 3 phase, 4 pin interlocked plug and switch with earthing contacts. Other requirements shall be same as type RO. The receptacle shall be suitable for 3.5C x 35/3.5Cx70 sq.mm. aluminium conductor cable entry and shall also be suitable for loop-in and loop out connection of cables of identical size. Receptacle shall be suitable for outdoor application.

Receptacles shall be housed in a box made out of 2mm thick G.I. sheet, with hinged door with padlocking arrangement. Door shall be lined with good quality gasketing. This shall conform to IP-55.

8.0 SWITCH AND SWITCHBOARD

(a) All switch boards/boxes shall be of bent steel construction, fabricated of 16 SWG sheet with 6 mm thick Bakelite sheet cover.

(b) Switch boards/ boxes located in office building areas shall be flush mounted type of brick wall with only the switch knob projecting outside.

c) Switch boards/ boxes shall have conduit knock outs on all the sides. Adequate provision shall be made for ventilation of these boxes.

d) Flush type receptacles provided shall be so located that only the plug project outsides.

e) Switches shall be of piano key type having quick make and quickbreak mechanism complete with position indicator and shall conform to relevant Indian Standard.

f) All the components housed in the switchboard shall be wired to an outgoing terminal block by 2.5 Sq.mm stranded flexible copper wire. The terminal block shall be adequately rated and shall be as specified in Technical Specification and shall be suitable for termination of sizes up to 2 Nos. 10 Sq.mm stranded Aluminum conductor on the outgoing side. Wiring from lighting distribution board to switch board in the control room shall be 2.5 Sq.mm copper wires.

g) The exact number of switches including regulator for fans and layout of the same. in the switchboard shall be to suit the requirement during installation.

(h) The maximum number of luminaires ,controlled by one no 6 amp switch would 4 nos. For DC fixtures there will be no switch and the same shall be directly controlled from DC LP.

(i) The luminaires shall be wired in such a fashion that luminaires on each phase are evenly distributed all over the room.

9.0 CONDUITS & CONDUIT ACCESSORIES

a) The Contractor shall supply and install all rigid steel, heavy duty conduits including all accessories required like associated couplers pull out boxes, elbows, tees, reducers, junction boxes, steel wire for cable/wire pulling, GI saddles, screws, bolts, nuts, other clamping material etc. required for wiring as required. The sizes of conduits to be used shall be as per enclosed 'Schedule of Material'. Supply and erection of all accessories excepting GI wire & junction boxes shall be included in unit rates quoted for erection of conduits.

b) All conduits shall be seemed by welding and shall be of heavy gauge, hot dip galvanized.

c) The conduits shall conform to IS:9537, IS:3419, IS:1653 as applicable. The minimum size of conduit shall be 20 mm.

d) Each piece of conduit shall be straight, free from blister and other defects, and furnished in standard length of 3.0 meters threaded at both ends. The manufacturers name shall be stamped on each piece.

e) Flexible conduits wherever required shall be made with bright, cold rolled annealed and electro galvanized mild steel strips or PVC/Plastic.

f) All conduits accessories shall confirm to relevant IS and shall be hot dip galvanized or High quality virgin PVC and shall be ISI marked.

10. JUNCTION BOXES

a) The contractor shall have the following in The Contractor shall supply and install the junction boxes wherever required.

b) The junction boxes shall be suitable for mounting on walls, columns, lighting poles structures etc. The supply and erection of brackets, bolts, nuts and screws required for the erection shall be included on the installation rates. The placement of junction boxes in the cutouts in the walls or on the surface of the walls shall be got approved from the Purchaser.

c) Junction boxes shall be of square/ rectangular type of 1.6 mm sheet steel or 6 mm thick pressure die cast aluminum and shall have bolted cover with good quality gasket lining. Bidder shall quote separate price for both type of junction boxes.

d) The junction box and cover shall be hot dip galvanized.

e) The junction boxes shall be complete with conduit knockouts/ threaded nuts and provided with terminal strips, which shall be as specified as per Technical Specification. The junction boxes shall be suitable for termination of 20, 25, 32, 40 mm dia conduits/ glands on all sides. The junction boxes shall be provided with 4 way terminals suitable for two numbers 10 mm sq. wire.

f) The junction boxes shall have the following in indelible markings.

i) Circuit Nos. on the top.

ii) Circuit Nos. with ferrules (inside) as per drawings.

iii) DANGER sign in case of 415volt junction box.

g) The junction boxes shall be weather proof type with gaskets conforming to lP-55 as per IS: 2147. The conduit connections shall also be properly sealed to prevent entry of water.

11.0 TERMINAL BLOCKS

a. Multiway terminal blocks shall be of reputed make and complete with screws, nuts, washers and marking strips. Terminals shall be stud type.

b. Each terminal shall be suitable for terminating up to 2 Nos. 16 mm sq. stranded Aluminum Conductors without any damage to the conductors or any looseness of connections. Terminal strips provided in street - lighting poles shall be suitable for terminating upto 2 nos. 4C x 16 sq. mm aluminium cables.

12.0 PULL OUT BOXES

a. The Contractor shall supply and install the pull out boxes.

b. The pull out boxes shall be concealed type for indoor lighting and suitable for mounting on walls, column, structures etc. for outdoor lighting. The supply of bolts, nuts and screws required for the erection shall be included in the installation rates. The installation of pullout boxes in the cutouts in the walls are on the surface of the walls shall be got approved from the Purchaser.

c. The pull out boxes shall be circular of cast iron or 16 SWG sheet steel and shall have cover with good quality gasket lining.

d. The pull out boxes and cover shall be hot dip galvanized.

e. The pull out boxes shall be complete with conduit knock outs/ threaded hubs and provided at approximately 4 meters intervals in a conduit run.

f. The pull out boxes used outdoor shall be weather proof type with gaskets conforming to lP-55 as per IS: 2147.

g. The Bidder shall include the cost of pull out boxes in the installation rates of conduits.

13.0 LIGHTING PANELS (L.P.): (INDOOR, OUTDOOR AND STREET LIGHTING PANELS)

Each panel shall be provided with one incoming triple pole switch fuse unit with neutral link and outgoing miniature circuit breakers.

14.0 LIGHTING PANELS (L.P.): (INDOOR, OUTDOOR AND STREET LIGHTING PANELS)

a) Panels shall be Wall Mounted/Floor Mounted and sheet steel enclosed and shall be dust, weather and vermin proof. Sheet steel used shall be of thickness not less than 2.0 mm (cold rolled) or 2.5 mm (hot rolled) smoothly finished leveled and free from flaws, stiffeners shall be provided wherever necessary.

b) All outdoor panels and panels located in damp atmospheres shall have degree of protection not less than lP-55 as per IS: 2147. All indoor panels shall have degree of protection not less than IP- 52 as per IS: 2147.

c) The panels shall be single front construction with hinged door suitable for either floor mounting on channels, sills or on walls/ columns by suitable M.S. Brackets.

d) Panels shall be a dead front assembly provided with hinged door(s) with padlocking arrangement with single key supplied in duplicate. The lock shall be permanently fixed on the panel.

e) All doors, removable covers and plates shall be gasketed all around with neoprene gaskets.

f) The panels shall be suitable for cable/ conduit entry from the top and bottom. Suitable removable cable gland-plate shall be provided on the top and bottom of panels. Necessary number of double compression cable gland shall be supplied, fitted on to this gland plate. The cable glands shall be screwed on type and made of tinned brass.

g) All sheet steel work shall be phosphated in accordance with IS 6005 "Code of practice for Phosphating Iron and Steel". After phosphating thorough rinsing shall be carried out with clean water followed by final rinsing with diluted dichromate solution and oven drying. The phosphate coating shall be sealed by the application of two coats of ready mixed stoving type metal printer (comprising of red oxide & zinc chromate in a synthetic medium). The first coat may be flash dried, while the second coat shall be stoved. After application of the primer, two coats of finishing synthetic enamel paint shall be applied with each coat followed by stoving. The second finishing coat for external of panels shall be applied after completion of tests. Both outside & inside of sheet metal fabricated junction boxes etc., & outside of lighting fixtures shall be finished in light Grey (IS-5 shade 631). Inside of

lighting fixtures shall be finished in white. Each coat of primer & finishing paint shall be of slightly different shade so as to enable inspection of the painting. The final finished thickness of paint film on steel shall not be less than 100 microns & shall not be more than 150 microns.

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

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

j) Each panel shall be provided with a circuit directory plate (of anodized Aluminum with the inscriptions indelibly etched on the plate) which is removable fitted on the inside of the door.

k) Each lighting panel shall be provided with one no 'ON' indicating lamp for each phase along with fuses.

15.0 MAIN BUS BARS

a) Bus bars shall be of aluminum alloy conforming to IS: 5082 and shall have adequate cross-section to carry the rated continuous 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 20 kA for AC panels and 16 kA for DC panels.

b) Switch-Fuse Units:

c) Switches shall be hand operated, air break, heavy duty, quick make, quick break type conforming to IS: 4064.

d) The rating of switch shall be so chosen as to get complete protection under all normal/abnormal conditions such as full load, overload, short circuit etc.

e) All fuses shall be plug in HRC cartridge link type. The fuses shall be of class 3 type (20 KA prospective breaking current) for A.C. circuits and class-I (16 KA prospective current) for D.C. circuits. Fuses shall be provided with visible operation indicator to show that they have operated. All accessible live connections shall be adequately shrouded and it shall be possible to change fuses with the circuit alive, without danger of contact with live metal.

16.0 MINIATURE CIRCUIT BREAKERS (MCB) AND MOULDED CASE CIRCUIT BREAKER (MCCB)

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.

b) Single pole as well as three pole versions shall be furnished as required in the Schedule of Lighting Panels.

c) The MCBs and panel incomer fuse together shall be rated for full fault level. In case the MCB rating is less than the specified fault level the bidder shall coordinate these breaker characteristics with the backup fuse in incomer switch fuse unit in such a way that if fault current is higher than breaker rating, the fuse should blow earlier

than the breaker. If the fault current is less than MCB breaking capacity, MCB shall operate first and not the incomer fuse.

d) The MCBs shall be suitable for housing in the lighting panels and shall be suitable 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.

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

f) The tenderer shall check and coordinate the ratings of MCBs with respect to starting characteristics of discharge lamps. The vendor has to furnish overload & short circuit curve of MCB as well as starting characteristics curves of lamps for Purchaser's approval.

g) The MCB shall generally conform to IS: 8828

h) The MCB / MCCBs shall be deployed based on their capability to handle short circuit level prevalent in the system.

17.0 CONTACTORS

a. 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.

b. Contactor shall be provided with the three element, positive acting, ambient temperature compensated time lagged, hand reset type thermal temperature compensated time lagged, hand reset type thermal overload relay with adjustable settings to suit the rated current. Hand Hand reset button shall be flush with the front of the cabinet and suitable for resetting with starter compartment door closed. The contactors shall be suitable for switching on of Tungsten filament lamp also. The bidder shall check the adequacy of the contactors rating wire to lighting load.

18.0 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 plated engraved with their functions. Push buttons shall be of reputed make.

19.0 TERMINALS

Stud type of terminals of reputed make shall be provided. Terminals for outgoing and incoming shall be suitable for accepting 2 Nos. 16 sq.mm and 2 Nos. 35 sq.mm/ 70 sq.mm cables respectively. The vendor has to furnish details of terminals for Purchaser's approval.

20.0 LABELS

i) The lighting panel shall be provided on the front with panel designation labels on a 3 mm thick plastic plate or approved equal. The letter shall be black engraved on white background.

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

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

21.0 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.

22.0 SUB LIGHTING PANELS

The sub lighting panels shall have 4 pole 32 A isolator suitable for 415V, 50 Hz, AC supply and requisite number of terminals.

23.0 EMERGENCY PORTABLE LIGHTING FIXTURES

a. The contractor shall supply, store and install portable emergency lighting fixtures.

b. The portable fixtures shall have a built in battery rated for six hours, battery charges and solid-state inverters with 2x20 W incandescent/florescent lamps. These shall be of approved make.

c. The portable fixtures shall be of a single unit, completely trivialized and suitable for prolonged use with no maintenance.

d. The portable fixtures shall be supplied and necessary supporting brackets of galvanized steel suitable for wall/column mounting shall also be supplied.

24.0 LIGHTING POLES

a) The Contractor shall supply, store and install the following types of steel tubular lighting poles required for street lighting:

i) Type A1 Street Lighting Pole - for one fixure

ii) Type E1 Post top lantern pole - for one fixure

The Bidder shall furnish the drawings indicating all details of street lighting poles offered.

b) The complete civil works for erection of street lighting poles/masts shall be included in the scope of work.

c) Lighting Poles shall be complete with fixing brackets and junction boxes. Junction boxes should be mounted one meter above ground level.

d) The lighting poles shall be coated with bituminous preservation paint on the inside as well as on the embedded outside surface. Exposed outside surface shall be coated with two coats of metal primer (comprising of red oxide and zinc chromate in a synthetic medium).

e) The Contractor shall install lamps and luminaries for outdoor lighting on the substation structures and lighting poles. The luminaries shall be mounted at 5 mtrs and 15mtrs height on substation structures making necessary cantilever arrangement. The Contractor may propose the change of height of mounting to achieve required illumination.

f) The galvanized sheet steel junction Box for the lighting shall be completely weather proof conforming to lP-55 provided with a lockable door (lock to permanently fixed on the junction box) and HRC fuse mounted on a fuse carrier and fuse base assembly. The fuses & junction box shall be as specified in the specification. However, terminals shall be stud type and suitable for 2 nos. 16 mm cable. Necessary arrangements for gladding cable along with supply of double compression glands are included in Vendor's scope.

g) 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 wire.

h) Distance of centre of pole from street edge should be approximately 1000 to 1200 mm.

i) Earthing of the Lighting Poles should be connected to the switchyard main earthmat wherever it is available the same should be earthed through 3M long, 20 mm dia, earth electrode.

25.0 CEILING & WALL MOUNTED FANS AND REGULATORS

a. The Contractor shall supply and install the 1400 mm sweep ceiling fans complete with electronic regulator and switch, suspension rod, canopy and accessories. The wall mounted fans shall be of 400 mm sweep.

b. The contractor shall supply and install the switch, electronic regulator and board for mounting switch and electronic regulator for celling fans. The regulator will be housed in common switchboard for lighting and shall be of similar make and model as that of modular switches.

c. Winding of the fans and regulators shall be insulated with class E insulating material. Winding shall be of copper wire.

d. Electronic regulator with stepped control shall be provided.

e. Precautions shall be taken in manufacture of fans and regulators to ensure reasonable degree of silence at all speeds.

f. Type tests, acceptance tests and routine tests for the fans and regulators shall be carried out as per latest relevant standard.

g. Ceiling Fans and Wall mounted Fans & Regulators shall be of reputed make.

26.0 LIGHTING WIRES

a) The wiring used for lighting shall be standard products of reputed manufacturers.

b) The wires shall be 1100V grade, PVC insulated unsheathed single wire cable conforming to IS: 694.

c) The conductor sizes for wires used for point wiring beyond lighting panels shall be single core 4 sq.mm., 6 sq.mm and 10 sq.mm stranded aluminium wires, 2.5 sq.mm stranded copper wire. Wiring from Lighting Distribution Board to Switch Board in the control room shall be with 2.5 sq.mm copper wires.

d) The wires used for connection of a lighting fixture from a nearest junction box or for loop-in-loop-out connection between two fluorescent fixtures shall be single core copper stranded conductor, 1100V grade flexible PVC insulated cords,

unsheathed, conforming to IS: 694 with nominal conductor cross sectional area of 2.5 sq.mm

e) The Contractor's scope covers the supply and installation of the above wires.

f) 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)

27.0 PAINTING OF SHOP MADE ITEMS

a. All sheet steel work shall be phosphated in accordance with the following procedure and in accordance with IS: 6005. 'Code of Practice for Phosphating Iron and Steel'.

b. Oil grease and dirt shall be thoroughly removed by emulsion cleaning.

c. Rust and scale shall be removed by picking with dilute acid followed by washing with running water running with slightly alkaline hot water and drying.

d. After phosphating thorough rinsing shall be carried out with clean water, followed by final rinsing with diluted dichromate solution and drying.

e. The phosphate coating shall be sealed by the application of two coats of ready mixed stoving type metal primer (comprising of red oxide and zinc-chromate in a synthetic medium). The first coat may be 'flash dried' while the second coat shall be stoved.

f. After application of the primer, two coats of finishing synthetic enamel paint shall be applied with each coat followed by stoving. The second finishing coat for the external of panels shall be applied after completion or tests.

g. Both outside and inside of lighting panel, sheet metal fabricated junction boxes etc. and outside of lighting fixtures shall be finished in light grey (IS-5 Shade 631). Inside of lighting fixture shall be finished in white.

h. One coat of primer and finishing coat shall be of lightly different shade to enable inspection of the painting.

i. The final finished thickness of paint film on steel shall not be less than 100 microns and shall not be more than 150 microns.

j. Finished painted appearance on equipment shall present an aesthetically pleasing appearance, free from dents and uneven surfaces.

28.0 TESTS AND TEST REPORTS

a) Type Tests, acceptance tests and routine tests for the lighting fixtures and accessories covered in this specification shall be carried out as per the relevant standard for the respective fixtures and their accessories.

b) Manufacturer's type and routine test certificates shall be submitted for tests conducted as per relevant standards for the fixtures and accessories. The type test certificates shall be furnished along with the bid.

c) All the type tests on the fixtures etc. are to be conducted and test reports shall be furnished.

d) Type tests, acceptance tests and routine tests for the lighting panels shall be carried out as per relevant Indian Standard IS: 8623. The routine tests shall also include i) wiring continuity test, ii) high voltage (2.5 kV) terminal & insulation test, iii) operational test and iv) Degree of protection. These test shall be conducted free of cost.

e) The prices for performing the type tests on different Lighting Panels if payable extra shall be indicated.

f) The Contractor shall measure actual lux level in all the areas as executed and furnish to the Purchaser. In case the actual lugs level is less, the contractor shall provide additional luminaries to achieve required lux levels.

g) The Contractor shall submit 6 (six) copies of type test reports for approval.

29.0 LIGHTING SYSTEM INSTALLATION WORKS

General

a) Accordance with specified installation instructions as shown on manufacturer's drawings or as directed by the Purchaser, 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 manufacturer's drawings or as stipulated by Purchaser.

b) The Contractor shall furnish all supervision, labour, tools, equipment, rigging materials and incidental materials such as bolts, wedges, anchors' concrete inserts etc. required to complete the installation test and adjust the equipment.

c) Manufacturer's drawings, instructions and recommendations shall be correctly followed in handling, setting, testing and commissioning of all equipment and care shall be exercised in handling to avoid distortion to structures, the marking of fittings or damaging of delicate instruments or other electrical parts. Adjustment shall be made as necessary to the stationary structures for plumb and level for the sake of appearance or to avoid twisting of frames, bending of hinged members etc.

d) All apparatus, connections and cabling shall be designed so as to minimize risk of fire or any damage which may be caused in the event of fire.

30.0 CONDUIT SYSTEM

a) The 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 ordinary and inspection tees and elbows, check nuts, male & female bushings (brass or galvanized steel, male plugs, nipples, gland sealing fittings, pull boxes, conduits terminal boxes, glands,

gaskets and box covers, saddles and all steel supporting work shall be supplied by the contractor. The conduit fittings shall be of the same material as conduits. The contractor shall also supply 20 mm mm PVC conduit and accessories for telephone wiring.

b) All unarmoured cables/wires shall run within the conduits from lighting panels to lighting fixtures, receptacles etc.

c) Size of conduit shall be selected as per the cable size.

d) Exposed conduits shall be run in straight lines parallel to building columns, beams and walls. Unnecessary bends and crossings shall be avoided to present a neat appearance.

e) Conduit supports shall be provided at an interval of 750 mm for horizontal runs and 1000 mm to vertical runs.

f) Conduit supports shall be clamped to approved type 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 rawl plugs. Wooden plug inserted in the masonry concrete for conduit support is not acceptable. The groove cutting in the brick walls for embedding the conduits shall be done before plastering and be of such depth that the groove after placements of conduits is filled with cement sand mix before plastering the wall. The cost of the cement sand mix shall be considered included in the conduit system.

g) Embedded conduits shall be securely fixed in position to preclude any movement. In fixing embedded conduit, if welding or brazing is used, extreme care should be taken to avoid any injury in the inner surface of the conduit.

h) Spacing of embedded conduits shall be such as to permit flow of concrete between them and in no case shall be less than 38 mm.

i) Where conduits are along with cable trays they shall be clamped to supporting steel at the internal of 600 mm.

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

k) Conduit shall be installed in such a way as to ensure against trouble from trapped condensation.

1) Running threads shall be avoided as far as practable. Where it is unavoidable, check nuts shall be used.

m) Conduits shall be kept, wherever possible, at least 300 mm away from hot pipes, heating devices etc. when it is evident that such proximity may reduce the service life of cables.

n) Slip joints shall be provided when conduits cross structural expansion joints or where long run of exposed conduits are installed, so that temperature change will cause no distortion due to expansion or contraction of conduit run.

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

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

q) Conduit lengths shall be joined by screwed couplers. Couplers shall be cleanly cut.

r) Conduit joints and connections shall be made thoroughly water tight and rust proof by application of a thread compound. White lead is suitable for application on embedded conduit and red lead for exposed conduit.

s) Field bends shall have a minimum radius of four (4) times the conduit diameter. All bends shall be free of kinks, indentations of flattened surfaces. Heat shall not be applied in making any conduit bend. Separate bends may be used for this purpose.

t) The entire metallic/PVC conduit system, whether embedded or exposed, shall be electrically continuous and thoroughly grounded. Where slip joints are used, suitable bounding shall be provided around the joint to ensure a continuous ground circuit.

u) 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.

v) After installation, the conduits shall be thoroughly cleaned by compressed air before pulling in the wire.

w) Lighting fixtures shall not be suspended directly from the junction box in the main conduit run.

31.0 WIRING

a) Wiring shall be generally carried out by PVC wires in conduits. All wires in a conduit shall be drawn simultaneously. No subsequent drawings of wires are permissible.

b) 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.

c) Wiring shall be spliced only at junction boxes with approved type terminal strip.

d) 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.

e) For vertical run of wires in conduit, wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/junction box.

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

g) Separate neutral wires are to be provided for each circuit.

h) A.C. and D.C. wiring should not run through the same conduit.

i) Wiring shall be provided to the ventilation fans and MCB if required. The location of ventilation fans is indicated in the plan for control room building.

j) Lighting Fixtures & Receptacles:

k) Continuous rows of fluorescent tubes shall be mounted on a continuous M.S. Channel for each row of lights.

1) Floodlights shall be mounted on steel base. Fixing holes shall be provided with slot to turn the fixture by about 5 deg. on both sides. Bolts shall be finally tightened with spring washer. The Contractor shall supply and install the steel base, channels, angles etc. for fixing the flood light on the flood light towers. Terminal connection to the floodlight shall be made through flexible conduits, and these flexible conduits shall be quoted along with the fixture itself.

m) The installation rate of lighting fixtures shall include the supply of necessary brackets except GI conduits for pendant mounted fixtures.

n) The drawings showing the mounting details of each fixture shall be furnished to the Purchaser and necessary approval to be obtained prior to installation.

o) The receptacles shall be installed in the locations approved by the Purchaser.

32.0 LIGHTING PANELS

a) The lighting panels shall be erected at the locations indicated in the drawing approved by the Purchaser.

b) Suitable foundations/supporting structures for all outdoor type lighting panels and necessary supporting structures for indoor lighting panels shall be provided by the Contractor.

c) Lighting panel incomer cable and their termination at the lighting panels are not in the scope of lighting contractor.

Type test reports for following tests on all lighting panels shall be submitted for approval.

(i) Wiring continuity test
(ii) High voltage (2.5 KV for 1 minute) and insulation test
(iii) Operational test
(iv) Degree of protection (not less than IP-55 test on outdoor Lighting Panels and IP-52 test on indoor Lighting Panels as per IS 13947 (part I))
(v) Heat run test

33.0 STREET LIGHTING/FLOOD LIGHTING POSTS

a) Street Lighting poles/masts shall be installed as indicated in the drawing approved by the Purchaser.

b) The steel tubular poles which are specified for the above purpose shall be painted with two coats of aluminum paints after completion of installation. Contractor shall erect the poles (including foundation work), mount the assembled fittings and install necessary cabling.

34.0 JUNCTION BOXES

a) Junction boxes having volume less than 1600 cc shall be installed without any support other than that resulting from connecting conduits where two or more rigid metallic conduits enter and accurately position the box.

b) Junction boxes with volume equal to or greater than 1600 cc and small boxes terminating on less than two rigid metallic conduits or for other reasons not rigidly held, shall be adequately supported by auxiliary steel of standard steel shapes or plates to be fabricated and installed.

c) Necessary holes for conduit for cable entry shall be made during installation depending on the requirement. The holes shall be drilled/punched neatly and shall be dust/vermin proof after installation of the conduit.

d) All welds, bolt holes, conduit entry holes etc. made during installation as mentioned above shall be wire brushed and touched up with metal primer as specified.

35.0 GROUNDING

a) All lighting panels, junction boxes, receptacles, fixtures, conduit etc. shall be grounded in compliance with the provision of I.E. rules.

b) Ground connections shall be made from nearest available station ground grid. All connections to ground grid shall be done by arc welding.

c) Lighting panels shall be directly connected to ground grid by two Nos. 50x6 M.S. Flats.

d) A continuous ground conductor of 16 SWG G.I. wire shall be run all along each conduit run and bonded at every 600 mm by not less than two turns of the same size of wires. The conductor shall be connected to each panel ground bus. All junction boxes, receptacles, lighting fixtures etc. shall be connected to this 16 SWG ground conductor.

e) All lighting poles shall be earthed as per drawings attached to this specification. A 16 SWG G.I. wire shall be taken up to junction box from the lighting fixture by the Contractor.

36.0 FOUNDATION & CIVIL WORKS

a) Foundations for lighting poles & panel foundation in switchyard area shall be done by the Contractor. The rates for these civil works shall be included in the erection rates in respective items.

b) The Contractor shall check these foundations before commencement of erection to ensure their suitability.

c) The Contractor shall make use of the trenches, cable trays etc. for conduit, cable installation as per approval of the Purchaser.

d) 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 work as may be required for erection.

e) Any cutting of masonry / concrete work, wherever necessary shall be done by the Contractor at his own cost and shall be made quad to match the original work. The Contractor shall obtain approval of the Site Engineer before proceeding with the cutting of masonry/concrete work.

37.0 EXCAVATION AND BACKFILLING

a) The Contractor shall perform all excavation and backfilling required for ground connections and for foundations for lighting Poles & panels.

b) Excavation shall be performed up to the required depth. Such sheeting and storing shall be done as may be necessary for protection of the work.

c) The Contractor shall make use his own arrangements for pumping out any water that may be accumulated in the excavation.

d) All excavation shall be backfilled to the original level with good consolidation.

e) The supply rates for sundry material required for welding and rates for miscellaneous civil works like excavation, backfilling etc. for grounding the equipment supplied in this contract and for foundations for lighting poles, panels & transformers have to be included in the erection rates quoted for corresponding items itself.

38.0 STEEL FABRICATION

a) The steel structures fabricated by the Contractor shall be cleaned of rust, etc. All fabrications shall be free of shaped edges.

b) All steel fabrications shall be painted with two coats of metal primer (comprising of red oxide and zinc chromate in a synthetic medium) followed by two coats of aluminum paint.

c) The supply, fabrication and erection of all steel structures required for panels, supporting fixtures, junction boxes etc. shall be included in the erection rates quoted for the respective items.

39.0 TESTING & COMMISSIONING

a) On completion of erection work, the Contractor shall request the Purchaser, for required checking and testing.

b) The Purchaser shall arrange for joint inspection of the installation for completeness and correctness of the work. Any defect pointed out during such inspection shall be promptly rectified by the Contractor.

c) The installation shall be then tested and commissioned in presence of the Purchaser 's Representative.

d) The Contractor shall provide all men, material and equipment required to carry out the tests.

e) All rectifications, repairs or adjustment work found necessary during inspection, testing and commissioning shall be carried out by the Contractor, without any extra cost.

f) The contractor shall be responsible for measuring light intensity indoor and outdoor and ensure the intensity levels conforming to the stipulated in the specification with the design made by the contractor.

ANNEXURE-I

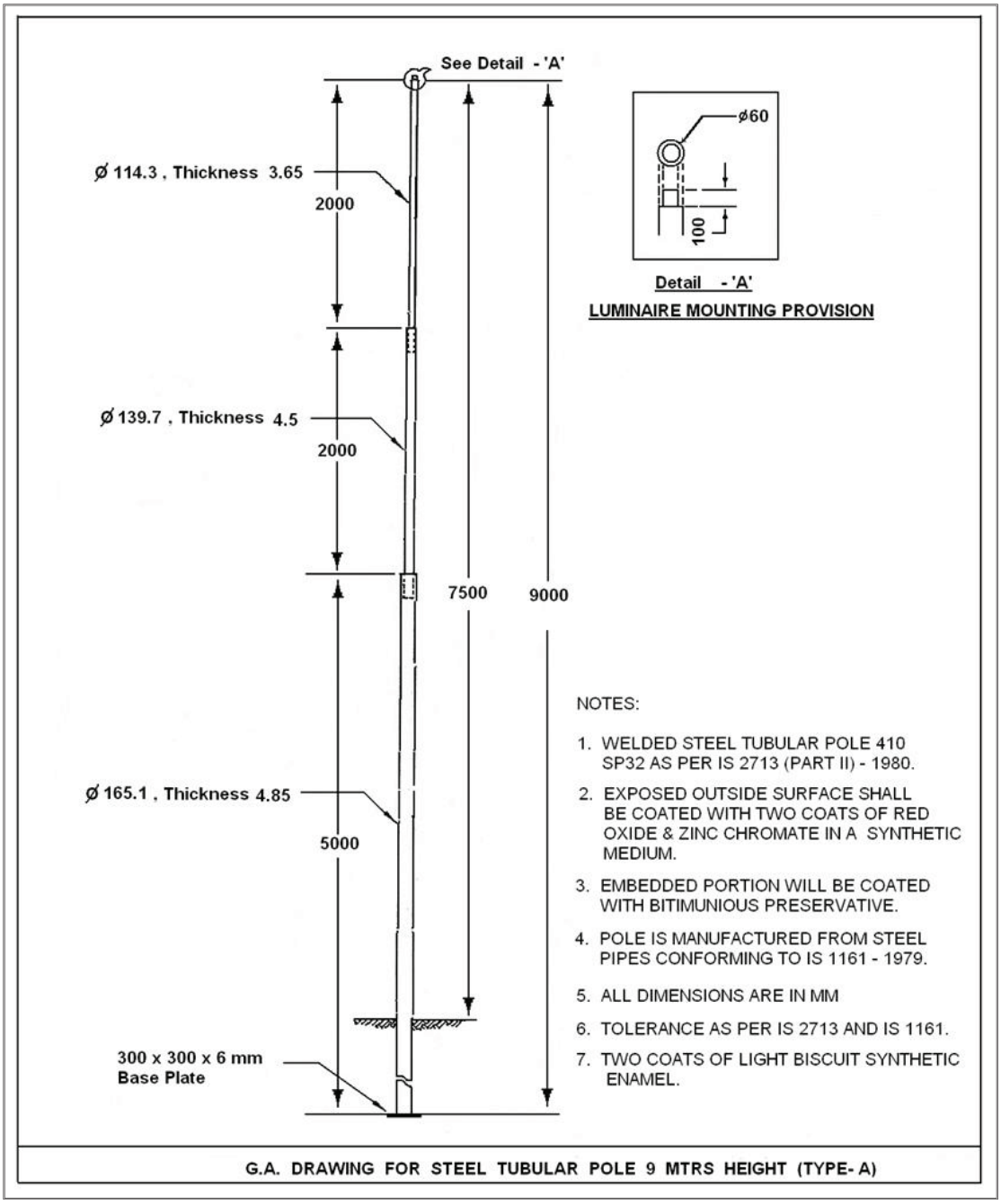
Sl. No.	Type of Lighting Fixture	Description	Philips Catalogue No	CGL Catalogue No	Bajaj Catalogue No
1	F1	2x28W T5 type fluorescent lamps in industrial reflector type fixture, complete with accessories and suitable for pendent /surface mounting.	TMS 122/228 HF	T5GP228EB	BTIR 228
2	FF	2x28 T5 energy efficient fluorescent lamps with low glare, mirror optics suitable for recess mounting type lighting fixture.	TBS 088/228 C5 HF	TSCQ12228EB	BTMRA 228 MATT
3	FL	2x28W T5 energy efficient fluorescent lamps with low glare mirror optics suitable for pendent/surface mounting with all accessories	TCS 398/228 D6 HF	----------	BTSMU 228 MSS
4	TL	Sleek and Functional electronic decobatten suitable for use with 1x'TLD'36W fluorescent lamp with dual tone end caps. Pre-phosphated & powder coated CRCA steel channel complete with all electrical accessories like electronic ballast, lamp holders all prewired up to a terminal block	TMS500/136 HF	DMLU14EB	BC1R136WEB
5	IB	60/100w GLS lamp in Bulkhead fixtures with Cast Aluminium alloy body, suitable for column, wall,and ceiling mounting finished stove enameled silver grey outside	NXC101	IBH1110/BC	BJDB100BC

6	BL	Aesthetic wall/ceiling mounted luminaire suitable for 1x PL-C 13W OR 11W CFL. Low loss O.C. Copper ballast.Built in high gloss anodized reflector. Twin finish UV stabilised SAN diffuser for protection & elimination of lamp glare.	FMC21/113	TLN11	BJC111
7	SL	Aesthetic ceiling mounted luminaire for Ecotone crystal/Décor CFL of 2x9W or 1x18W. ABS housing prewired with porcelain lampholder. Pre phospated plated CRCA gear tray.	FL343/118	CBHE29	----------
8	BH	Bulkhead luminaire suitable for use with PL-S 9W CFL. Single piece pressure die-cast aluminium & cover retaining Frame. Opal acrylic cover along with a gasket made of E.P.R..	FXC 101/109	ICBH10	BJBE19
9	BLD	2X9 Or 1x18 watt CFL bollard light for landscape lighting having FRP/LLDPE housing	FGC202 /118	CFBL1229	BJBOL 03 29 CFL
10	DLR	2x18 watt CFL Downlighter with HF ballast suitable for recess mounting	FBH145/218L HF	DDLH218TG	BJDR 65C 218 DL
11	DSM	1X13 WATT surface mounted CFL	FCS100/113	----------	BJDS110/113C WEB
12	IF	Incandescent GLS lamp down light	DN622	DDLV10BC	BJDR 100W
13	SF1	1 X 400W HPSV lamps in high flood lighting fixture with integral control gear	SWF 330/1X400	FAI40IH	BJFL 400SV TS

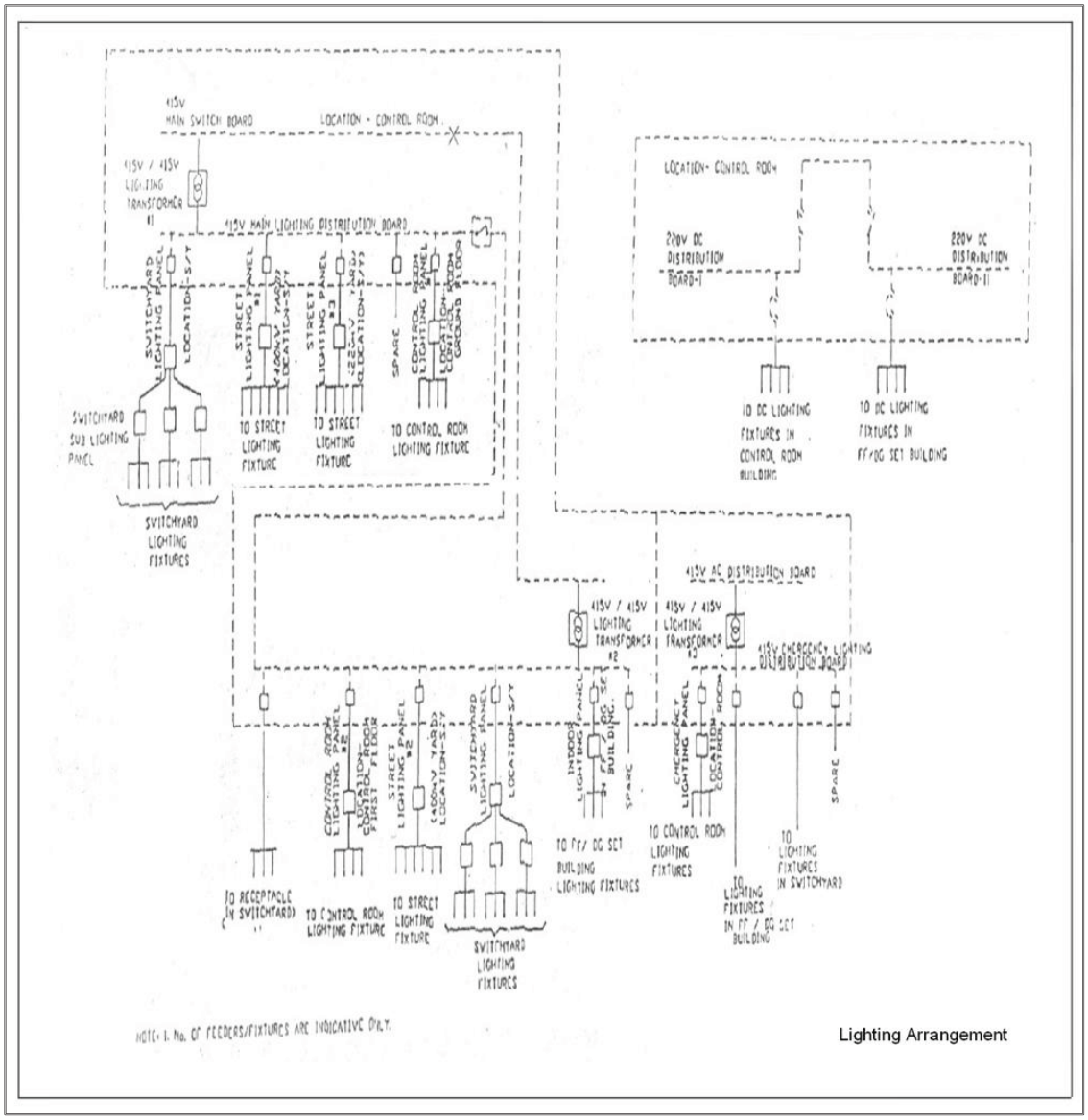
14	SF2	2 X 400W HP sodium Vapour lamps in high flood lighting, non-integral control gear:	RVP302/2x400W	FHD1424	BJENF 22
15	SF3	1 X 250W HPSV lamps in high flood lighting fixture with integral control gear:	SWF 330/1X250	FAI1125IH	BJFL 250 SV TS
16	SF4	150W HP Metal halide MHNTD lamp in flood lighting fixture with integral control gear.	SWF230/150 MHNTD	FAD1215IH/MH	BGEMF150MH DE
17	SF5	125 HP MV Lamp in weather proof post top lantern for mounting on pole top	HPC-101/125 HPF	MPT1112IL/BM/ ES	BJDPTI 125 MV
18	SC	150W SON-T Tubular Sodium Vapour lamp in street lighting	SRX-51/150	SSG2315IH.	BGEST 150 SV

ANNEXURE-II

Sl No	Item	Abbreviation	Item Description	Make(s)
1	TELEPHONE BOX/TELEVISION BOX	TB	Termination box for Television and Telephone	Approved makes
2	FLAT DB TYPE A	DB	240V Indoor AC Distribution board, 63A or 32A, DP RCCB as Incomer with 12 Nos. 16A SP MCBs as outgoing. DB shall be flush mounted type.	Legrand/ Hagger
3	METER DB TYPE-A & TYPE-B	MB	For feeder details, please refer drgno.C/ENGG/TS/STD/COMMON/SLD/01	Approved makes
4	SWITCHBOARD WITHOUT 6A SOCKET	SBA	MODULAR SWITCHBOARD WITH 5A SWITCHES AS REQUIRED	Anchor/ Crabtree
5	TWO WAY SWITCHBOARD FOR STAIRS	SBB	MODULAR SWITCHBOARD WITH 5A TWO WAY SWITCH	Anchor/ Crabtree
6	SWITCHBOARD WITH 6A SOCKET	SBC	MODULAR SWITCHBOARD WITH 1 No. Socket and 5A SWITCHES AS REQUIRED	Anchor/ Crabtree
7	TELEPHONE POINT	TP	Modular Socket	Anchor/ Crabtree
8	TELEVISION POINT	TV	Modular Socket	Anchor/ Crabtree
9	AIRCONDITIONER POINT WITH 15A SWITCH	RAC	Socket with Switch Metal clad Type	Anchor/ Crabtree
10	15A POWER POINT WITH 15A SWITCH	RB	Modular Socket with Switch	Anchor/ Crabtree
11	5A POWER POINT WITH 5A SWITCH	RA	Modular Socket with Switch	Anchor/ Crabtree
12	CHANDELIER	CH	Decorative fixture with 1 X 60 W GLS Lamp	Any Reputed Make
13	BELL PUSH	BP	Modular Type	Anchor/ Crabtree
14	BELL	BELL	Call Bell	Anchor/ Crabtree
15	EXHAUST FAN	EFC	300 mm sweep Trans'Air	CGL/Bajaj/ Usha
16	CEILING FAN	CFC	1200 mm sweep with electronic regulator	CGL/Bajaj/ Usha



G.A. DRAWING FOR STEEL TUBULAR POLE 9 MTRS HEIGHT (TYPE- A)



Lighting Arrangement

Section -2C

LED LUMINAIRES

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

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

Necessary Care shall be taken so that there is no water stagnation anywhere in the Luminaries. The entire housing shall be dust and water proof protection as per IS 12063. Parameters of outdoor & indoor Lighting fixtures are detailed in **Annexure-II**.

LIGHTING POLES (AS PER BOQ).

(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
(ii) Type D1 Post top lantern pole of 4 meter - for Sl-D1 type fixture

(ii) "L1" type poles shall be used for street lighting. "D1" type (Decorative post top lantern) poles and Bollards shall be installed In front of control room building, Fire Fighting Buildings as finalized during detailed engineering.

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

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

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

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

(vii) Distance of centre 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.

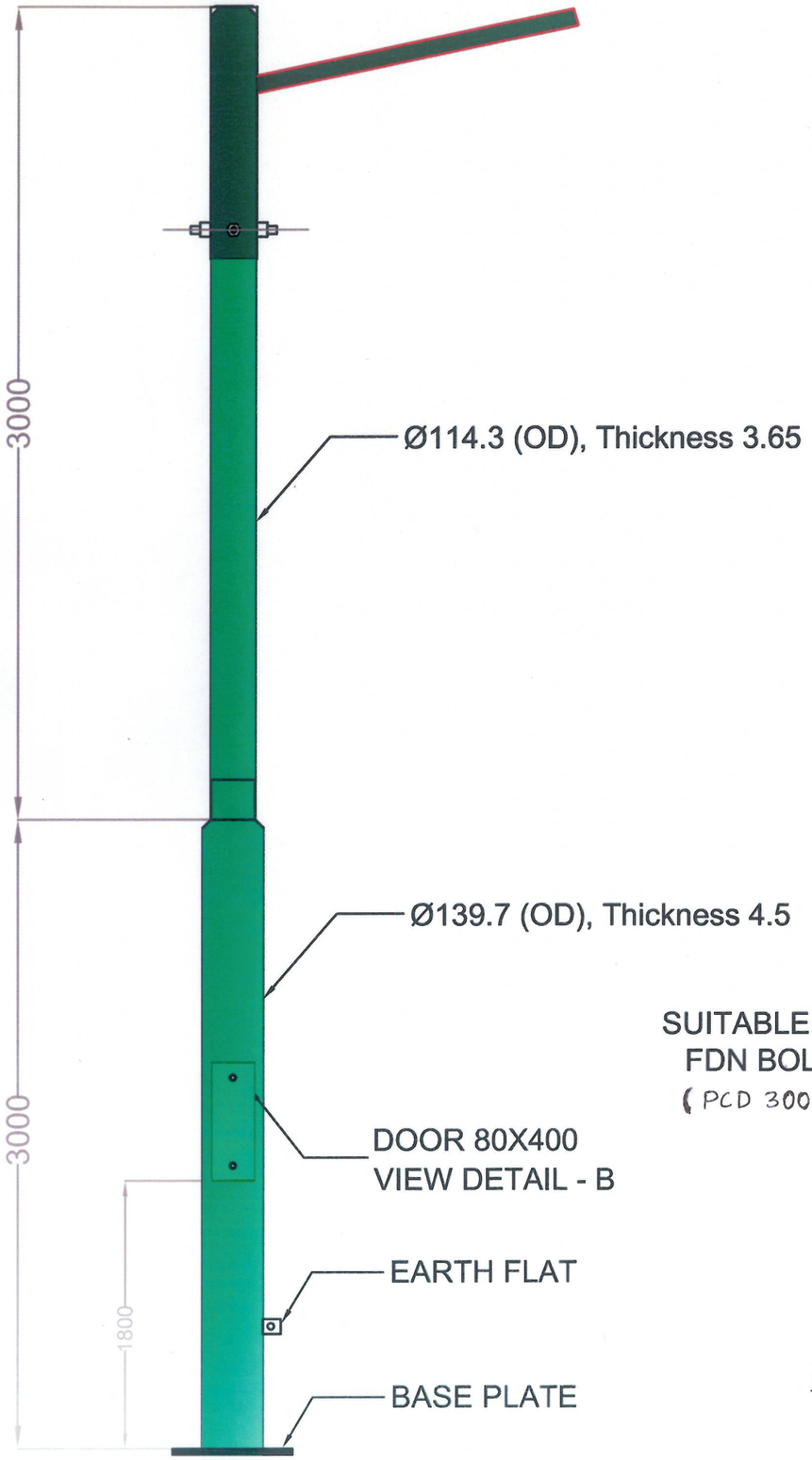
ANNEXURE-II

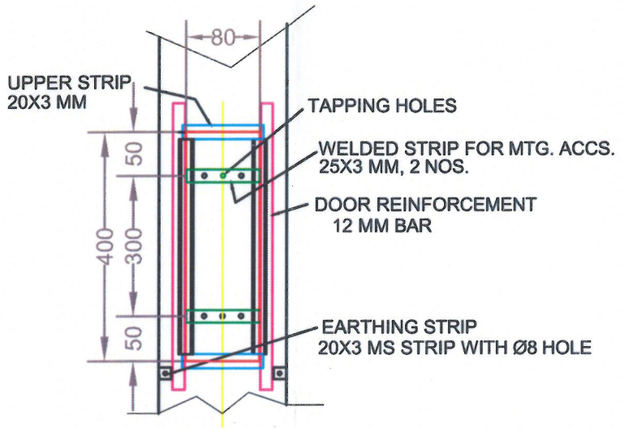
(a) Indoor Application

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

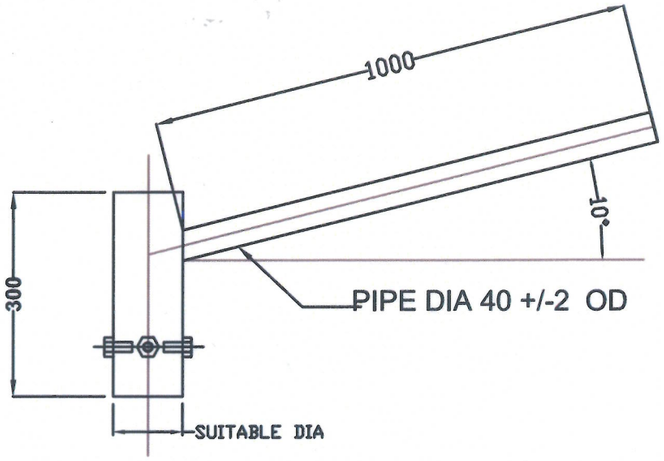
(b) Outdoor Application

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

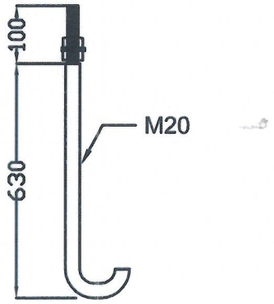




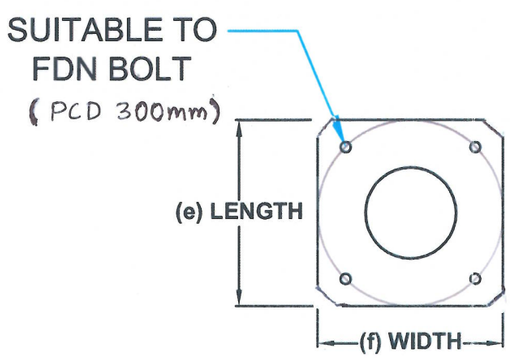
DETAIL - B
(AFTER REMOVE DOOR COVER)



SINGLE ARM BRACKET



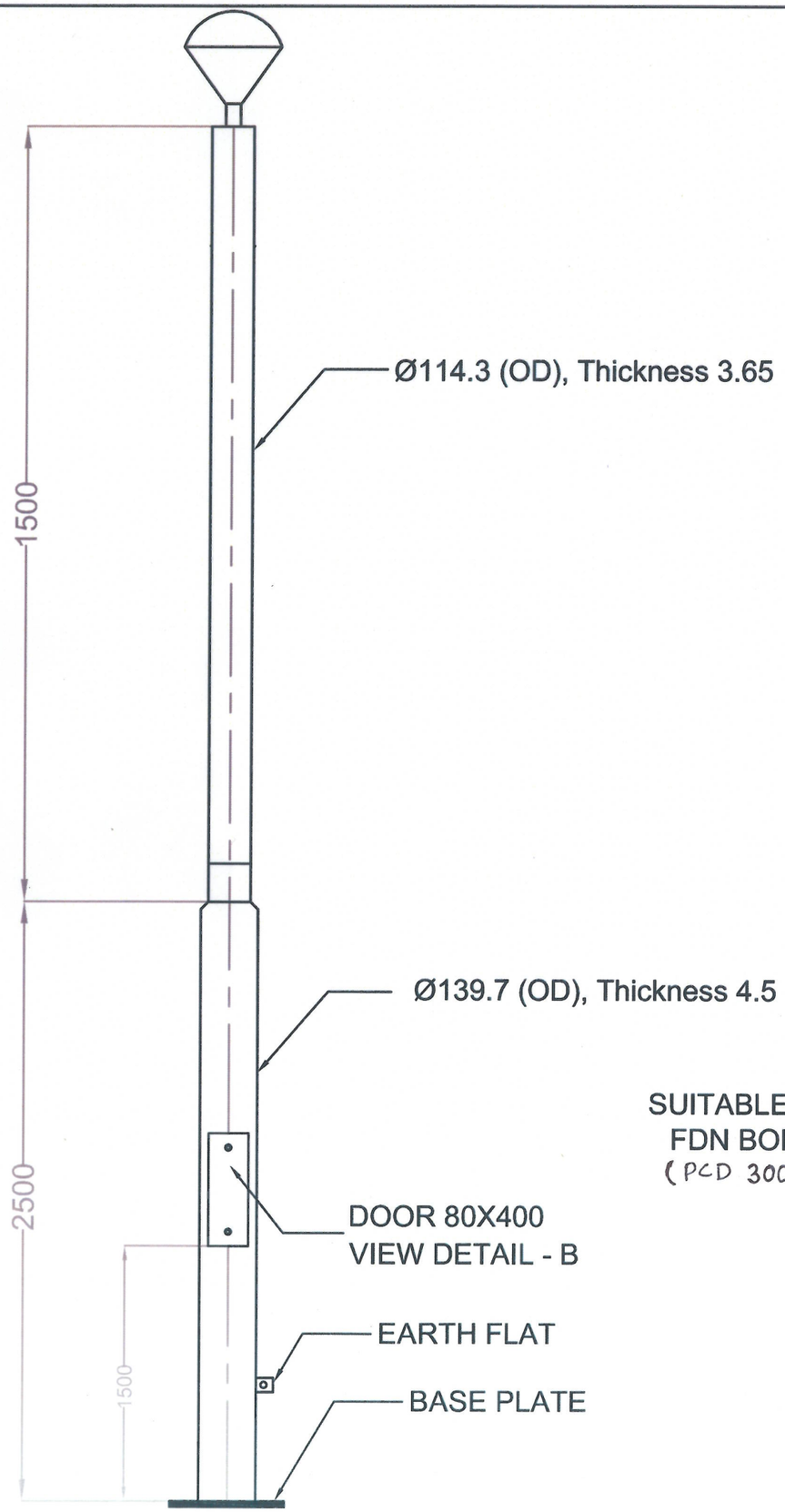
FOUNDATION BOLTS J-TYPE
WITH HARDWARE

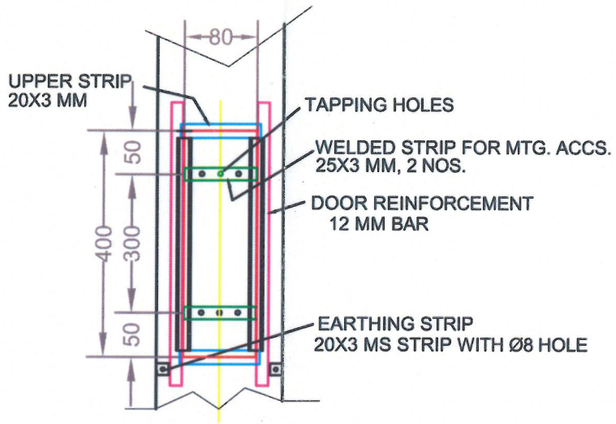


BASE PLATE 300 x 300 x 12mm
BOTTOM VIEW

NOTES:

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





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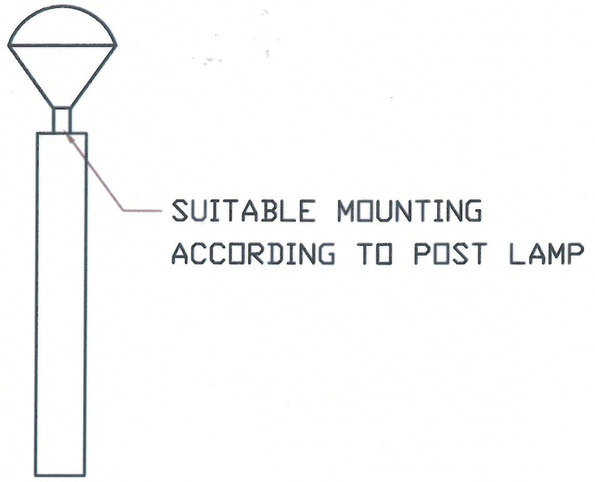
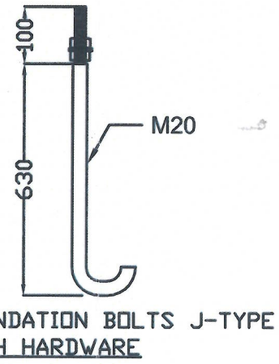
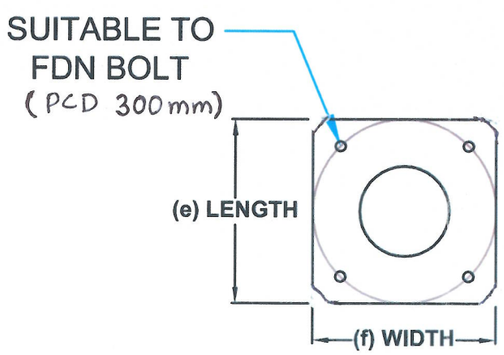
(AFTER REMOVE DOOR COVER)



DETAIL - A
POST TOP LAMP



FOUNDATION BOLTS J-TYPE
WITH HARDWARE



BASE PLATE 300 x 300 x 12mm
BOTTOM VIEW

NOTES:

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

SECTION-3

GENERAL TECHNICAL REQUIREMENTS OF SPECIFICATIONS (GTR)

INDEX

1.0 GENERAL
2.0 COMPLETENESS OF EQUIPMENTS
3.0 STANDARDS
4.0 PROJECT DATA
5.0 SYSTEM PARTICULARS
6.0 SYSTEM PARAMETERS
7.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT
8.0 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS
9.0 SUPPORT STRUCTURES
10.0 COLOUR SCHEME AND CODES FOR PIPE SERVICE
11.0 MATERIAL / WORKMANSHIP
12.0 SPACE HEATERS
13.0 FUNGISTATIC VARNISH
14.0 VENTILATION OPENING
15.0 DEGREE OF PROTECTION
16.0 RATING PLATES, NAME PLATES AND LABELS
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26.0 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS
27.0 MOTORS
28.0 TECHNICAL REQUIREMENT OF EQUIPMENTS

ANNEXURE – A CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST
ANNEXURE – B SEISMIC WITHSTAND TEST PROCEDURE
ANNEXURE – C LIST OF SPECIFICATIONS STANDARDS AND CODES

GENERAL TECHNICAL REQUIREMENTS OF SPECIFICATIONS (GTR)

1.0 GENERAL

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

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

Every effort will be made to supply all equipment as per the technical details furnished in the specification. However, due to the standard manufacturing practice of various equipment suppliers and depending on the selected vendor, there may be slight variations from indicated values at the contract stage. Such variations should not affect the quality and performance of the equipment.

It is not the intent to specify completely in technical specifications of equipments/ materials all details of the design and construction of equipment. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation. The Purchaser will interpret the meaning of drawing and specification and shall have the power to reject any work or material which in his judgement is not in accordance therewith. The equipment offered shall be complete with all components necessary for its effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply, irrespective of whether these are specifically brought out in this specification and/or commercial order or not.

2.0 COMPLETENESS OF EQUIPMENTS

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

2.2 The Bidder shall supply type tested (including special test as per technical specification) equipments and materials. The test reports/details shall be furnished by the Bidder in the bid. In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification and/or IEC/ IS, same, shall be carried out without any additional cost implication to the Purchaser. The Purchaser reserves the right to get any or all type tests conducted/ repeated.

The reports for all type tests and additional type tests as per technical specification furnished by the Bidder shall be of the tests conducted within last 05(five) years prior to the date of bid opening. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.

3.0 STANDARDS

3.1 Except as modified by this Bid specification, all material and equipment shall conform to the requirement of the latest editions of relevant ISS/ IEC and other applicable standards. The equipments/ works shall be designed, engineered, manufactured, built, tested and commissioned shall be carried out in accordance with the Acts, Rules, Laws and Regulations in force in India.

3.2 In addition to meeting the specific requirements called for in the respective sections of the Technical Specification, the equipment shall also conform to the general requirement of the relevant standards which shall form an integral part of the specification. When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.3 In the event of the Bidder offering equipment conforming to standards other than ISS/IES standards, which ensure equivalent or better performance than that specified in the standards, the salient point of comparison between the standards adopted and relevant ISS/ IEC standards shall be indicated clearly in the proposal, along with English language version of such standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's approval.

3.4 The standards mentioned in the respective equipment specifications are not mutually exclusive or complete in themselves. The equipment &/or work shall also conform to any other applicable standard, even if not specifically mentioned in these specifications.

3.5 Should the Bidder wish to depart from the provisions of the specifications, either on accounts of manufacturing practices or for any other reason, he shall clearly mention the departure and submit complete justification supported by information, drawings etc. as will enable to assess the suitability of equipment(s) offered. In the event of the Bidder's specifications, drawings, forms and tables etc. being found to disagree with the requirement of the Bid specifications at any stage, Bid specifications shall be binding, unless the departures have been duly approved in writing by the Purchaser.

3.6 REFERENCE OF STANDARDS

Reference	**Abbreviation**	**Name and Address**
IEC/ CISPR	International Electro technical Commission	Bureau Central de la Commission, Electro Technique International, 1 Rue de verembe Geneva, Switzerland
IS	Indian Standards,	Bureau of Indian Standard, Manak Bhavan, 9, Bahadur Shah Zafar Marg, New Delhi-110 002, INDIA

BS	British Standards,	British Standards Institution, 101, Pentonnvilla Road, N-19-ND UK
ISO	International Organization For Standardization,	Danish Board of Standardization Danish Standardising Sraat, Aurehoegvej-12, DK-2900, Heelprup, DENMARK
NEMA	National Electric Manufacture Associate	115, East 44th Street, New York NY 10017 U.S.A

4.0 PROJECT DATA

i.	Location	UTTAR PRADESH
ii.	Altitude	not exceeding 1000 Meters
iii.	Climatic Conditions	
(a)	Design maximum ambient Air Temperature	50^0 C
(b)	Minimum ambient air temperature in shade	0^0C
(c)	Relative Humidity	100%Max.
(d)	Wind Load	195 Kg./ Sq.m.
(e)	Seismic Level	0.3 g
(f)	Isoceraunic Level	50days/ year
(g)	Average annual rain fall	1200 mm
(h)	Hot and humid tropical Climate conductive to rust and fungus growth	

5.0 SYSTEM PARTICULARS

(i)	Rated System voltage	420 kV, 245kV, 145kV, 36kV
(ii)	System frequency	50 Hz, This may vary by ± 5%
(iii)	Number of phases	Three
(iv)	Neutral	Effectively Earthed

(v) **Auxiliary power supply:-**

Auxiliary electrical equipment shall be suitable for operation on the following supply system:

(a)	Power device (Like drive motors)	400V, 3Phase, 4Wire 50Hz Effectively earthed AC system.
(b)	Lighting fixtures, space heaters, fractional Horse Power motors and control devices.	250V, 2wire, 50Hz, AC supply with one point grounded.
(c)	DC alarm, Control and Protective Devices from sub station batteries as under	2wire ungrounded DC supplies

(i) 400 kV S/S : 220V DC (ii) 220/132kV S/S : 110V DC (iii) Communication equipment : 48 V DC

The above supply voltage is subject to variation as follows:

All devices must be suitable for a continuous operation over the entire range of voltage variations :

(i) AC — Voltage may vary by ± 10%.
Frequency by ± 5%
Combined Voltage & frequency by ±10%.

(ii) DC

a) 220 V may vary between 187 & 242 V
b) 110 V may vary between 93 & 121 V
c) 48 V may vary between 41 & 53 V

6.0 SYSTEM PARAMETERS

The following system parameters shall prevail:

Sl. No.	Description of Parameters	400 kV System	220 kV System	132 kV System	33 kV System
1.	Nominal system voltage	4000kV	220kV	132kV	33kV
2.	Maximum operating voltage of the system(rms)	420kV	245kV	145kV	36kV
3.	Rated frequency	50Hz	50Hz	50Hz	50Hz
4.	No. of phase	3	3	3	3
5.	Rated short time current	50 kA for 3 Sec.	40 kA for 3 sec	31.5 kA for 3 sec	25 kA for 3 sec
6.	Dry and wet one minute power frequency withstand voltage	680 kV	460 kV	275 kV	95 kV
7.	Dry and wet impulse withstand voltage positive and negative	1550 kVp	1050 kVp	650 kVp	250 kVp
8.	Corona extinction voltage	320 kV	156 kV	105 kV	-
9.	Max. Radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765kV, 320kV rms for 400kV system and 156kV rms for 220kV system & 92kV rms for 132kV system	1000 microvolt	1000 microvolt	500 microvolt	-
10.	Minimum total creepage	25mm/ kV (10500 mm)	25mm/ kV (6125 mm)	25mm /kV (3625 mm)	25mm/kV (1300 mm)
11.	Min. clearances				
	i. Phase to phase	4000mm (for Conductor-conductor) 4200mm (for rod - Conductor)	2100 mm	1300 mm	320 mm
	ii. Phase to earth	3500 mm	2100 mm	1300 mm	320 mm

	iii) Sectional clearances	6500 mm	5000 mm	4000 mm	3000 mm
12.	System neutral earthing	Effectively Earthed	Effectively Earthed	Effectively Earthed	Effectively Earthed

Major technical parameters of bushings/ hollow column/ support insulators are given below:

Sl. No	**. Parameters**	**400 kV System**	**220 kV System**	**132 kV System**	**33 kV System**
(a)	Max. System voltage Um (kV)	420	245	145	36
(b)	Impulse withstand voltage (dry & wet) (kVp)	± 1425	± 1050	± 650	±170
(c)	Switching surge withstand voltage (dry & wet) (kVp)	1050	-	-	-
(d)	Power frequency withstand voltage (dry and wet) (kV rms)	650	460	275	75
(e)	Total creepage distance(min) (mm)	10500	6125	3625	900

Insulator shall also meet requirement of IEC- 815 for 420kV, 245kV, 145kV and 36kV systems, as applicable having alternate long and short sheds.

7.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT

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

All equipment shall be able to withstand all external and internal mechanical thermal and electromechanical forces due to various factors like wind load temperature variation, ice & snow (wherever applicable) short circuit etc for the equipment.

The Bidder shall design the various forces which the terminal connectors of the equipment are required to withstand.

All outdoor EHV equipments except marshalling kiosks shall be suitable for hot line washing.

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

8.0 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

8.1 Each equipment shall be supplied with necessary terminals and connectors as required by the design for the particular installation. The terminal connector shall be suitable for the conductor used for particular installation, which are as under as per UPPTCL's practice:

8.2 Where copper to aluminum connections are required, bimetallic clamps shall be used, which shall be properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to part which are not current carrying or subjected to stress. The design details of the joint shall be furnished to the Purchaser by the Bidder.

8.3 Low voltage connectors, grounding connectors and accessories for grounding all equipment are also included in the scope of work.

8.4 No current carrying part of any clamp shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanized. Copper alloy liner of minimum 2 mm thickness shall be used with aluminum body for Bimetallic clamps.

8.5 All casting shall be free from blow holes, surface blisters cracks and cavities. Sharp edges and corners shall be blurred and rounded off.

8.6 Flexible connectors, braids or laminated straps made for the terminal clamps for bus posts shall be suitable for both expansion or through (fixed/sliding) type connection of 4" IPS AL. tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.

8.7 The clamps/ connectors shall be designed to carry the same current as the conductor and the temperature rise shall be equal or less than that of the conductor at the specified ambient temperature. The rated current for which the clamp/ connector is designed with respect to specified reference ambient temperature, shall also be indelibly marked on each component of the clamp/connector, except on hardware.

8.8 All current carrying parts shall be designed and manufactured to have minimum contact resistant.

8.9 Clamps and connectors shall be designed to be corona controlled. Corona extinction voltage for 420kV, 220kV and 132kV class clamps shall not be less than 320, 156 and 105kV (rms) respectively and R.I.V. level shall not be more than specified 1000, 1000 and 500 micro volts for 420kV, 220kV and 132kV system at the test voltage specified.

9.0 SUPPORT STRUCTURES

9.1 The base design of all the equipments, to be installed on auxiliary structures, shall conform to the standard auxiliary structure designs presently being used in UPPTCL at 400/220/132/33kV Substations.

9.2 All equipment support structures shall be supplied alongwith brackets, angles, stools etc. for attaching the operating mechanism, control cabinets and marshalling box (wherever applicable) etc.

9.3 The support structures should be hot dip galvanised with minimum 610 gram/sq.m net of zinc.

10.0 COLOUR SCHEME AND CODES FOR PIPE SERVICE

The Bidder shall propose a colour scheme for the those equipments/ items for which the colour scheme has not been specified in the specification. For the approval of purchaser. The decision of Purchaser shall be final. The scheme shall include.

Finishing colour of Indoor equipment.

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All steel structures, plates etc. shall be painted with non-corrosive paint with a suitable primer. It may be noted that normally all electrical equipments in switchyard are painted with shade 631 of IS-5. The indoor cubicles, GIS enclosures and other miscellaneous items, the colour scheme shall be approved by the Purchaser during detailed engineering.

11.0 MATERIAL/ WORKMANSHIP

11.1 General Requirement

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

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

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

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be considered as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances, instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits. Suitable guards shall be provided for the protection of personnel on all exposed rotating and/ or moving machine parts and shall be designed for easy installation and removal for maintenance purposes. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Bidder shall apply oil and grease of the proper specification to suit the machinery, as is

necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation.The Bidder shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Bidder has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease in available. He shall help Purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

A cast iron or welded steel base plate shall be provided for all rotating equipment which are to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of design with pads for anchoring the units and shall have a raised up all around and shall have threaded in air connections, of so required.

11.2 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

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

12.0 SPACE HEATERS

The heaters shall be suitable for continuous operation at 240V AC supply. On-off switch and fuse shall be provided for the heater.

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

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

13.0 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where

the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

14.0 VENTILATION OPENING

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds and suitable provision shall be made so as to avoid any communication of air/ dust with any part in the enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc.

15.0 DEGREE OF PROTECTION

The enclosures of the Control Cabinets, junction boxes and Marshalling Boxes, panels etc. to be installed shall be provided with degree of protection as detailed here under:

a) Installed out door : IP-55

b) Installed indoor in air conditioned area : IP-31

c) Installed in covered area : IP -52

d) Installed indoor in non air-conditioned area where possibility of entry of water is limited: IP-41

e) For LT Switchgear (AC & DC distribution Boards): IP-52

The degree of protection shall be in accordance with :13947 (Part-I)/ IEC-60947 (Part-I)/ IS 12063 / IEC-60529. Type test report for degree of protection test, on each type of the box shall be submitted for approval.

16.0 RATING PLATES, NAME PLATES AND LABELS

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

All such nameplates, instructions plates, rating plates CB, CT, VT, SA, Isolators and Relay & Protection panels equipments shall be bilingual with Hindi inscription first followed by English. Alternatively two separate plates one with Hindi and the other with English inscriptions may be provided.

17.0 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

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

the exclusions in these specifications and documents.

18.0 PACKAGING AND PROTECTION

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. The Bidder shall also submit packing details/associated drawing for any equipment/material, to facilitate the Purchaser to repack any equipment/material at a later date. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Bidder.

All coated surfaces shall be protected against abrasion, impact, discolouration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protectin device. All ends of all valves and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

19.0 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

All external painting shall be as per shade No. 631 of IS: 5.

20.0 HOT DIP GALVANISING

All ferrous parts including all sizes of nuts, bolts, plain and spring washers, support channels, structures, shall be hot dip galvanized conforming to latest version of IS: 2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be 610 gm/ sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6 mm. For items lower than 6mm thickness, requirement of coating shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq. m minimum.

The galvanized surfaces shall have a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off,

etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

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

Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

21.0 PROTECTIVE GUARDS

Suitable guards shall be provided for protection of personnel on all exposed rotation and/of moving machine parts. All such guards with necessary spares and accessories shall be designed for easy installation and removal for maintenance purpose.

22.0 TOOLS AND TACKLES

The Bidder shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately packed and brought on to site.

23.0 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

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

23.2 Control cabinets, junction boxes, marshalling boxes and terminal boxes shall be made of sheet steel or aluminum enclosure and shall be dust, water and vermin proof. Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braces to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminum enclosed box, the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

23.3 Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements. A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes/ Control cabinets to prevent ingress of rain water.

23.4 Cabinet/boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of the gasket shall be such that it does not get damaged/cracked during the operation of the equipment.

23.5 All doors, removable covers and plates shall be provided gasket all around with suitably profiled EPDM/Neoprene gaskets. The gasket shall be tested in accordance with approved quality plan, IS:11149 and IS:3400. The quality of gasket shall be such that it does not get damaged/cracked during 10(ten) years of operation of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth straight and reinforced if necessary to minimize distortion

and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters, the screen shall be fine wire mesh made of brass.

23.6 All boxes/ cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting at least 150 mm above the base of the marshalling kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland plate. Gland plate shall have provision for some future glands to be provided later, if required.

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

23.8 For illumination, a 20 Watts fluorescent tube or 15 watts CFL/LED bulb shall be provided. The switching of the fittings shall be controlled by the door switch.

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

23.9 All control switches shall be of rotary type. Toggle piano switches shall not be accepted.

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

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

23.12 a) The following routine tests alongwith the routine tests as per IS: 5039 shall also be conducted.

Check for wiring
Visual and dimension check

b) The enclosure of bay marshalling kiosk, junction box, terminal box shall be type tested for IP-55 as per IS: 13947. After IP-55 test, 2.5 kVrms for 1 (one) minute, insulation resistance and functional test should be conducted.

23.13 Auxiliary Switches

All the auxiliary switches shall be fully type tested as per relevant IS.

The following type test reports on auxiliary switches shall be submitted:

(a) Electrical endurance test - A minimum of 2000 operation for 2A D. C. with a time constant greater than or equal to 20 millisecond with a subsequent examination of mV drop/visual defects/temperature rise test.

(b) Mechanical endurance test. A minimum of 1,00,000 operations with a subsequent checking of contact pressure test/visual examination.

(c) Heat run test on contacts.

(d) IR/HV test etc.

24.0 TERMINAL BLOCKS AND WIRING

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

24.2 Terminal blocks shall be 1100 V grade and have continuous rating to carry the maximum expected current on the terminals. These shall be of moulded piece, complete with insulated/barriers stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be non-disconnecting stud type of Elmex type CATM4, phoenix cage clamp type or equivalent. The insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

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

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

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

24.6 The terminal blocks shall be of extensible design.

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

24.8 The terminal blocks shall be fully enclosed with removable covers of transparent, non-deterioration type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator form carrying out the wiring without removing the barriers.

24.9 Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

a)	All circuits except CT circuits	Minimum of 2 nos. of 2.5 sq. mm copper flexible
b)	All CT circuits	Minimum of 4 nos. of 2.5 sq.mm copper flexible

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

24.11 At least 20% spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminal rows.

24.12 There shall be minimum clearance of 250 mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm.

24.13 The Bidder shall furnish all wire, conduits and terminals for the necessary interphase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets.

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

25.0 LAMPS AND SOCKETS

25.1 Lamps

All incandescent lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

25.2 Sockets

All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

25.3 Hand Lamp

A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON- OFF Switch for connection of hand lamps.

25.4 Switches and Fuses

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

All fuses shall be of HRC cartridge type conforming to IS-9228 mounted on plug-in type fuse bases. Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints to the fuse rating and voltage. All control switches shall be of rotary type. Toggle piano switches shall not be accepted.

26.0 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS

26.1 Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC-60137 while hollow column insulators shall be manufactured and tested in accordance with IEC-62155/IS:5621. The support insulators shall be manufactured and tested as per IS:2544/IEC-60168 and IEC-60273. The insulators shall also conform to IEC-60815 as applicable.

The bidder may also offer composite silicon rubber insulator, conforming to IEC-61462.

26.2 Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.

26.3 Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.

26.4 Support insulators/bushings/hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

26.5 When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the normal rated voltage.

26.6 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

26.7 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.

26.8 Tests

In bushing, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests in accordance with IS: 2099 & IS: 2544 & IS : 5621.

27.0 MOTORS

Motors shall be “Squirrel Cage” three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall be subjected to routine tests as per applicable standards. The motors shall be of approved make.

27.1 Enclosures

a) Motors to be installed outdoor without enclosure shall have hose proof enclosure equivalent to IP-55 as per IS: 4691. For motors to be installed indoor i.e. inside a box, the motor enclosure, shall be dust proof equivalent to IP-44 as per IS: 4691.

b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.

c) Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing.

d) Motors weighing more than 25 Kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

27.2 Operational Features

a) Continuous motor rating (name plate rating) shall be at least ten (10) percent above the maximum load demand of the driven equipment at design duty point and the motor shall not be over loaded at any operating point of driven equipment that will rise in service.

b) Motor shall be capable at giving rated output without reduction in the expected life span when operated continuously in the system.

27.3 Starting Requirements

a) All induction motors shall be suitable for full voltage direct-on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.

b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.

c) The locked rotor current shall not exceed six (6) times the rated full load current for all motors, subject to tolerance as given in IS:325.

d) Motors when started with the driven equipment imposing full starting torque under the supply voltage conditions specified, shall be capable of withstanding atleast two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.

e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speed lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

27.4 Running Requirements

a) The maximum permissible temperature rise over the ambient temperature of 50 degree C shall be within the limits specified in IS:325 (for 3 - phase induction motors) after adjustment due to increased ambient temperature specified.

b) The double amplitude of motor vibration shall be within the limits specified in IS: 4729.

Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

c) All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.

27.5 TESTING AND COMMISSIONING

The Bidder shall conduct following tests alongwith list of instruments and calibration certificates to the Purchaser. If any additional test is required the same shall be conducted without any extra cost to the Purchaser.

(a) Insulation resistance.

(b) Phase sequence and proper direction of rotation.

(c) Any motor operating incorrectly shall be checked to determine the cause and the conditions corrected.

28.0 TECHNICAL REQUIREMENT OF EQUIPMENTS

28.1 Circuit Breakers (Applicable for 400kV, 220kV & 132 kV)

28.1.(i) The manufacturer(s) whose SF6 Circuit Breaker are offered should have designed, manufactured tested as per IEC/IS or equivalent standard supplied the same for the specified system voltage and **40kA/ 50kA fault level or above class** which are in satisfactory operation for at least 2 (two) years as on the date of bid opening

Or

28.1.(ii)(a) The manufacturer(s) whose SF6 Circuit Breaker are offered who have recently established production line in India for the specified system voltage or above class, based on technological support of a parent company or collaborator for the respective equipment(s) can also be considered provided the parent company (Principal) or collaborator meets qualifying requirements stipulated under clause no 28.1.(i) given above.

And

28.1.(ii)(b) Furnishes (jointly with parent company or collaborator) a legally enforceable undertaking to guarantee quality, timely supply, performance and warranty obligations as specified for the equipment(s)

And

28.1.(ii)(c) Furnishes a confirmation letter from the parent company or collaborator along with the bid stating that parent company or collaborator shall furnish performance guarantee for an amount of 10% of the cost of such equipment(s). This performance guarantee shall be in addition to contract performance guarantee to be submitted by the Bidder

28.2 Isolators (Applicable for 400kV, 220kV & 132kV)

28.2.(i) The manufacturer whose isolator are offered, should have designed, manufactured & tested as per IS/IEC or equivalent standard and supplied the isolator for the specified system voltage and and **40kA/ 50kA fault level or above class** and should be in satisfactory operation for at least 2 (two) years as on the date of bid opening

Or

28.2.(ii)(a) The manufacturer(s) whose Isolator are offered who have recently established production line in India for the specified system voltage or above class, based on technological support of a

parent company or collaborator for the respective equipment(s) can also be considered provided the parent company (Principal) or collaborator meets qualifying requirements stipulated under clause no 28.2.(i) given above.

And

28.2.(ii)(b) Furnishes (jointly with parent company or collaborator) a legally enforceable undertaking to guarantee quality, timely supply, performance and warranty obligations as specified for the equipment(s)

And

28.2.(ii)(c) Furnishes a confirmation letter from the parent company or collaborator along with the bid stating that parent company or collaborator shall furnish performance guarantee for an amount of 10% of the cost of such equipment(s). This performance guarantee shall be in addition to contract performance guarantee to be submitted by the Bidder

28.3 Instrument Transformers (Applicable for 400kV, 220kV & 132kV)

28.3.(i) The manufacturer whose instrument transformers are offered, should have designed, manufactured & tested as per IS/IEC or equivalent standard and supplied the same for the specified system voltage for CT & VT and 40kA/ 50kA fault level or above class. These equipment should be in satisfactory operation for at least 2 (two) years as on the date of bid opening

Or

28.3.(ii)(a) The manufacturer(s) whose Instrument Transformer are offered who have recently established production line in India for the specified system voltage or above class, based on technological support of a parent company or collaborator for the respective equipment(s) can also be considered provided the parent company (Principal) or collaborator meets qualifying requirements stipulated under clause no 28.3.(i) given above.

And

28.3.(ii)(b) Furnishes (jointly with parent company or collaborator) a legally enforceable undertaking to guarantee quality, timely supply, performance and warranty obligations as specified for the equipment(s)

And

28.3.(ii)(c) Furnishes a confirmation letter from the parent company or collaborator alongwith the bid stating that parent company or collaborator shall furnish performance guarantee for an amount of 10% of the cost of such equipment(s). This performance guarantee shall be in addition to contract performance guarantee to be submitted by the Bidder

28.4 Surge Arresters (Applicable for 400kV, 220kV & 132kV)

(a) The manufacturer whose Surge Arresters are offered should have designed, manufactured and tested as per IEC/IS or equivalent standard and supplied the Surge Arrester for the specified energy capability with rated system voltage and which are in satisfactory operation for at least 2 (two) years as on the date of bid opening.

Or

(b) The manufacturer(s) whose Surge Arrestors are offered who have recently established production line in India for the specified system voltage or above class, based on technological support of a parent company or collaborator for the respective equipment(s) can also be considered provided the parent company (Principal) or collaborator meets qualifying requirements stipulated under clause no (a) given above.

And

Furnishes (jointly with parent company or collaborator) a legally enforceable undertaking to

guarantee quality, timely supply, performance and warranty obligations as specified for the equipment(s)

And

Furnishes a confirmation letter from the parent company or collaborator alongwith the bid stating that parent company or collaborator shall furnish performance guarantee for an amount of 10% of the cost of such equipment(s). This performance guarantee shall be in addition to contract performance guarantee to be submitted by the Bidder.

28.5 220 kV Grade XLPE Power Cables

The cable shall be from the manufacturer who must have designed, manufactured, type tested and supplied in a single contract at least 15 (fifteen) km of single core, 220kV or higher grade XLPE insulated cable which must be in operation for at least 2 (two) years as on the date of bid opening.

28.6 132 kV Grade XLPE Power Cables

The cable shall be from the manufacturer who must have designed, manufactured, type tested and supplied in a single contract at least 15 (fifteen) km of single core, 132kV or higher grade XLPE insulated cable which must be in operation for at least 2 (two) years as on the date of bid opening.

28.7 33 kV Grade XLPE Power Cables

The cable shall be from the manufacturer who must have designed, manufactured, type tested and supplied in a single contract at least 15 (fifteen) km of single core, 33kV or higher grade XLPE insulated cable which must be in operation for at least 2 (two) years as on the date of bid opening.

28.8 1.1 kV Grade Power & Control Cables

28.8.1 Applicable for PVC Control Cable

The manufacturers, whose PVC control cables are offered, should have designed, manufactured, tested and supplied in a single contract at least 100 kms of 1.1 kV grade PVC insulated control cables as on the date of bid opening. Further the manufacturer should also have designed, manufactured, tested and supplied at least 1 km of 27C x 2.5 Sq.mm or higher size as on the date of bid opening.

28.8.2 Applicable for PVC Power Cable

The manufacturer, whose PVC Power Cables are offered, should have designed, manufactured, tested and supplied in a single contract atleast 100 kms of 1.1 kV or higher grade PVC insulated power cables as on the date of bid opening. Further the manufacturer should also have designed, manufactured, tested and supplied at least 1 km of 1C x 150 Sq. mm or higher size as on the date of bid opening.

28.8.3 Applicable for XLPE Power Cables

The Manufacturer, whose XLPE Power cables are offered, should have designed, manufactured,

tested and supplied in a single contract atleast 25 kms of 1.1 kV or higher grade XLPE insulated power cables as on the date of bid opening. Further the manufacturer should also have designed, manufactured, tested and supplied at least 1 km of 1C x 630 Sq. mm or higher size as on the date of bid opening.

28.9 LT Switchgear

28.9.1 The Manufacturer whose LT Switchgear are offered, should be a manufacturer of LT Switchboards of the type and rating being offered. He should have designe manufactured, tested and supplied at least 50 nos. draw out circuit breaker panels, out of which at least 5 nos. should have been with relay and protection schemes with current transformer. He should have also manufactured at least 50 nos. MCC panels comprising of MCCBs (ie Moulded Case Circuit Breakers) modules of the type offered which should be in successful operation as on date of bid opening.

28.9.2 The Switchgear items (such as circuit breakers, fuse switch units, contactors etc.), may be of his own make or shall be procured from reputed manufacturers and of proven design. At least one hundred circuit breakers of the make and type being offered shall be operating satisfactory as on date of bid opening.

28.10 Battery and Battery Charger

28.10.1 Requirements for Battery Manufacturers

The manufacturer whose Batteries are offered should have designed, manufactured and supplied DC Batteries of the type specified and being offered, having a capacity of at least 600 AH and these shall be operating satisfactorily for two years in power sector and/or industrial installations as on date of bid opening.

28.10.2 Requirements for Battery Charger Manufacturers

The manufacturer, whose Battery Chargers are offered, should have designed, manufactured and supplied Battery Chargers generally of the type offered, with static automatic voltage regulators and having a continuous output of at least ten (10) kW and these should be in successful as on the date of bid opening.

28.11 LT Transformers

The manufacturer, whose transformers are offered should have designed, manufactured, type tested including short circuit test as per IEC/IS or equivalent standards and supplied transformers of at least 33 kV class of 800 kVA or higher. The transformer should have been in successful operation for at least 2 years as on the date of bid opening.

28.12 Fire Fighting System

The bidder or his sub-vendor should have designed, supplied, tested, erected and commissioned at least one number fire protection system of the each type described in (i), (ii), (iii) and (iv) below in installations such as power plants, substations, refineries, fertilizer plants or other industrial or commercial installations. Such systems must have been designed to the recommendations of Tariff Advisory Committee of India or any other international reputed

authority like (FOC, London or NFPA, USA etc.) executed during last ten (10) years and should have been in successful operation for at least 2 (two) years as on the date of bid opening.

i) Nitrogen Injection Fire Prevention cum Extinguishing System
ii) Portable Fire Extinguishers
iii) GI Buckets – 9.0 liters capacity and Steel stand for Buckets
iv) Fire Detection and Alarm System

In case bidder himself do not meet the requirement of design, he can engage a consultant(s) who must have designed the above system, which must be in successful operation for at least two years as on the date of bid opening.

28.13 Control and Relay Panels (400 kV, 220 kV, 132 kV & 33 kV)

The manufacturer whose Control, Relay & Protection System (Control & protection Intelligent Electronic Devices (IEDs)), and Sub-station Automation System (If applicable) are offered should have designed, manufactured, tested, installed and commissioned Control, Relay & Protection system along with Sub-station Automation System which must be in satisfactory operation on specified voltage level or above for atleast 2 (two) years on the date of bid opening.

AND

The Manufacturer or their joint venture or subsidiary company must have established repair, testing and integration (for at least 4 bays) facilities for Control, Relay & Protection System and Sub-station Automation System in India.

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1.0 General

Unless otherwise stipulated, all equipment together with its associated connectors, where applicable, shall be tested for external corona (for 400 kV & above) both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and by measurement of radio interference voltage (RIV) for 132 kV above.

2.0 Test Levels

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

3.0 Test Methods for RIV

3.1 RIV tests shall be made according to measuring circuit as per International Special-Committee on Radio Interference (CISPR) Publication 16-1(1993) Part -1. The measuring circuit shall preferably be tuned to frequency with 10% of 0.5 MHz but other frequencies in the range of 0.5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be in microvolts.

3.2 Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107-1964, except otherwise noted herein.

3.3 In measurement of, RIV, temporary additional external corona shielding may be provided. In measurements of RIV only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.

3.4 Ambient noise shall be measured before and after each series of tests to ensure that there is no variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100%, and 110% of the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 400kV, 220kV, 132kV is listed in the detailed specification together with maximum permissible RIV level in microvolts.

3.5 The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.

3.6 The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to voltage read by noisel meter.

4.0 Test Methods for Visible Corona

The purpose of this test is to determine the corona extinction voltage of apparatus, connectors etc. The test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltage, when the test voltage is raised

and lowered to determine their precise values. The test voltage shall be raised to 110% of specified corona extinction voltage and maintained there for five minutes. In case corona inception does not take place at 110%, test shall be stopped, otherwise test shall be continued and the voltage will then be decreased slowly until all visible corona disappears. The procedure shall be repeated at least 4 times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purposes of determining compliance with the specification shall be the lowest of the four values at which visible corona (negative or positive polarity) disappears. Photographs with laboratory in complete darkness shall be taken under test conditions, at all voltage steps i.e. 85%, 100%, and 110%. Additional photographs shall be taken at corona inception and extinction voltages. At least two views shall be photographed in each case using Panchromatic film with an ASA daylight rating of 400 with an exposure of two minutes at a lens aperture of f/5.6 or equivalent. The photographic process shall be such that prints are available for inspection and comparison with conditions as determined from direct observation. Photographs shall be taken from above and below the level of connector so as to show corona on bushing, insulators and all parts of energised connectors. The photographs shall be framed such that test object essentially, fills the frame with no cut-off.

For recording purpose, modern devices utilizing UV recording methods such as image intensifier may also be used.

4.1 The test shall be recorded on each photograph. Additional photograph shall be taken from each camera position with lights on to show the relative position of test object to facilitate precise corona location from the photographic evidence.

4.2 In addition to photographs of the test object preferably four photographs shall be taken of the complete test assembly showing relative positions of all the test equipment and test objects. These four photographs shall be taken from four points equally spaced around the test arrangement to show its features from all sides. Drawings of the laboratory and test set up locations shall be provided to indicate camera positions and angles. The precise location of camera shall be approved by Purchaser's inspector, after determining the best camera locations by trial energisation of test object at a voltage which results in corona.

4.3 The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.

4.4 However, both test shall be carried out with the same test set up and as little time duration between tests as possible. No modification on treatment of the sample between tests will be allowed. Simultaneous RIV and visible corona extinction voltage testing may be permitted at the discretion of Purchaser's inspector if, in his opinion, it will not prejudice other test.

5.0 Test Records

In addition to the information previously mentioned and the requirements specified as per CISPR or NEMA 107-1964 the following data shall be included in test report:

a) Background noise before and after test.
b) Detailed procedure of application of test voltage.
c) Measurements of RIV levels expressed in micro volts at each level.

d) Results and observations with regard to location and type of interference sources detected at each step.

e) Test voltage shall be recorded when measured RIV passes through 100 microvolts in each direction.

f) Onset and extinction of visual corona for each of the four tests required shall be recorded.

ANNEXURE – B

SEISMIC WITHSTAND TEST PROCEDURE

The seismic withstanding test on the complete equipment (for 132 kV and above) shall be carried out alongwith supporting structure.

The Bidder shall arrange to transport the structure from his Contractor's premises/UPPTCL sites for the purpose of seismic withstand test only.

The seismic level specified shall be applied at the base of the structure. The accelerometers shall be provided at the Terminal Pad of the equipment and any other point as agreed by the Purchaser. The seismic test shall be carried out in all possible combinations of the equipment. The seismic test procedure shall be furnished for approval of the Purchaser.

ANNEXURE – C

LIST OF SPECIFICATIONS

GENERAL STANDARDS AND CODES

India Electricity Rules

Indian Electricity Act

Indian Electricity (Supply) Act

Indian Factories Act

IS-5,	-	Colors for Ready Mixed Paints and Enamels.
IS-335,	-	New Insulating Oils.
IS-617,	-	Aluminium and Aluminium Alloy Ingots and Castings for General Engineering Purposes
IS-1448 (P1 to P 145)	-	Methods of Test for Petroleum and its Products.
IS-2071 (P1 to P3)	-	Methods of High Voltage Testing.
IS-12063	-	Classification of degrees of protection provided by enclosures of electrical equipment.
IS-2165 P1:1997 P2:1983	-	Insulation Coordination.
IS-3043	-	Code of Practice for Earthing
IS-6103	-	Method of Test for Specific Resistance (Resistivity) of Electrical Insulating Liquids
IS-6104	-	Method of Test for Interfacial Tension of Oil against Water by the Ring Method
IS-6262	-	Method of test for Power factor & Dielectric Constant of Electrical Insulating Liquids.
IS-6792	-	Method for determination of electric strength of insulating oils.
IS-5578	-	Guide for marking of insulated conductors.
IS-11353	-	Guide for uniform system of marking & identification of conductors & apparatus terminals.
IS-8263	-	Methods for Radio Interference Test on High voltage Insulators.
IS-9224 (Part 1,2&4)	-	Low Voltage Fuses
IEC-60060 (Part 1 to P4)	-	High Voltage Test Techniques
IEC 60068	-	Environmental Test

IEC-60117	-	Graphical Symbols
IEC-60156,	-	Method for the Determination of the Electrical Strength of Insulation Oils.
IEC-60270,	-	Partial Discharge Measurements.
IEC-60376	-	Specification and Acceptance of New Sulphur Hexafloride
IEC-60437	-	Radio Interference Test on High Voltage Insulators.
IEC-60507	-	Artificial Pollution Tests on High Voltage Insulators to be used on AC Systems.
IEC-62271-1	-	Common Specification for High Voltage Switchgear & Controlgear Standards.
IEC-60815	-	Guide for the Selection of Insulators in respect of Polluted Conditions.
IEC-60865 (P1 & P2)	-	Short Circuit Current - Calculation of effects.
ANSI-C.1/NFPA.70	-	National Electrical Code
ANSI-C37.90A	-	Guide for Surge Withstand Capability (SWC) Tests
ANSI-C63.21,	-	Specification for Electromagnetic Noise and
C63.3	-	Field Strength Instrumentation 10 KHz to 1 GHZ
C36.4ANSI-C68.1	-	Techniquest for Dielectric Tests
ANSI-C76.1/EEE21	-	Standard General Requirements and Test Procedure for Outdoor Apparatus Bushings.
ANSI-SI-4	-	Specification for Sound Level Metres
ANSI-Y32-2/C337.2	-	Drawing Symbols
ANSI-Z55.11	-	Gray Finishes for Industrial Apparatus and Equipment No. 61 Light Gray
NEMA-107T	-	Methods of Measurements of RIV of High Voltage Apparatus
NEMA-ICS-II	-	General Standards for Industrial Control and Systems Part ICSI-109
CISPR-1	-	Specification for CISPR Radio Interference Measuring Apparatus for the frequency range 0.15 MHz to 30 MHz
CSA-Z299.1-1978h	-	Quality Assurance Program Requirements
CSA-Z299.2-1979h	-	Quality Control Program Requirements
CSA-Z299.3-1979h	-	Quality Verification Program Requirements

CSA-Z299.4-1979h	-	Inspection Program Requirements

TRANSFORMERS AND REACTORS

IS:10028 (Part 2 & 3)	-	Code of practice for selection, installation & maintenance of Transformers (P1:1993), (P2:1991), (P3:1991)
IS-2026 (P1 to P4)	-	Power Transformers
IS-3347 (part 1 to Part 8)	-	Dimensions for Porcelain transformer Bushings for use in lightly polluted atmospheres.
IS-3639	-	Fittings and Accessories for Power Transformers
IS-6600	-	Guide for Loading of OIl immersed Transformers.
IEC-60076 (Part 1 to 5)	-	Power Transformers
IEC-60214	-	On-Load Tap-Changers.
IEC-60289	-	Reactors.
IEC- 60354	-	Loading Guide for Oil - Immersed power trans formers
IEC-60076-10	-	Determination of Transformer and Reactor Sound Levels
ANSI-C571280	-	General requirements for Distribution, Power and Regulating Transformers
ANSI-C571290	-	Test Code for Distribution, Power and Regulation Transformers
ANSI-C5716	-	Terminology & Test Code for Current Limiting Reactors
ANSI-C5721	-	Requirements, Terminology and Test Code for Shunt Reactors Rated Over 500 KVA
ANSI-C5792	-	Guide for Loading Oil-Immersed Power Transformers upto and including 100 MVA with 55 deg C or 65 deg C Winding Rise
ANSI-CG,1EEE-4	-	Standard Techniques for High Voltage Testing

CIRCUIT BREAKERS

IEC-62271-100	-	High-voltage switchgear and controlgear - Part 100: Alternating current circuit-breakers
IEC-62271-101	-	High-voltage switchgear and controlgear - Part 101:

		Synthetic testing
IEC-62155	-	Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1000 V
IEC-62271-110	-	High-voltage switchgear and controlgear - Part 110: Inductive load switching
IEC-62271-109	-	High-voltage switchgear and controlgear - Part 110: Inductive load switching

CURRENT TRANSFORMERS, VOLTAGE TRANSFORMERS AND COUPLING CAPACITOR VOLTAGE TRANSFORMERS

IS-2705- (P1 to P4)	-	Current Transformers.
IS:3156- (P1 to P4)	-	Voltage Transformers.
IS-4379	-	Identification of the Contents of Industrial Gas Cylinders
IEC-60044-1	-	Current transformers.
IEC-60044-2	-	Inductive Voltage Transformers.
IEC-60044-4	-	Instrument Transformes : Measurement of Partial Discharges
IEC-60044-5	-	Instrument transformers - Part 5: Capacitor voltage transformers
IEC-60358	-	Coupling capacitors and capacitor dividers.
IEC-60481	-	Coupling Devices for power Line Carrier Systems.
ANSI-C5713	-	Requirements for Instrument transformers
ANSIC92.2	-	Power Line Coupling voltage Transformers
ANSI-C93.1	-	Requirements for Power Line Carrier Coupling Capacitors
BUSHING		
IS-2099	-	Bushings for Alternating Voltages above 1000V
IEC-60137	-	Insulated Bushings for Alternating Voltages above 1000V

SURGE ARRESTERS

IS-3070 (PART2)	-	Lightning arresters for alternating current systems

		: Metal oxide lightning arrestors without gaps.
IEC-60099-4	-	Metal oxide surge arrestors without gaps
IEC-60099-5	-	Selection and application recommendation
ANSI-C62.1	-	IEE Standards for S A for AC Power Circuits
NEMA-LA 1	-	Surge Arresters

CUBICLES AND PANELS & OTHER RELATED EQUIPMENTS

IS-722, IS-1248, IS-3231, 3231 (P-3)	-	Electrical relays for power system protection
IS:5039	-	Distributed pillars for Voltages not Exceeding 1000 Volts.
IEC-60068.2.2	-	Basic environmental testing procedures Part 2: Test B: Dry heat
IEC-60529	-	Degree of Protection provided by enclosures.
IEC-60947-4-1	-	Low voltage switchgear and control gear.
IEC-61095	-	Electromechanical Contactors for household and similar purposes.
IEC-60439 (P1 & 2)	-	Low Voltage Switchgear and control gear assemblies
ANSI-C37.20	-	Switchgear Assemblies, including metal enclosed bus.
ANSI-C37.50	-	Test Procedures for Low Voltage Alternating Current Power Circuit Breakers
ANSI-C39	-	Electric Measuring instrument
ANSI-C83	-	Components for Electric Equipment
IS: 8623: (Part I to 3)	-	Specification for Switchgear & Control Assemblies.
NEMA-AB	-	Moulded Case Circuit and Systems
NEMA-CS	-	Industrial Controls and Systems
NEMA-PB-1	-	Panel Boards
NEMA-SG-5	-	Low voltage Power Circuit breakers
NEMA-SG-3	-	Power Switchgear Assemblies
NEMA-SG-6	-	Power switching Equipment
NEMA-5E-3	-	Motor Control Centers
1248 (P1 to P9)	-	Direct acting indicating analogue electrical

		measuring instruments & their accessories.

Disconnecting Switches

IEC-62271-102	-	High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches
IEC-60129	-	Alternating Current Disconnectors (Isolators) and Earthing switches
IEC-1129	-	Alternating Current Earthing Switches Induced Current switching
IEC-60265 (Part 1 & 2)	-	High Voltage switches
ANSI-C37.32	-	Schedule of preferred Ratings, Manufacturing Specifications and Application Guide for high voltage Air Switches, Bus supports and switch accessories
ANSI-C37.34	-	Test Code for high voltage air switches
NEMA-SG6	-	Power switching equipment

PLCC and Line Traps

IS-8792	-	Line traps for AC power system.
IS-8793	-	Methods of tests for line traps.
IS-8997	-	Coupling devices for PLC systems.
IS-8998	-	Methods of test for coupling devices for PLC systems.
IEC-60353	-	Line traps for A.C. power systems.
IEC-60481	-	Coupling Devices for power line carrier systems.
IEC-60495	-	Single sideboard power line carrier terminals
IEC-60683	-	Planning of (single Side-Band) power line carrier systems.
CIGRE	-	Teleprotection report by Committee 34 & 35.
CIGRE	-	Guide on power line carrier 1979.
CCIR	-	International Radio Consultative Committee
CCITT	-	International Telegraph & Telephone Consultative Committee

EIA	-	Electric Industries Association

Protection and Control Equipment

IEC-60051 : (P1 to P9)	-	Recommendations for Direct Acting indicating analogue electrical measuring instruments and their accessories.
IEC-60255 (Part 1 to 23)	-	Electrical relays.
IEC-60297		
(P1 to P4)	-	Dimensions of mechanical structures of the 482.6mm (19 inches) series.
IEC-60359	-	Expression of the performance of electrical & electronic measuring equipment.
IEC-60387	-	Symbols for Alternating-Current Electricity meters.
IEC-60447	-	Man machine interface (MMI) - Actuating principles.
IEC-60521	-	Class 0.5, 1 and 2 alternating current watt hour metres
IEC-60547	-	Modular plug-in Unit and standard 19-inch rack mounting unit based on NIM Standard (for electronic nuclear instruments)
ANSI-81	-	Screw threads
ANSI-B18	-	Bolts and Nuts
ANSI-C37.1	-	Relays, Station Controls etc.
ANSI-C37.2	-	Manual and automatic station control, supervisory and associated telemetering equipment
ANSI-C37.2	-	Relays and relay systems associated with electric power apparatus
ANSI-C39.1	-	Requirements for electrical analog indicating Instruments

MOTORS

IS-325	-	Three phase induction motors.
IS-4691	-	Degree of protection provided by enclosure for rotating electrical machinery.
IEC-60034 (P1 to P19:)	-	Rotating electrical machines

IEC-Document 2	-	Three phase induction motors

(Central Office) NEMA-MGI Motors and Generators

Electronic Equipment and Components

MIL-21B, MIL-833 & MIL-2750

IEC-60068 (P1 to P5)	-	Environmental testing
IEC-60326 (P1 to P2)	-	Printed boards Material and workmanship standards
IS-1363 (P1 to P3)	-	Hexagon headbolts, screws and nuts of product grade C.
IS-1364 (P1 to P5)	-	Hexagon head bolts, screws and nuts of products grades A and B.
IS-3138	-	Hexagonal Bolts and Nuts (M42 to M150)
ISO-898	-	Fasteners: Bolts, screws and studs
ASTM	-	Specification and tests for materials

Clamps & Connectors

IS-5561	-	Electric power connectors.
NEMA-CC1	-	Electric Power connectors for sub station
NEMA-CC 3	-	Connectors for Use between aluminium or aluminum-Copper Overhead Conductors

Bus Hardware and Insulators

IS: 2121	-	Fittings for Aluminum and steel cored Al conductors for overhead power lines.
IS-731	-	Porcelain insulators for overhead power lines with a nominal voltage greater than 1000 V.
IS-2486 (P1 to P4)	-	Insulator fittings for overhead power lines with a nominal voltage greater than 1000 V.
IEC-60120	-	Dimensions of Ball and Socket Couplings of string insulator units.
IEC-60137	-	Insulated bushings for alternating voltages above 1000 V.
IEC-60168	-	Tests on indoor and outdoor post insulators of ceramic material or glass for Systems with Nominal Voltages Greater than 1000 V.

IEC-62155	-	Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V
IEC-60233	-	Tests on Hollow Insulators for use in electrical equipment.
IEC-60273	-	Characteristices of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
IEC-61462	-	Pressurized and un-pressurized insulator for use in electrical equipment with rated voltage greater than 1000V – Definitions, Test methods, acceptance criteria and design recommendations
IEC-60305	-	Insulators for overhead lines with nominal voltage above 1000V-ceramic or glass insulator units for a.c. systems Characteristics of String Insulator Units of the cap and pintype.
IEC-60372 (1984)	-	Locking devices for ball and socket couplings of string insulator units : dimensions and tests.
IEC-60383 (P1 and P2)	-	Insulators for overhead lines with a nominal voltage above 1000 V.
IEC-60433	-	Characteristics of string insulator units of the long rod type.
IEC-60471	-	Dimensions of Clevis and tongue couplings of string insulator units.
ANSI-C29	-	Wet process proelain insulators
ANSI-C29.1	-	Test methods for electrical power insulators
ANSI-C92.2	-	For insulators, wet-process porcelain and toughened glass suspension type
ANSI-C29.8	-	For wet-process porcelain insulators apparatus, post-type
ANSI-G.8	-	Iron and steel hardware
CISPR-7B	-	Recommendations of the CISPR, tolerances of form and of Position, Part 1
ASTM A-153	-	Zinc Coating (Hot-Dip) on iron and steel hardware

Strain and Rigid Bus-Conductor

IS-2678	-	Dimensions & tolerances for Wrought Aluminum and Aluminum Alloys drawn round tube.

IS-5082	-	Wrought Aluminum and Aluminum Alloy Bars. Rods, Tubes and Sections for Electrical purposes.
ASTM-B 230-82	-	Aluminum 1350 H19 Wire for electrical purposes
ASTM-B 231-81	-	Concentric - lay - stranded, aluminum 1350 conductors
ASTM-B 221	-	Aluminum - Alloy extruded bar, road, wire, shape
ASTM-B 236-83	-	Aluminum bars for electrical purpose (Bus-bars)
ASTM-B 317-83	-	Aluminum-Alloy extruded bar, rod, pipe and structural shapes for electrical purposes (Bus Conductors)

Batteries and Batteries Charger

Battery

IS:1651	-	Stationary Cells and Batteries, Lead-Acid Type (with Tubular Positive Plates)
IS:1652	-	Stationary Cells and Batteries, Lead-Acid Type (with Plante Positive Plates)
IS:1146	-	Rubber and Plastic Containers for Lead-Acid Storage Batteries
IS:6071	-	Synthetic Separators for Lead-Acid Batteries
IS:266	-	Specification for Sulphuric Acid
IS:1069	-	Specification for Water for Storage Batteries
IS:3116	-	Specification for Sealing Compound for Lead-Acid Batteries
IS:1248	-	Indicating Instruments
IS:10918	-	Vented type nickel Cadmium Batteries
IEC:60896-21&22	-	Lead Acid Batteries Valve Regulated types – Methods of Tests & Requirements
IEC: 60623	-	Vented type nickel Cadmium Batteries
IEC:60622	-	Secondary Cells & Batteries – Sealed Ni-Cd rechargeable single cell
IEC:60623	-	Secondary Cells & Batteries – Vented Ni-Cd rechargeable single cell
IEC:60896-11	-	Stationary Lead Acid Batteries – Vented Type – General requirements & method of tests
IEEE-485	-	Recommended practices for sizing of Lead Acid

		Batteries
IEEE-1115	-	Sizing of Ni-Cd Batteries
IEEE-1187	-	Recommended practices for design & installation of VRLA Batteries
IEEE-1188	-	Recommended practices for design & installation of VRLA Batteries
IEEE-1189	-	Guide for selection of VRLA Batteries

Battery Charger

IS:3895	-	Mono-crystalline Semiconductor Rectifier Cells and Stacks
IS:4540	-	Mono-crystalline Semiconductor Rectifier Assemblies and Equipment.
IS:6619	-	Safety Code for Semiconductor Rectifier Equipment
IS:2026	-	Power Transformers
IS:2959	-	AC Contactors for Voltages not Exceeding 1000 Volts
IS:1248	-	Indicating Instruments
IS:2208	-	HRC Fuses
IS:13947 (Part-3)	-	Air break switches, air break disconnectors & fuse combination units for voltage not exceeding 1000V AC or 1200V DC
IS:2147	-	Degree of protection provided by enclosures for low voltage switchgear and controlgear.
IS:6005	-	Code of practice for phosphating of Iron and Steel
IS:3231	-	Electrical relays for power system protection
IS:3842	-	Electrical relay for AC Systems
IS:5	-	Colours for ready mix paint
IEEE-484	-	Recommended Design for installation design and installation of large lead storage batteries for generating stations and substations.
IEEE-485	-	Sizing large lead storage batteries for generating stations and substations

Wires and Cables

ASTMD-2863	-	Measuring the minimum oxygen concentration to support candle like combustion of plastics (oxygen index)
IS-694	-	PVC insulated cables for working voltages upto and including 1100 Volts.
IS-1255	-	Code of practice for installation and maintenance of power cables, upto and including 33 kV rating
IS-1554 (P1 and P2)	-	PVC insulated (heavy duty) electric cables (part 1) for working voltage upto and including 1100 V.
	-	Part (2) for working voltage from 3.3 kV upto and including 11kV.
IS:1753	-	Aluminium conductor for insulated cables
IS:2982	-	Copper Conductor in insulated cables.
IS-3961 (P1 to P5)	-	Recommended current ratings for cables.
IS-3975	-	Mild steel wires, formed wires and tapes for armouring of cables.
IS-5831	-	PVC insulating and sheath of electric cables.
IS-6380	-	Elastometric insulating and sheath of electric cables.
IS-7098	-	Cross linked polyethylene insulated PVC sheathed cables for working voltage upto and including 1100 volts.
IS-7098	-	Cross-linked polyethyle insulated PVC sheathed cables for working voltage from 3.3kV upto and including 33 kV.
IS-8130	-	Conductors for insulated electrical cables and flexible cords.
IS-1753	-	Aluminum Conductors for insulated cables.
IS-10418	-	Specification for drums for electric cables.
IEC-60096 (part 0 to p4)	-	Radio Frequency cables.
IEC-60183	-	Guide to the Selection of High Voltage Cables.
IEC-60189 (P1 to P7)	-	Low frequency cables and wires with PVC insulation and PVC sheath.
IEC-60227 (P1 to P7)	-	Polyvinyl Chloride insulated cables of rated voltages up to and including 450/750V.
IEC-60228	-	Conductors of insulated cables
IEC-60230	-	Impulse tests on cables and their accessories.

IEC-60287 (P1 to P3)	-	Calculation of the continuous current rating of cables (100% load factor).
IEC-60304	-	Standard colours for insulation for low-frequency cables and wires.
IEC-60331	-	Fire resisting characteristics of Electric cables.
IEC-60332 (P1 to P3)	-	Tests on electric cables under fire conditions.
IEC-60502	-	Extruded solid dielectric insulated power cables for rated voltages from 1 kV upto to 30 kV
IEC-754 (P1 and P2)	-	Tests on gases evolved during combustion of electric cables.

Air Conditioning and Ventilation

IS-659	-	Safety code for air conditioning
IS-660	-	Safety code for Mechanical Refrigeration
ARI:520	-	Standard for Positive Displacement RefrigerationCompressor and Condensing Units
IS:4503	-	Shell and tube type heat exchanger
ASHRAE-24	-	Method of testing for rating of liquid coolers
ANSI-B-31.5	-	Refrigeration Piping
IS:2062	-	Steel for general structural purposes
IS:655	-	Specification for Metal Air Dust
IS:277	-	Specification for Galvanised Steel Sheets
IS-737	-	Specification for Wrought Aluminium and Aluminium Sheet & Strip
IS-1079	-	Hot rolled cast steel sheet & strip
IS-3588	-	Specification for Electrical Axial Flow Fans
IS-2312	-	Propeller Type AC VentilationFans
BS-848	-	Methods of Performance Test for Fans
BS-6540 Part-I	-	Air Filters used in Air Conditioning and General Ventilation
BS-3928	-	Sodium Flame Test for Air Filters (Other than for Air Supply to I.C. Engines and Compressors)
US-PED-2098	-	Method of cold DOP & hot DOP test
MIL-STD-282	-	DOP smoke penetration method
ASHRAE-52	-	Air cleaning device used in general ventilation for

		removing particle matter
IS:3069	-	Glossary of Terms, Symbols and Units Relating to Thermal Insulation Materials.
IS:4671	-	Expanded Polystyrene for Thermal Insulation Purposes
IS:8183	-	Bonded Mineral Wool
IS:3346	-	Evaluation of Thermal Conductivity properties by means of guarded hot plate method
ASTM-C-591-69	-	Standard specification for rigid preformed cellular urethane thermal insulation
IS:4894	-	Centrifugal Fans
BS:848 Fans	-	Method of Performance Test for Centrifugal
IS:325	-	Induction motors, three-phase
IS:4722	-	Rotating electrical machines
IS:1231	-	Three phase foot mounted Induction motors, dimensions of
IS:2233	-	Designations of types of construction and mounting arrangements of rotating electrical machines
IS:2254	-	Vertical shaft motors for pumps, dimensions of
IS:7816	-	Guide for testing insulation resistance of rotating machines
IS:4029	-	Guide for testing three phase induction motors
IS:4729	-	Rotating electrical machines, vibration of, Measurement and evaluation of
IS:4691	-	Degree of protection provided by enclosures for rotating electrical machinery
IS:7572	-	Guide for testing single-phase a.c. motors
IS:2148	-	Flame proof enclosure for electrical apparatus
BS:4999 (Part-51)	-	Noise levels

Galvanizing

IS-209	-	Zinc Ingot
IS-2629	-	Recommended Practice for Hot-Dip galvanizing

		on iron and steel.
IS-2633	-	Methods for testing uniformity of coating of zinc coated articles.
ASTM-A-123	-	Specification for zinc (Hot Galavanizing) Coatings, on products Fabricated from rolled, pressed and forged steel shapes, plates, bars and strips.
ASTM-A-121-77	-	Zinc-coated (Galvanized) steel barbed wire

Painting

IS-6005	-	Code of practice for phosphating of iron and steel.
ANSI-Z551	-	Gray finishes for industrial apparatus and equipment
SSPEC	-	Steel structure painting council

Fire Protection System

Fire protection manul issued by tariff advisory committee (TAC) of India

HORIZONTAL CENTRIFUGAL PUMPS

IS:1520	-	Horizontal centrifugal pumps for clear, cold and fresh water
IS:9137	-	Code for acceptance test for centrifugal & axial pumps
IS:5120	-	Technical requirement - Rotodynamic special purpose pumps
API-610	-	Centrifugal pumps for general services
	-	Hydraulic Institutes Standards
BS:599	-	Methods of testing pumps
PTC-8.2	-	Power Test Codes - Centrifugal pumps

DIESEL ENGINES

IS:10000	-	Methods of tests for internal combustion engines
IS:10002	-	Specification for performance requirements for

		constant speed compression ignition engines for general purposes (above 20 kW)
BS:5514	-	The performance of reciprocating compression ignition (Diesel) engines, utilising liquid fuel only, for general purposes
ISO:3046	-	Reciprocating internal combustion engines performance
IS:554	-	Dimensions for pipe threads where pressure tight joints are required on threads
ASME Power Test Code	-	Internal combustion engine PTC-17
	-	Codes of Diesel Engine Manufacturer's Association, USA

PIPING VALVES & SPECIALITIES

IS:636	-	Non percolating flexible fire fighting delivery hose
IS:638	-	Sheet rubber jointing and rubber inserting jointing
IS:778	-	Gun metal gate, globe and check valves for general purpose
IS:780	-	Sluice valves for water works purposes (50 to 300 mm)
IS:901	-	Couplings, double male and double female instantaneous pattern for fire fighting
IS:902	-	Suction hose couplings for fire fighting purposes
IS:903	-	Fire hose delivery couplings branch pipe nozzles and nozzle spanner
IS:1538	-	Cast iron fittings for pressure pipes for water, gas and sewage
IS:1903	-	Ball valve (horizontal plunger type) including floats for water supply purposes
IS:2062	-	SP for weldable structural steel
IS:2379	-	Colour Code for the identification of pipelines
IS:2643	-	Dimensions of pipe threads for fastening purposes
IS:2685	-	Code of Practice for selection, installation and maintenance of sluice valves
IS:2906	-	Sluice valves for water-works purposes (350 to 1200 mm size)

IS:3582	-	Basket strainers for fire fighting purposes (cylindrical type)
IS:3589	-	Electrically welded steel pipes for water, gas and sewage (150 to 2000 mm nominal diameter)
IS:4038	-	Foot valves for water works purposes
IS:4927	-	Unlined flax canvas hose for fire fighting
IS:5290	-	Landing valves (internal hydrant)
IS:5312	-	Swing check type reflex (non-return) valves
(Part-I)		
IS:5306	-	Code of practice for fire extinguishing installations and equipment on premises
Part-I	-	Hydrant systems, hose reels and foam inlets
Part-II	-	Sprinkler systems
BS:5150	-	Specification for cast iron gate valves

MOTORS & ANNUNCIATION PANELS

IS:325	-	Three phase induction motors
IS:900	-	Code of practice for installation and maintenance of induction motors
IS:996	-	Single phase small AC and universal electric motors
IS:1231	-	Dimensions of three phase foot mounted induction motors
IS:2148	-	Flame proof enclosure of electrical apparatus
IS:2223	-	Dimensions of flange mounted AC induction motors
IS:2253	-	Designations for types of construction and mounting arrangements of rotating electrical machines
IS:2254	-	Dimensions of vertical shaft motors for pumps
IS:3202	-	Code of practice for climate proofing of electrical equipment
IS:4029	-	Guide for testing three phase induction motors
IS:4691	-	Degree of protection provided by enclosure for rotating electrical machinery
IS:4722	-	Rotating electrical machines

IS:4729	-	Measurement and evaluation of vibration of rotating electrical machines
IS:5572	-	Classification of hazardous areas for electrical (Part-I) installations (Areas having gases and vapours)
IS:6362	-	Designation of methods of cooling for rotating electrical machines
IS:6381	-	Construction and testing of electrical apparatus with type of protection ‘e’
IS:7816	-	Guide for testing insulation for rotating machine
IS:4064	-	Air break switches
IEC DOCUMENT 2	-	Three Phase Induction Motor
(Control Office) 432		
VDE 0530 Part I/66	-	Three Phase Induction Motor
IS:9224	-	HRC Fuses
(Part-II)		
IS:6875	-	Push Button and Control Switches
IS:694	-	PVC Insulated cables
IS:1248	-	Indicating instruments
IS:375	-	Auxiliary wiring & busbar markings
IS:2147	-	Degree of protection
IS:5	-	Colour Relay and timers
IS:2959	-	Contactors

PG Test Procedures

NFPA-13	-	Standard for the installation of sprinkler system
NFPA-15	-	Standard for water spray fixed system for the fire protection
NFPA-12A	-	Standard for Halong 1301 Fire Extinguishing System
NFPA-72E	-	Standard on Antomatic Fire Detectors

Fire Protection Manual by TAC (Latest Edition)

NFPA-12	-	Standard on Carbon dioxide extinguisher systems
IS:3034	-	Fire of industrial building:

Electrical generating and distributing stations code of practice

IS:2878	-	CO2 (Carbon dioxide) Type Extinguisher
IS:2171	-	DC (Dry Chemical Powder) type
IS:940	-	Pressurised Water Type

D.G. SET

IS:10002	-	Specification for performance requirements for constant speed compression ignition (diesel engine) for general purposes
IS:10000	-	Method of tests for internal combustion engines
IS:4722	-	Rotating electrical machines-specification
IS:12063	-	Degree of protection provided by enclosures
IS:12065	-	Permissible limit of noise levels for rotating electrical machines.
	-	Indian Explosive Act 1932

Steel Structures

IS-228 (1992)	-	Method of Chemical Analysis of pig iron, cast iron and plain carbon and low alloy steels.
IS-802 (P1 to 3:)	-	Code of practice for use of structural steel in overhead transmission line towers.
IS-806	-	Code of practice for use of steel tubes in general building construction
IS-808	-	Dimensions for hot rolled steel beam, column channel and angle sections.
IS-814	-	Covered electrodes for manual arc welding of carbon of carbon manganese steel.
IS-816	-	Code of Practice for use of metal arc welding for general construction in Mild steel
IS-817	-	Code of practice for training and testing of metal arc welders. Part 1 : Manual Metal arc welding.
IS-875 (P1 to P4)	-	Code of practice for design loads (other than earthquake) for buildings and structures.
IS-1161	-	Steel tubes for structural purposes.
IS-1182	-	Recommended practice for radiographic examination of fusion welded butt joints in steel

		plates.
IS-1363 (P1 to P3)	-	Hexagonal head bolts, screws & nuts of products grade C.
IS-1364	-	Hexagon headbolts, screws and nuts of product grades A and B.
IS-1367 (P1 to P18)	-	Technical supply condition for threaded steel fasteners.
IS-1599	-	Methods for bend test.
IS-1608	-	Method for tensile testing of steel products.
IS-1893	-	Criteria for earthquake resistant design of structures.
IS-1978	-	Line Pipe.
IS-2062	-	Steel for general structural purposes.
IS-2595	-	Code of practice for Radiographic testing.
IS-3063	-	Single coil rectagular section spring washers for bolts, nuts and screws.
IS-3664	-	Code of practice for ultrasonic pulse echo testing by contact and immersion methods.
IS-7205	-	Safety code for erection of structural steel work.
IS-9595	-	Recommendations for metal arc welding of carbon and carbon manganese steels.
ANSI-B18.2.1	-	Inch series square and Hexagonal bolts and screws
ANSI-B18.2.2	-	Square and hexagonal nuts
ANSI-G8.14	-	Round head bolts
ASTM-A6	-	Specification for General Requirements for rolled steel plates, shapes, sheet piling and bars of structural use
ASTM-A36	-	Specifications of structural steel
ASTM-A47	-	Specification for malleable iron castings
ASTM-A143	-	Practice for safeguarding against embilement of Hot Galvanized structural steel products and procedure for detaching embrilement
ASTM-A242	-	Specification for high strength low alloy structural steel
ASTM-A283	-	Specification for low and intermediate tensile strength carbon steel plates of structural quality
ASTM-A394	-	Specification for Galvanized steel transmission

		tower bolts and nuts
ASTM-441	-	Specification for High strength low alloy structural manganese vanadium steel.
ASTM-A572	-	Specification for High strength low alloy colombium-Vanadium steel of structural quality
AWS D1-0	-	Code for welding in building construction welding inspection
AWS D1-1	-	Structural welding code
AISC	-	American institute of steel construction
NEMA-CG1	-	Manufactured graphite electrodes

Piping and Pressure Vessels

IS-1239 (Part 1 and 2) steel	-	Mild steel tubes, tubulars and other wrought fittings
IS-3589	-	Seamless Electrically welded steel pipes for water, gas and sewage.
IS-6392	-	Steel pipe flanges
ASME	-	Boiler and pressure vessel code
ASTM-A120	-	Specification for pipe steel, black and hot dipped, zinc-coated (Galvanized) welded and seamless steel pipe for ordinary use
ASTM-A53	-	Specification for pipe, steel, black, and hotdipped, zinc coated welded and seamless
ASTM-A106	-	Seamless carbon steel pipe for high temperature service
ASTM-A284	-	Low and intermediate tensile strength carbonsilicon steel plates for machine parts and general construction.
ASTM-A234	-	Pipe fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures
ASTM-S181	-	Specification for forgings, carbon steel for general purpose piping
ASTM-A105	-	Forgings, carbon steel for piping components
ASTM-A307	-	Carbon steel externally threated standard fasteners
ASTM-A193	-	Alloy steel and stainless steel bolting materials for

		high temperature service
ASTM-A345	-	Flat rolled electrical steel for magnetic applications
ASTM-A197	-	Cupola malleable iron
ANSI-B2.1	-	Pipe threads (Except dry seal)
ANSI-B16.1	-	Cast iron pipe flangesand glanged fitting. Class 25, 125, 250 and 800
ANSI-B16.1	-	Malleable iron threaded fittings, class 150 and 300
ANSI-B16.5	-	Pipe flanges and flanged fittings, steel nickel alloy and other special alloys
ANSI-B16.9	-	Factory-made wrought steel butt welding fittings
ANSI-B16.11	-	Forged steel fittings, socket-welding and threaded
ANSI-B16.14	-	Ferrous pipe plug, bushings and locknuts with piplethreads
ANSI-B16.25	-	Butt welding ends
ANSI-B18.1.1	-	Fire hose couplings screw thread.
ANSI-B18.2.1	-	Inch series square and hexagonal bolts and screws
ANSI-B18.2.2	-	Square and hexagonal nuts
NSI-B18.21.1	-	Lock washers
ANSI-B18.21.2	-	Plain washers
ANSI-B31.1	-	Power piping
ANSI-B36.10	-	Welded and seamless wrought steel pipe
ANSI-B36.9	-	Stainless steel pipe

Other Civil Works Standards

IS-269	-	33 grade ordinary portland cement.
IS2721	-	Galvanized steel chain link fence fabric
IS-278	-	Galvanized steel barbed wire for fencing.
IS-383	-	Coarse and fine aggregates from natural sources for concrete.
IS-432 (P1 and P2)	-	Mild steel and medium tensile steel bars and hard-dawn steel wire for concrete reinforcement.
IS-456	-	Code of practice for plain and reinforced concrete.

IS-516	-	Method of test for strength of concrete.
IS-800	-	Code of practice for general construction in steel.
IS-806	-	Steel tubes for structural purposes.
IS-1172	-	Basic requirements for water supply, drainage and sanitation.
IS-1199	-	Methods of sampling and analysis of concrete.
IS-1566	-	Hard-dawn steel wire fabric for concrete reinforcement.
IS-1742	-	Code of Practice for Building drainage.
IS-1785	-	Plain hard-drawn steel wire for prestressed concrete.
IS-1786	-	High strength deformed Steel Bars and wires for concrete reinforcement.
IS-1811	-	Methods of sampling Foundry sands.
IS-1893	-	Criteria for earthquake resistant design of structures.
IS-2062	-	Steel for general structural purposes.
IS-2064	-	Selection, installation and maintenance of sanitary appliances-code of practices.
IS-2065	-	Code of practice for water supply in buildings.
IS-2090	-	High tension steel bars used in prestressed concrete.
IS-2140	-	Standard Galvanized steel wire for fencing.
IS-2470 (P1 & P2)	-	Code of practice for installation of septic tanks.
IS-2514	-	Concrete vibrating tables.
IS-2645	-	Integral cement waterproofing compounds.
IS-3025 (Part 1 to Part 48)	-	Methods of sampling and test (Physical and chemical) for water and waste water.
IS-4091	-	Code of practice for design and construction of foundations for transmission line towers and poles.
IS-4111 (Part 1 to P5)	-	Code of practice for ancillary structures in sewerage system.
IS-4990	-	Plywood for concrete shuttering work.
IS-5600	-	Sewage and drainage pumps.

National Buiding Code of India 1970

USBR E12	-	Earth Manual by United States Department of the interior Bureau of Reclamation
ASTM-A392-81	-	Zinc/Coated steel chain link fence fabric
ASTM-D1557-80	-	test for moisture-density relation of soils using 10-lb (4.5 kg) rame land 18-in. (457 mm) Drop.
ASTM-D1586	-	Penetration Test and Split-Barrel
(1967)	-	Sampling of Soils
ASTM-D2049-69	-	Test Method for Relative Density of Cohesionless Soils
ASTM-D2435	-	Test method for Unconsolidated, (1982) Undrained Strengths of Cohesive Soils in Triaxial Compression.
BS-5075	-	Specification for accelerating Part I Admixtures, Retarding Admixtures and Water Reducing Admixtures.
CPWD	-	Latest CPWD specifications

ACSR MOOSE CONDUCTOR

IS:6745	Methods for Determination of BS:443-1969 Mass of zinc coating on zinc coated Iron and Steel Articles
IS:8263	Methods for Radio Interference
IEC:437-1973	Test on High Voltage Insulators NEMA:107-1964 CISPR
IS:209	Zinc Ingot BS:3436-1961
IS:398	Aluminum Conductors for IEC:209-1966
Part - V	Overhead Transmission Purposes
BS:215(Part-II)	Aluminium Conductors galvanized IEC:209-1966 steel reinforced extra high
BS:215(Part-II)	voltage (400 kV and above)
IS:1778	Reels and Drums forBS:1559-1949 Bare Conductors
IS:1521	Method for Tensile Testing ISO/R89-1959of steel wire

IS:2629	Recommended practice for Hot dip Galvanising on Iron and Steel.
IS:2633	Method for Testing Uniformity of coating of zinc Coated Articles.
IS:4826	Hot dip galvanised coatings on round steel wires ASTMA-472-729

GALVANISED STEEL EARTHWIRE

IS:1521	Method for Tensile Testing ISO/R:89-1959 of Steel Wire
IS:1778	Reels and Drums for Bare Conductors
IS:2629	Recommended practice for Hot Dip Galvanising on Iron and Steel.
IS:2633 Coated	Methods for testing Uniformity of Coating of Zinc Articles.
IS:4826	Hot dip Galvanised Coatings ASTM:A 475-72a on Round Steel Wires BS:443-1969
IS:6745	Method for Determination BS:443-1969of mass of Zinc Coating on Zinc coated Iron and Steel Articles.
IS:209	Zinc ingot BS:3463-1961
IS:398 (Pt. I to P5:1992)	Aluminum Conductors for BS:215 (Part-II) overhead transmission purposes.

Lighting Fixtures and Accessories

IS:1913	General and safety requirements for electric lighting fittings.
IS:3528	Water proof electric lighting fittings.
IS:4012	Dust proof electric lighting fittings.
IS:4013	Dust tight proof electric lighting fittings.
IS:10322	Industrial lighting fittings with metal reflectors.
IS:10322	Industrial lighting fittings with plastic reflectors.
IS:2206 mines	Well glass lighting fittings for use under ground in

	(non-flameproof type).
IS:10322	Specification for flood light.
IS:10322	Specification for decorative lighting outfits.
IS:10322	Luminaries for street lighting
IS:2418	Tubular fluorescent lamps
IS:9900	High pressure mercury vapour lamps.
IS:1258	Specification for Bayonet lamp fluorescent lamp.
IS:3323	Bi-pin lamp holder tubular fluorescent lamps.
IS:1534	Ballasts for use in fluorescent lighting fittings. (Part-I)
IS:1569	Capacitors for use in fluorescent lighting fittings.
IS:2215	Starters for fluorescent lamps.
IS:3324	Holders for starters for tubular fluorescent lamps
IS:418	GLS lamps
IS:3553	Water tight electric fittings
IS:2713	Tubular steel poles
IS:280	MS wire for general engg. Purposes

Conduits, Accessories and Junction Boxes

IS:9537	Rigid steel conduits for electrical wiring
IS:3480	Flexible steel conduits for electrical wiring
IS:2667	Fittings for rigid steel conduits for electrical wiring
IS:3837	Accessories for rigid steel conduits for electrical wiring
IS:4649	Adaptors for flexible steel conduits.
IS:5133	Steel and Cast Iron Boxes
IS:2629	Hot dip galvanising of Iron & Steel.

Lighting Panels

IS:13947	LV Switchgear and Control gear(Part 1 to 5)
IS:8828 hold	Circuit breakers for over current protection for house
	and similar installations.
IS:5	Ready mix paints

IS:2551	Danger notice plates
IS:2705	Current transformers
IS:9224	HRC Cartridge fuse links for voltage above 650V(Part-2)
(7)IS:5082 and	Wrought aluminium and Al. alloys, bars, rods, tubes sections for electrical purposes.
(8)IS:8623 Gear	Factory built Assemblies of Switchgear and Control for voltages upto and including 1000V AC and 1200V DC.
(9)IS:1248	Direct Acting electrical indicating instruments

Electrical Installation

IS:1293 3	pin plug
IS:371	Two to three ceiling roses
IS:3854	Switches for domestic and similar purposes
IS:5216	Guide for safety procedures and practices in electrical work.
IS:732 (system	Code of practice for electrical wiring installation voltage not exceeding 650 Volts.)
IS:3043	Code of practice for earthing.
IS:3646	Code of practice of interior illumination part II & III.
IS:1944	Code of practice for lighting of public through fares.
IS:5571 hazardous	Guide for selection of electrical equipment for areas.
IS:800	Code of practice for use of structural steel in general building construction.
IS:2633 coated	Methods of Testing uniformity of coating on zinc articles.
IS:6005	Code of practice for phosphating iron and steel.
	INDIAN ELECTRICITY ACT
	INDIAN ELECTRICITY RULES

LT SWITCHGEAR

IS:8623 (Part-I) gear	Specification for low voltage switchgear and control assemblies
IS:13947 (Part-I) gear,	Specification for low voltage switchgear and control Part 1 General Rules
IS:13947 (part-2) gear,	Specification for low voltage switchgear and control Part 2 circuit breakers.
IS:13947 (part-3) gear.	Specification for low voltage switchgear and control Part 3 Switches, Disconnectors, Switch-disconnectors and fuse combination units
IS:13947 (part-4) gear.	Specification for low voltage switchgear and control Part 4 Contactors and motors starters.
IS:13947 (part-5) gear.	Specification for low voltage switchgear and control Part 5 Control-circuit devices and switching elements
IS:13947 (part-6) gear.	Specification for low voltage switchgear and control Part 6 Multiple function switching devices.
IS:13947 (part-7) gear.	Specification for low voltage switchgear and control Part 7 Ancillary equipments
IS:12063	Degree of protection provided by enclosures
IS:2705	Current Transformers
IS:3156	Voltage Transformers
IS:3231	Electrical relays for power system protection
IS:1248	Electrical indicating instruments
IS:722	AC Electricity meters
IS:5578	Guide for Marking of insulated conductors of apparatus terminals
IS:13703 (part 1) or	Low voltage fuses for voltage not exceeding 1000V AC 1500V DC Part 1 General Requirements
IS:13703 (part 2) or	Low voltage fuses for voltage not exceeding 1000V AC 1500V DC Part 2 Fuses for use of authorized persons

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

ANNEXURE - A
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

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

ANNEXURE- B

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	
	I) Control Wing i) Material of conductor ii) Size of conductor /dia of wire (mm2)	
	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	

ANNEXURE- C

CHECK LIST FOR ILLUMINATION SYSTEM

TO BE FILLED AND RETURNED WITH THE OFFER DULY SIGNED

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 :

Sl.no	Parameter	Data (Where possible shall be filled before issue of Spec.)	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 lux 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.	Supervision of ETC of Package included in the offer		YES / NO	
9.	Supply of all wires / Cables / earthing material required for the package other than the items supplied by BHEL included in the package.		YES / NO	
10.	Additional flood light luminaries in switchyard for maintenance of equipment specified in specification included in offer.		YES/ NO	
11.	Type and lumen output of lamps included in the offer are as per		YES / NO	

	specification.			
12.	Whether any new item other than the BOQ given required to meet the specification requirement.		YES/ NO	
13.	If new item is required whether these are listed with quantities in the offer		YES/ NO	
14.	Equipment included suitable for operation on voltage & frequency Variation limits specified in the specification without effecting their performance			
15.	Power factor of lamp circuit is as per specification		YES/NO	
16.	Fully filled in GTP enclosed		YES/NO	
17.	Auto change over arrangement for emergency AC/ emergency DC included in EAC & DC boards			
18.	Auto switching arrangement for outdoor flood lighting / street lighting through Timer / Photo call included		YES / NO.	
19.	Spares included in the offer (a) Mandatory (b) Commissioning		YES/ NO YES/ NO	
20.	Activity Schedule enclosed		YES /NO	

Bidder's

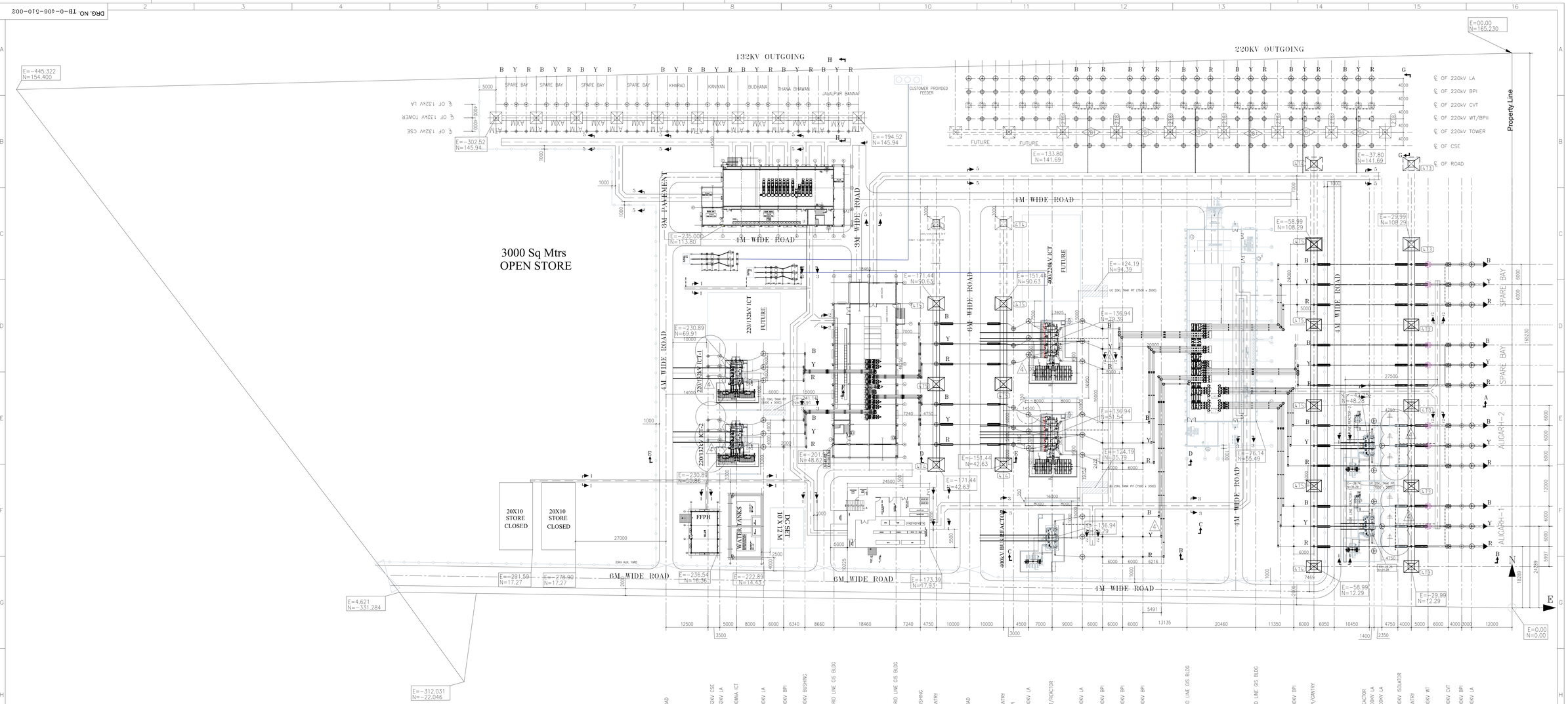
Sign :

Date :

Name :

Design :

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. DEPTH OF INDIVIDUAL TRANSFORMER (500MVA, 200MVA) SOAK PIT WILL BE 600MM BELOW THE FGL. THE TOP OF SOAK PIT SHALL BE PROVIDED WITH MS FLAT GRATING SUPPORTED BY ISMB/ISMC SECTION. ON THE ABOVE GARTING 40 MM METAL SPREADING FOR 100MM THICK SHALL BE PROVIDED .
3. DETAILS DESIGN OF INDIVIDUAL SOAK PIT AND COMMON CENTRAL OIL COLLECTING PIT SHALL BE SHOWN IN SEPARATE CIVIL DRAWING.
4. EQUIPMENT DIMENSIONS ARE TENTATIVE & SUBJECT TO CHANGE AFTER APPROVAL OF FINAL DOCUMENTS, SAME SHALL BE INCORPORATED SUBSEQUENTLY.
5. SPACE FOR 4 No FUTURE BAYS (NOT IN BHEL SCOPE OF SUPPLY) IS SHOWN IN 400kV/220kV/132kV GIS BUILDING.
6. ALL EQUIPMENT DIMENSIONS ARE TENTATIVE & FINAL DIMENSIONS SHALL BE AS PER MANUFACTURER DRAWING.
7. TYPE OF CONDUCTOR SHALL BE AS PER APPROVED CONDUCTOR SIZING CALCULATION, SHORT CIRCUIT CALCULATIONS & STRUCTURE LOADING DIAGRAM.
8. CONTROL BUILDING DIMENSION & ROOMS PLAN/ARCHITECTURE SHALL BE AS PER APPROVED CONCEPTUAL DRAWING.
9. CABLE TRENCH/CABLING LAYOUT DRAWING SHALL BE SUBMITTED SEPERATELY.
10. IPS ALUMINUM TUBE SHALL BE USED FOR CONNECTIONS AS SHOWN IN THE SECTION SHALL BE 4 INCH FOR 400KV/220KV.
11. FOR 220KV OUTDOOR FEEDERS, LA & BPI SHALL BE IN BHEL SCOPE. WAVE TRAP & CVT SHALL BE CUSTOMER SCOPE AS PER TENDER BOQ.

REFERENCE DRAWINGS:

1. TENDER SPECIFICATION REF: ESD-8/126
2. APPROVED ESLD DOC NO: TB-0-406-510-001 Rev 02

BILL OF QUANTITY:-

S.NO.	DESCRIPTION	SYMBOL	QUANTITY (NOS.)
1	420 kV INDOOR GIS		01
2	420 KV, 1-ph SF6 TO AIR BUSHING		21
3	420kV, 1-ph CVT		12
4	360kV, 1-ph SURGE ARRESTER		27
5	420kV, 8 KN , 1-ph, BUS POST INSULATOR		24
6	420kV, 1mH , 1-ph, WT		04

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE	DESCRIPTION
03	24.07.19	SY / MSP / SKS		CHANGES IN BLOCKS OF ICT ALLIGNMENT OF EQUIMPENTS OIL TANKS PLACEMENT SHOWN
02	26.04.19	SY / MSP / SKS		DRAWING REVISED IN LINE WITH -REVISED COORDINATES AS PER JOINT SURVEY WITH UPPTCL, SHAMLI CIVIL -COORDINATES BEING SHOWN ON THE DRAWING

TENDER SINGLE LINE DIAGRAM 400/220/132kV GIS S/S

REF. DRG. NO. — TITLE

LOI NO. : 1311/ESD-8/126/lii/400kV SHAMLI dated 14.11.2018

ADDITIONAL INFORMATION W.O.No.

STATUS OF DRAWING CONTRACT

DISTRIBUTION OF PRINTS

आवक/परियोजना का नाम NAME OF CUSTOMER / PROJECT: UTTAR PRADESH POWER TRANSMIISSIION CORPORATIION LIMITED
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

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

	नाम /NAME	हस्ता./SIGN	दि./DATE
ड्राइ. DRAWN	SY	-SIGNED-	24.04.19
चेक्ड CHECKED	MSP	-SIGNED-	24.04.19
स्वीकृत APPROVED	SKS	-SIGNED-	24.04.19

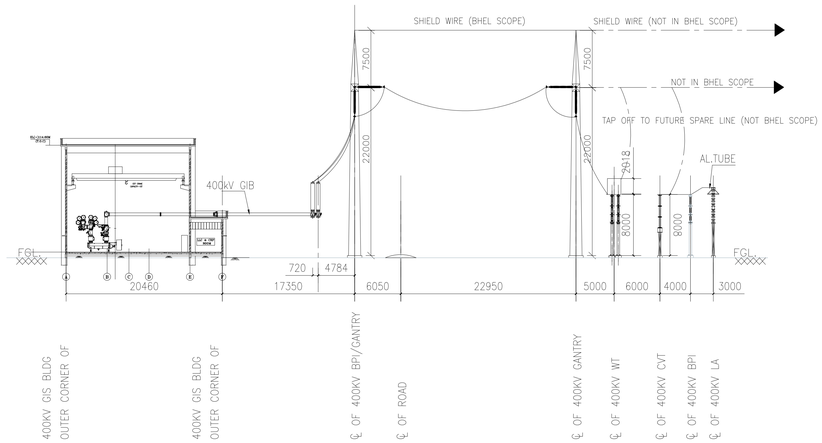
विभाग DEPT. TBEM; कोड CODE 422; उपपत्र / SCALE; कार्ड कोड CARD CODE

शीर्षक/TITLE: 400/220/132KV ELECTRICAL LAYOUT-SHAMLI

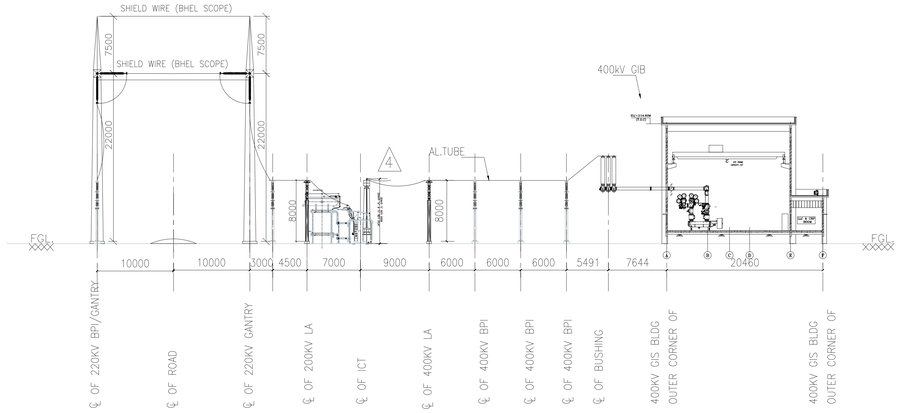
ड्रा.सं./DRAWING NO. TB-0-406-510-002; पुन./REV. 03

ड्रा.सं./SHEET No.01 अगला ड्रा./NEXT SHEET 02

DRG. NO. TB-0-406-510-002



SECTION: A–A



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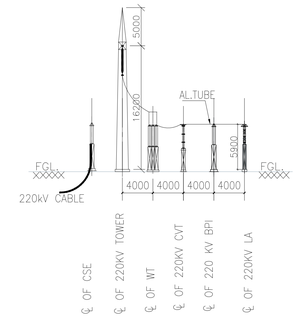

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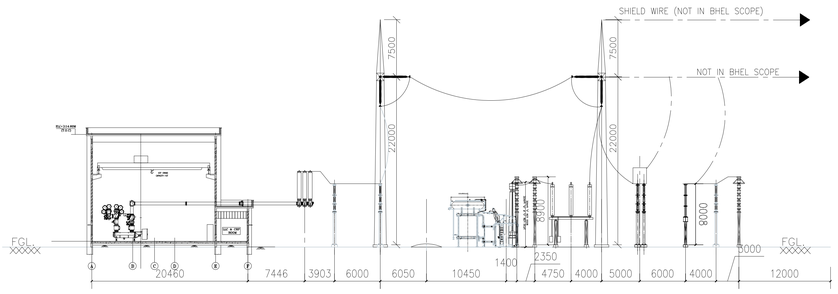

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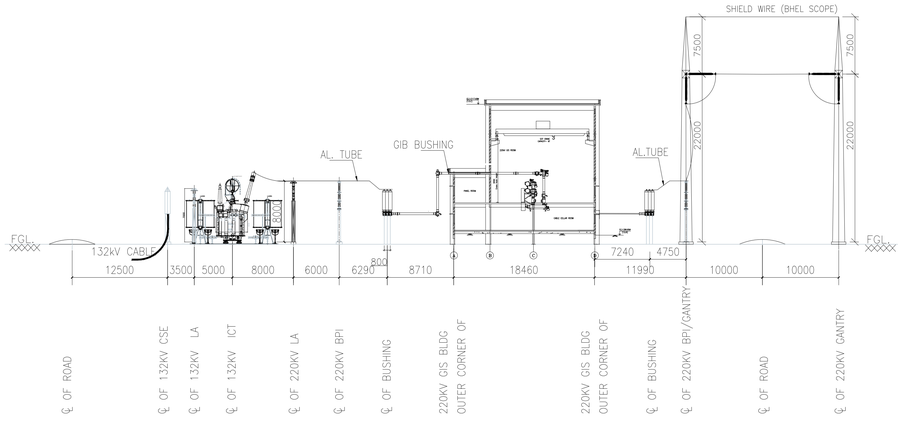

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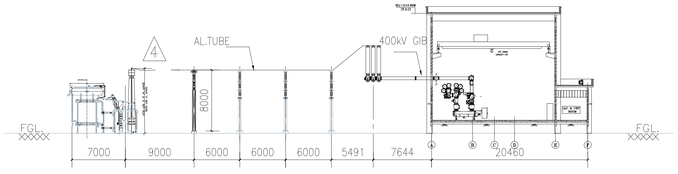
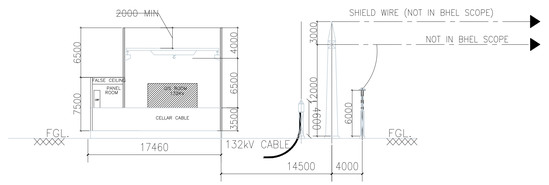


SECTION: C–C



SECTION: H–H

REF. DRG. NO.:	TENDER SINGLE LINE DIAGRAM 400/220/132kV GIS S/S
LOI NO. : 1311/ESD-8/126/III/400kV SHAMLI dated 14.11.2018	TITLE
ADDITIONAL INFORMATION W.O.No.	ग्राहक/परियोजना का नाम NAME OF CUSTOMER / PROJECT: UTTAR PRADESH POWER TRANSMISSION CORPORATIION LIMITED — 400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)
STATUS OF DRAWING: CONTRACT	
DISTRIBUTION OF PRINTS	भारत हेवी इलेक्ट्रिकल्स लिमिटेड, भूपरिवहन परियोजना विभाग — BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता. /SIGN.	दि./DATE
बनाया DRAWN	SY	–SIGNED–	24.04.19
जांचा CHECKED	MSP	–SIGNED–	24.04.19
स्वीकृत APPROVED	SKS	–SIGNED–	24.04.19

विभाग DEPT.: TBEM | कोड CODE: 422 | कार्ड कोड CARD CODE | अनुपात / SCALE

शीर्षक/TITLE: 400/220/132KV ELECTRICAL LAYOUT–SHAMLI

ड्रॉइंग सं./DRAWING NO.: TB–0–406–510–002 | पुनरी./REV.: 03

पृष्ठ सं./SHEET No.01 | अगला पृष्ठ /NEXT SHEET 02

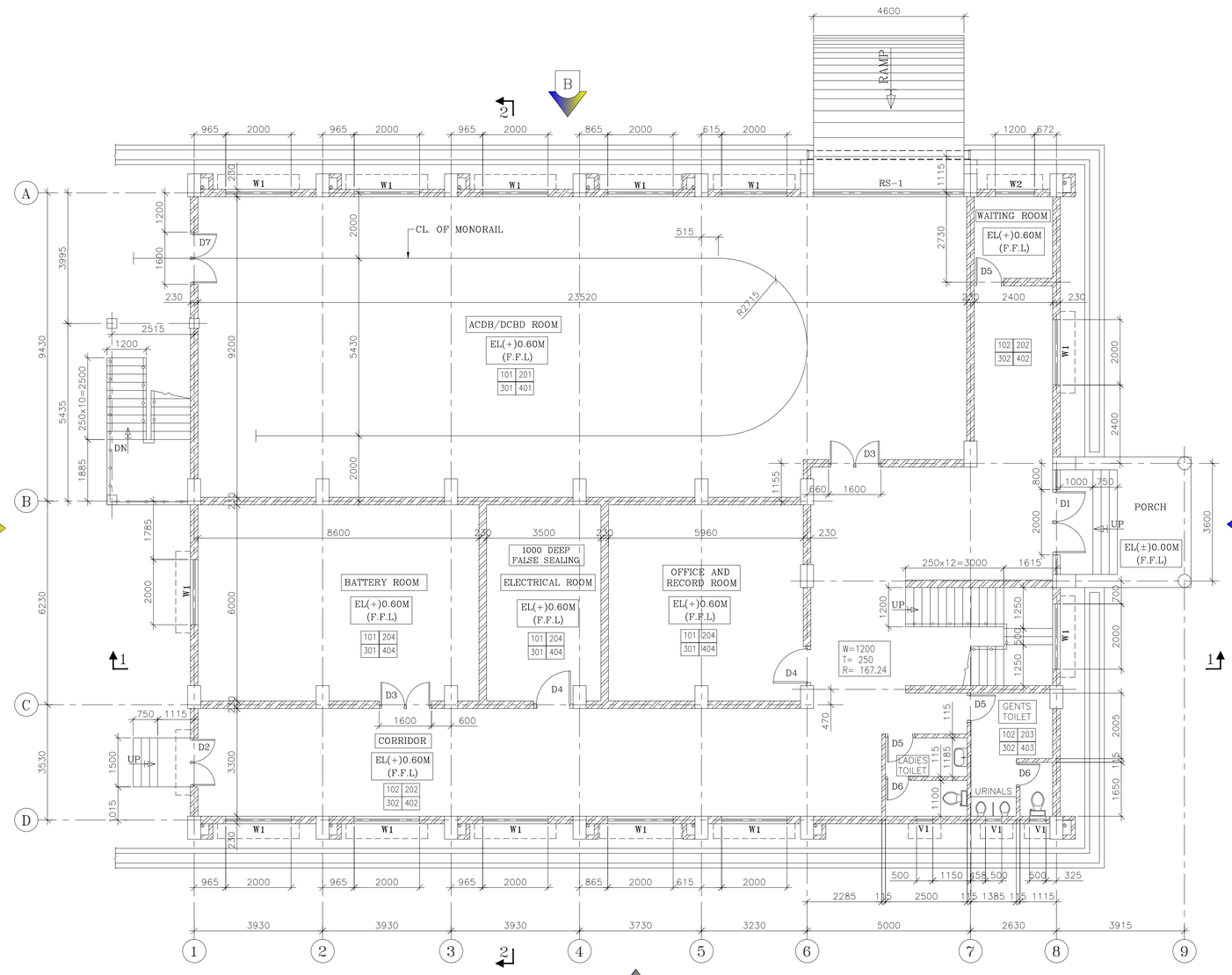
REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE
03	24.07.19	SY / MSP / SKS	CHANGES IN BLOCKS OF ICT ALIGNMENT OF EQUIMPENTS OIL TANKS PLACEMENT SHOWN
02	26.04.19	SY / MSP / SKS	DRAWING REVISED IN LINE WITH •REVISED COORDINATES AS PER JOINT SURVEY WITH UPPTCL SHAMLI CVIL •COORDINATES BEING SHOWN ON THE DRAWING

COMPUTER FILE NAME | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-620-1



GROUND FLOOR PLAN

(SCALE- 1:75)

PLASTER:

INTERNAL:
12mm THK. PLASTER (1:6 CEMENT : SAND)

EXTERNAL:
18mm THK. PLAIN PLASTER (1:6 CEMENT : SAND)
12mm 1ST LAYER 1:6 C&S, 6MM 2ND LAYER 1:4 C&S

CEILING EXCEPT FOR WHERE FALSE CEILING WILL BE PROVIDED.
6mm THK. PLAIN PLASTER (1:4 CEMENT : SAND)

WATER PROOFING ON ROOF

PROVIDING AND LAYING INTEGRAL CEMENT BASED WATER PROOFING TREATMENT INCLUDING PREPARATION OF SURFACE AS REQUIRED FOR TREATMENT OF ROOFS, BALCONIES, TERRACES ETC CONSISTING OF FOLLOWING OPERATIONS: (A) APPLYING A SLURRY COAT OF NEAT CEMENT USING 2.75 KG/SQM OF CEMENT ADMIXED WITH WATER PROOFING COMPOUND CONFORMING TO THE RCC SLAB INCLUDING ADJOINING WALLS UPTO 300 MM HT. INCLUDING CLEANING THE SURFACE BEFORE TREATMENT
(B) LAYING BRICK BATS WITH MORTAR USING BROKEN BRICKS/BRICK BATS 25 MM TO 115 MM SIZE WITH 50% OF CEMENT MORTAR 1:5 (1 CEMENT : 5 COARSE SAND) ADMIXED WITH WATER PROOFING COMPOUND CONFORMING OVER 20 MM THICK LAYER OF CEMENT MORTAR OF MIX 1:5 ADMIXED WITH WATER PROOFING COMPOUND TO REQUIRED SLOPE AND TREATING SIMILARLY THE ADJOINING WALLS UPTO 300 MM HEIGHT INCLUDING ROUNDING OF JUNCTIONS OF WALLS AND SLABS.
(C) AFTER TWO DAYS OF PROPER CURING APPLYING A SECOND COAT OF CEMENT SLURRY USING 2.75 KG/ SQM OF CEMENT ADMIXED WITH WATER PROOFING COMPOUND
(D) FINISHING THE SURFACE WITH 20 MM THICK JOINTLESS CEMENT MORTAR OF MIX 1:4 WITH WATER PROOFING INCLUDING LAYING GLASS FIBRE CLOTH OF APPROVED QUALITY IN TOP LAYER OF PLASTER AND FINALLY FINISHING THE SURFACE WITH TROWEL WITH NEAT CEMENT SLURRY AND MAKING PATTERN OF 300X300 MM SQUARE 3 MM DEEP.
(E) THE WHOLE TERRACE SO FINISHED SHALL BE FLOODED WITH WATER FOR A MINIMUM PERIOD OF TWO WEEKS FOR CURING AND FOR FINAL TEST.?ALL ABOVE OPERATIONS TO BE DONE IN ORDER AND AS DIRECTED WITH AVERAGE THICKNESS OF 120 MM AND MINIMUM THICKNESS AT KHURRA AS 65 MM. (CSI NO. 28.30)

NOTES:-

1 ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD WHICH IS +100.0M ABSOLUTE ELEVATION.
5. FINAL LOCATION OF CABLE TRENCHES REFER APPROVED ELECTRICAL DRAWINGS.

REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:-
STRUCMECH ENGINEERS PVT. LTD.
93, MAYA BHAWAN, OLD A.G. COLONY, KADRU, RANCHI.
PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		26.03.19	N.A.
CHD.	Mukesh		26.03.19	
APPD.	Mukesh		26.03.19	

DEPT. TBG	UNTOL. DIMS. GR.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
CODE	Ø/M/F		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE
CONTROL ROOM BUILDING
ARCHITECTURAL GROUND FLOOR PLAN

CARD CODE: NA

DRG. NO. TB-1-406-607-620-1

REV. 00

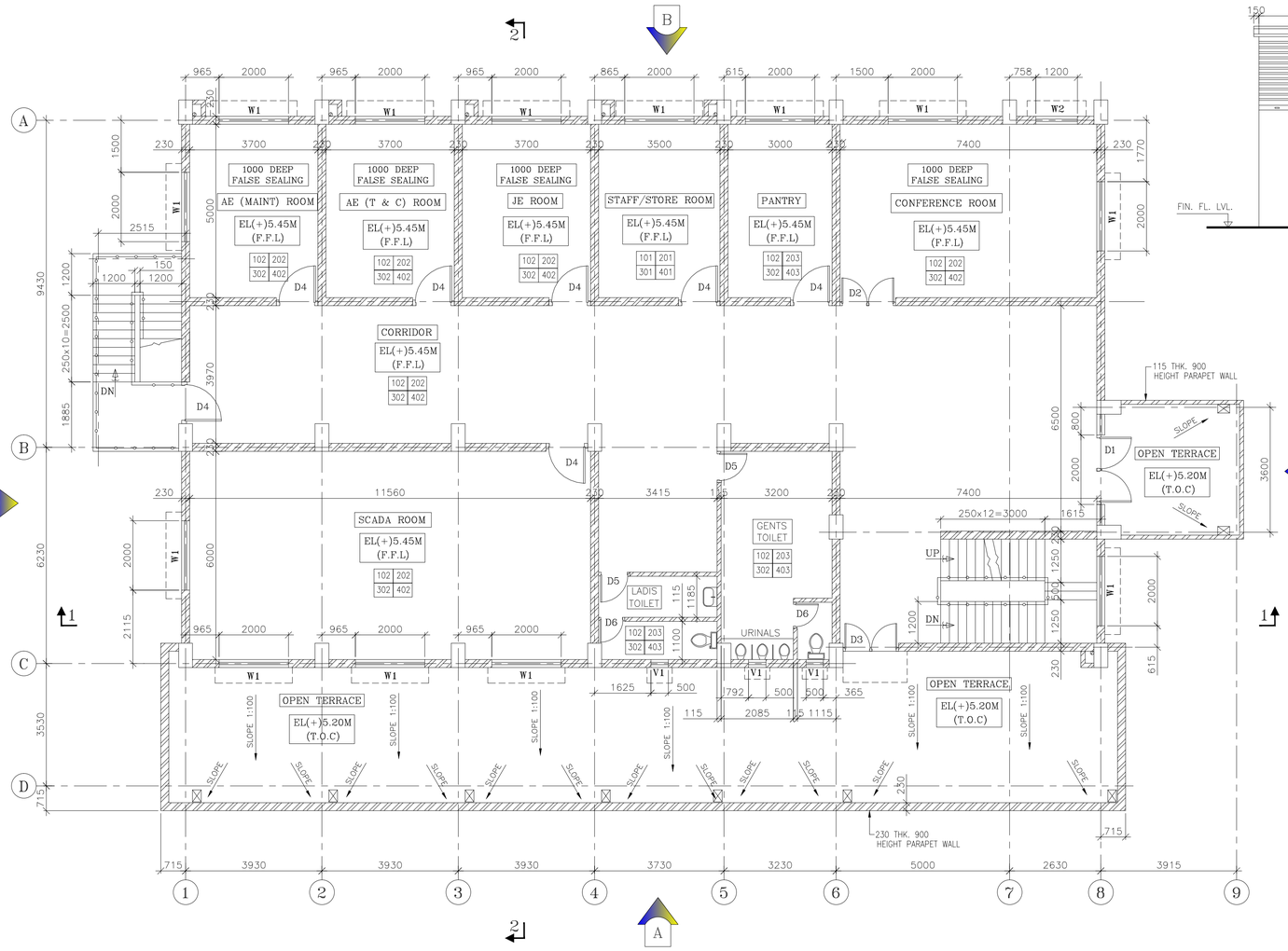
SHT. No 01 NO. OF SHT. 03

SIZE-A1

FIRST ANGLE PROJECTION

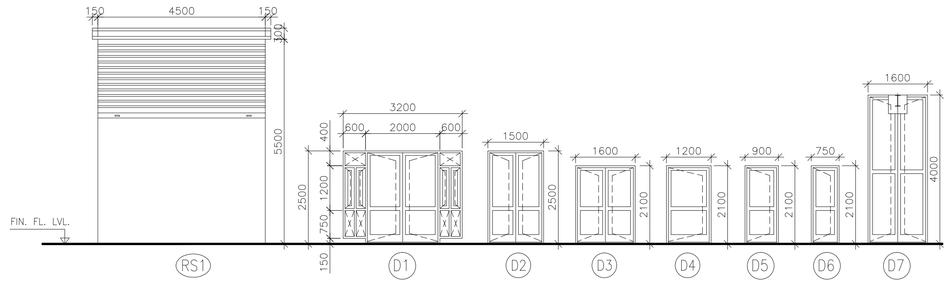
(ALL DIMENSIONS ARE IN mm)

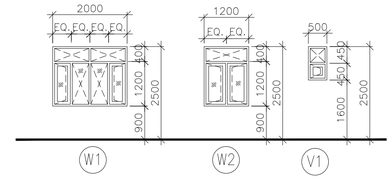
DRG. NO. TB-1-406-607-620-1



FIRST FLOOR PLAN

(SCALE- 1:75)





SCHEDULE OF DOORS & WINDOWS

TYPE	OPENING SIZE	FRAME SIZE	CILL LEVEL	LINTEL LEVEL	NOS.	DESCRIPTION
RS-1	4500x5500	4500x5500	–	6100	1	STEEL ROLLING SHUTTER
D1	2000x2500	1980x2490	–	3100	2	DOUBLE SHUTTER ALUMINIUM DOOR
D2	1500x2500	1480x2490	–	3100	2	DOUBLE SHUTTER STEEL DOOR
D3	1600x2100	1580x2090	–	2600	4	DOUBLE SHUTTER ALUMINIUM DOOR
D4	1200x2100	1180x2080	–	2600	10	SINGLE SHUTTER STEEL DOOR
D5	900x2100	880x2080	–	2600	4	SINGLE SHUTTER PVC DOOR
D6	750x2100	730x2080	–	2600	4	SINGLE SHUTTER PVC DOOR
D7	1600x4000	1580x3880	–	–	1	DOUBLE SHUTTER ALUMINIUM DOOR
W1	2000x1200	1980x1180	1500	2600	24	ALUMINIUM WINDOW FULLY GLAZED
W2	1200x1200	1180x1180	1500	2600	1	ALUMINIUM WINDOW FULLY GLAZED
V1	2000x600	1980x580	2200	2600	6	FIXED ALUMINIUM VENTILATOR

NOTES:-

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2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD WHICH IS +100.0M ABSOLUTE ELEVATION.
5. FINAL LOCATION OF CABLE TRENCHES REFER APPROVED ELECTRICAL DRAWINGS.

REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT: 400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER: UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:-
STRUCMECH ENGINEERS PVT. LTD.
93, MAYA BHAWAN, OLD A.G. COLONY, KADRU, RANCHI.
☎PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		26.03.19	N.A.
CHD.	Mukesh		26.03.19	
APPD.	Mukesh		26.03.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ℄/M/₱	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: CONTROL ROOM BUILDING
ARCHITECTURAL FIRST FLOOR & DETAILS OF DOOR AND WINDOWS.

CARD CODE: NA

DRG. NO. TB-1-406-607-620-1 REV. 00

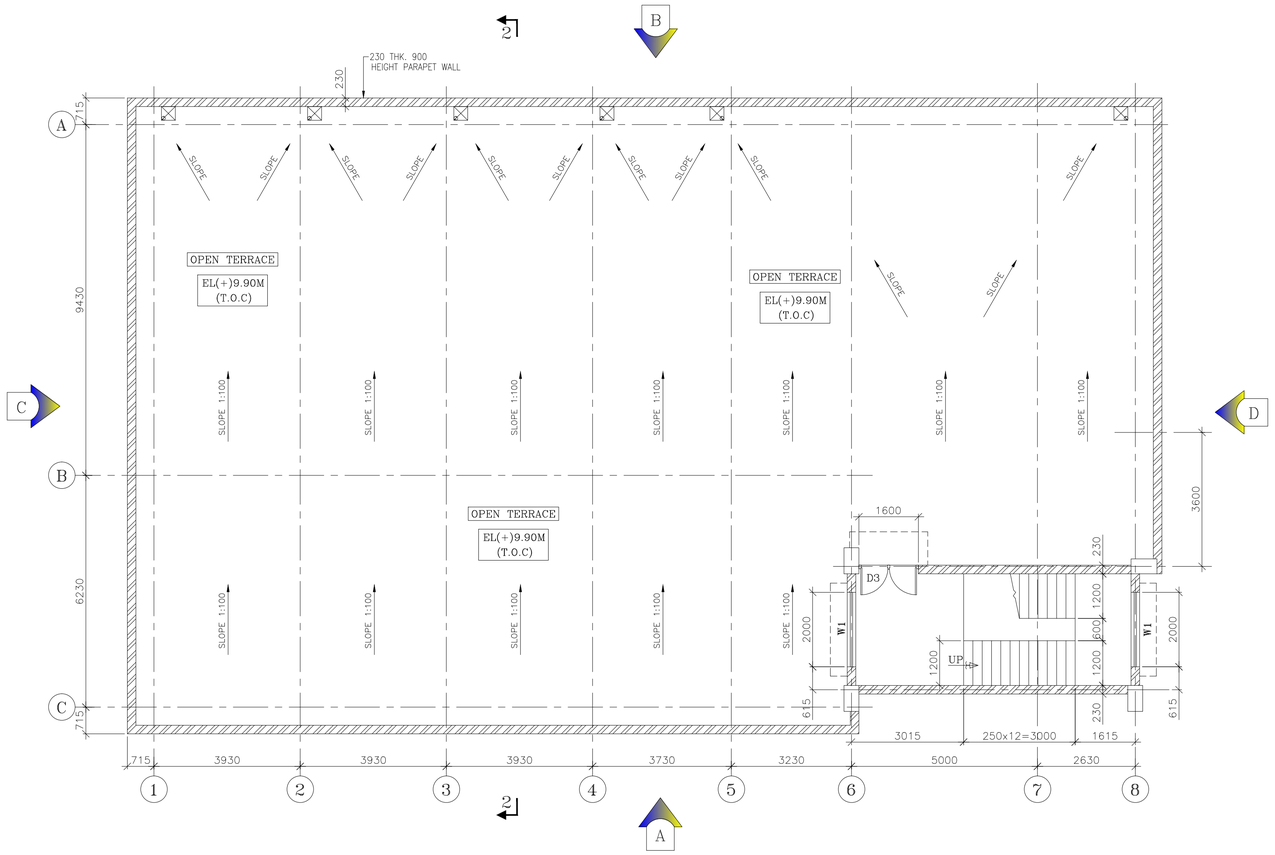
SHT. No 02 NO. OF SHT. 03

SIZE-A1

FIRST ANGLE PROJECTION

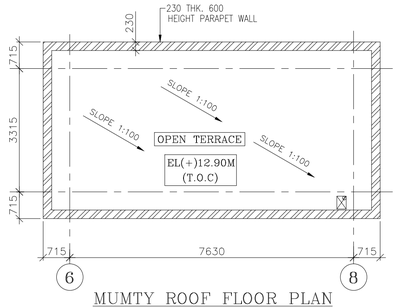
(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-620-2



TERRACE FLOOR PLAN

(SCALE– 1:75)



MUMTY ROOF FLOOR PLAN

(SCALE– 1:75)

ILLUSTRATION OF FINISHES.	
WALL SERIES 100	FLOORING SERIES 200
CEILING SERIES 300	SKIRTING/ DADO SERIES 400

FINISHES OF SCHEDULE		
WALL FINISHES–		
SR.NO.	CODE NO.	DESCRIPTION
1.	101	ARYLIC DISTEMPER
2.	102	ARYLIC EMULSION PAINT

SKIRTING/DADO FINISHES			FLOORING FINISHES		
1.	401	CEMENT PLASTER SKIRTING 150 MM HIGH	1.	201	CEMENT CONCRETE FLOORING
2.	402	VITRIFIED TILES SKIRTING 150 MM HIGH	2.	202	VITRIFIED TILES
3.	403	GLAZED TILE UPTO 1200 MM HIGH	3.	203	GLAZED TILES
4.	404	ACID RESISTANT TILES UPTO 1200 MM HIGH	4.	204	ACID RESISTANT TILES
CEILING FINISHES					
1.	301	ARYLIC DISTEMPER			
2.	302	ARYLIC EMULSION PAINT			

NOTES:–

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2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR–WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD WHICH IS +100.0M ABSOLUTE ELEVATION.
5. FINAL LOCATION OF CABLE TRENCHES REFER APPROVED ELECTRICAL DRAWINGS.

REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:–
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	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		26.03.19	N.A.
CHD.	Mukesh		26.03.19	
APPD.	Mukesh		26.03.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ¢/M/₹	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE
CONTROL ROOM BUILDING
ARCHITECTURAL TERRACE PLAN & FINISHING SCHEDULE

CARD CODE: NA

DRG. NO. TB-1-406-607-620-2

REV. 00

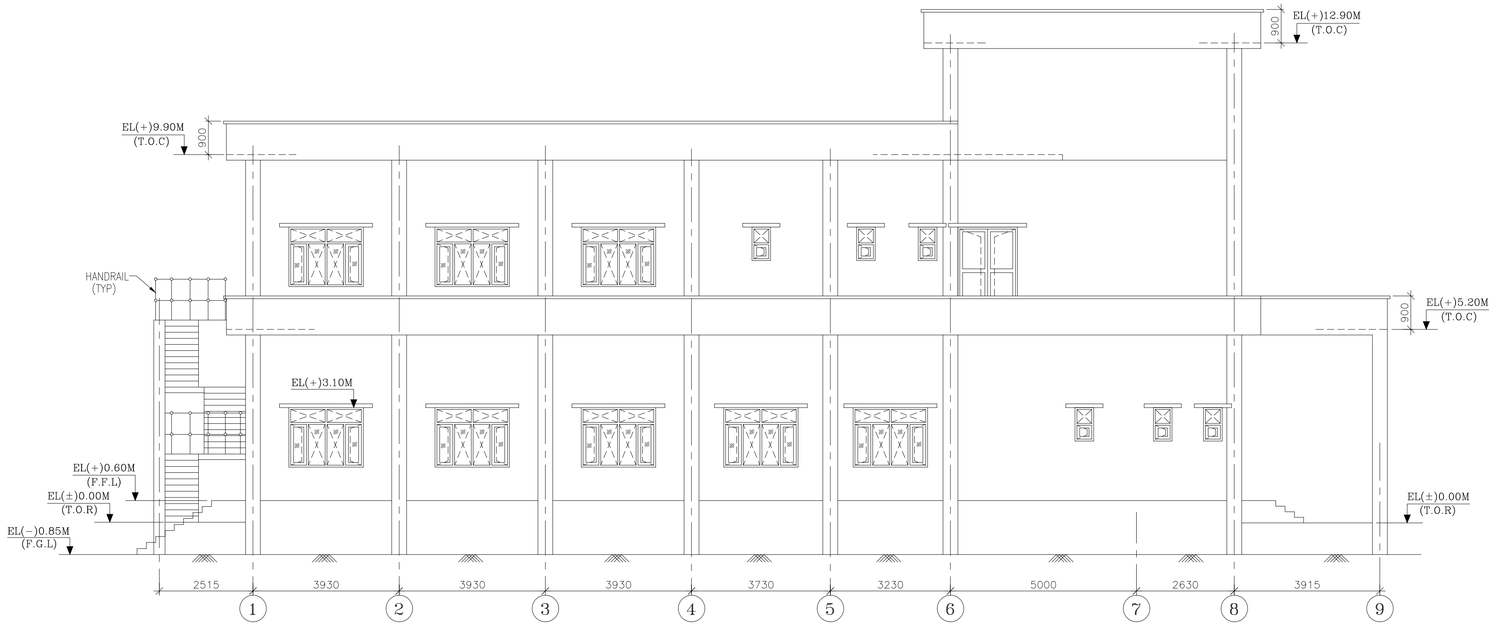
SHT. No 03 | NO. OF SHT. 03

SIZE–A1

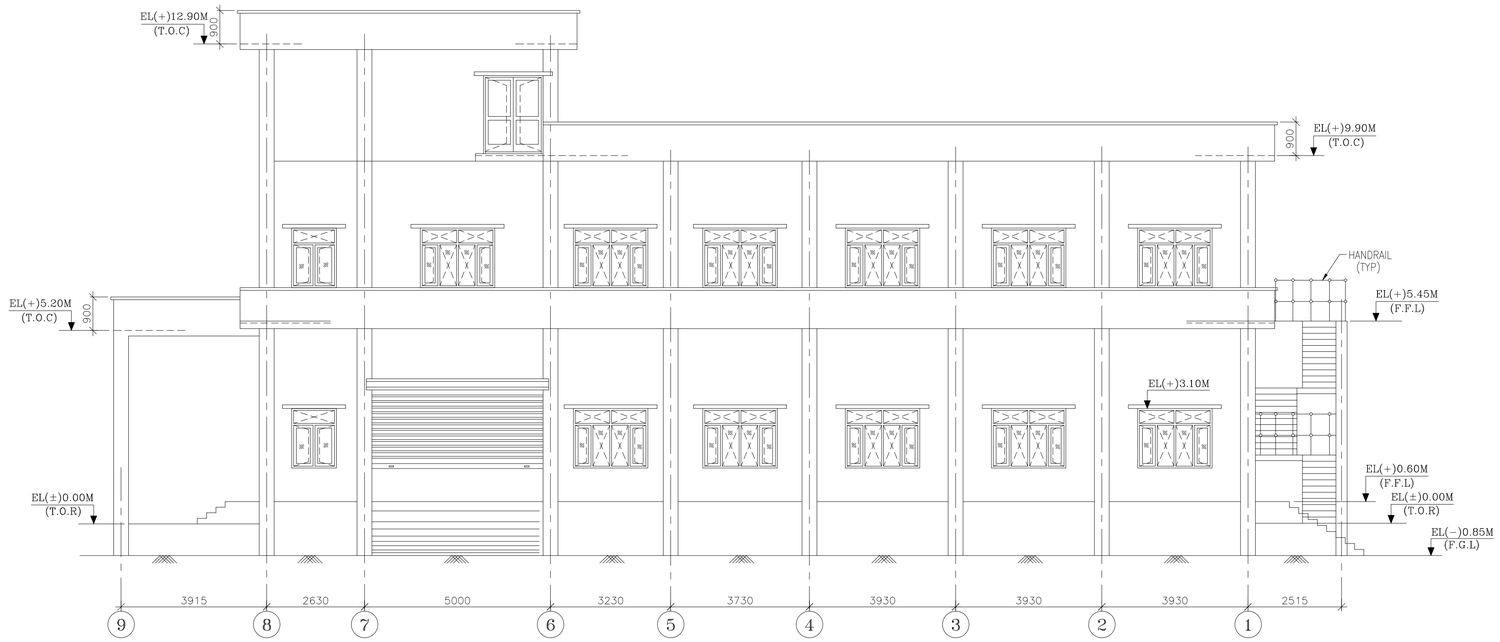
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-620-2



ELEVATION–A



ELEVATION–B

NOTES:–

1 ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR–WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD WHICH IS +100.0M ABSOLUTE ELEVATION.
5. FINAL LOCATION OF CABLE TRENCHES REFER APPROVED ELECTRICAL DRAWINGS.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:–
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	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		26.03.19	N.A.
CHD.	Mukesh		26.03.19	
APPD.	Mukesh		26.03.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ∅/M/F	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE
CONTROL ROOM BUILDING
ARCHITECTURAL ELEVATIONS

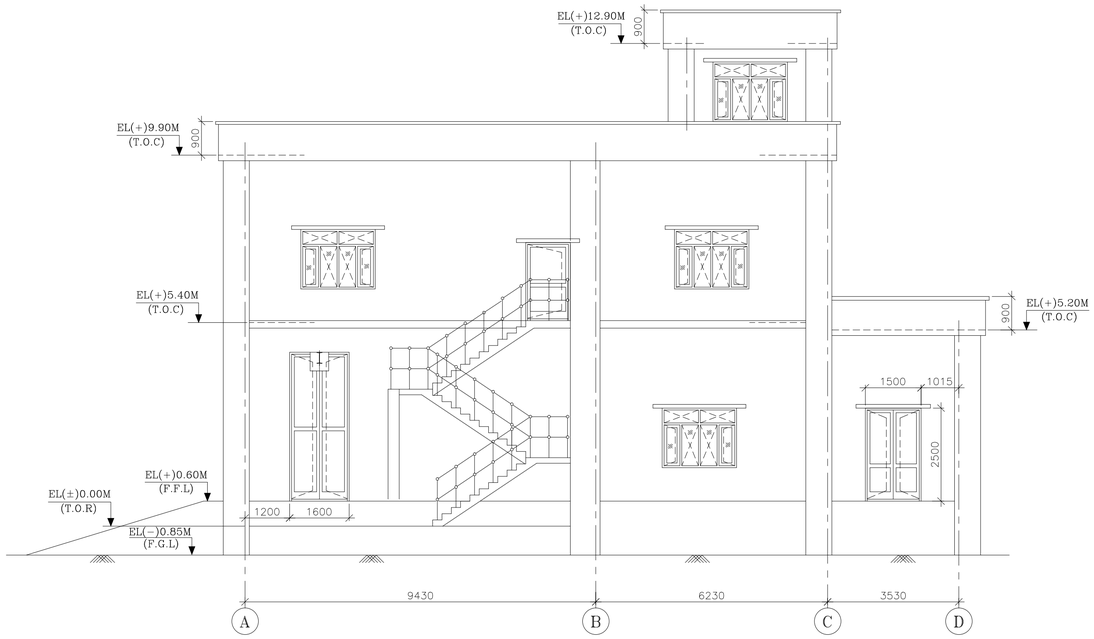
CARD CODE: NA

DRG. NO. TB-1-406-607-620-2

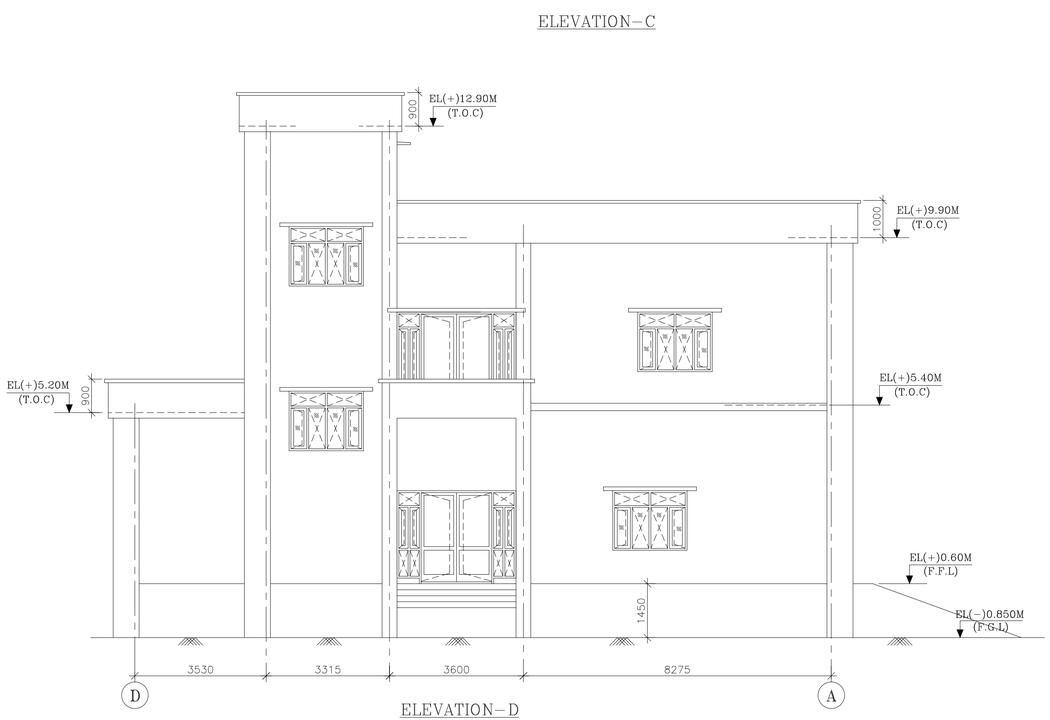
REV. 00

SHT. No 01 NO. OF SHT. 02

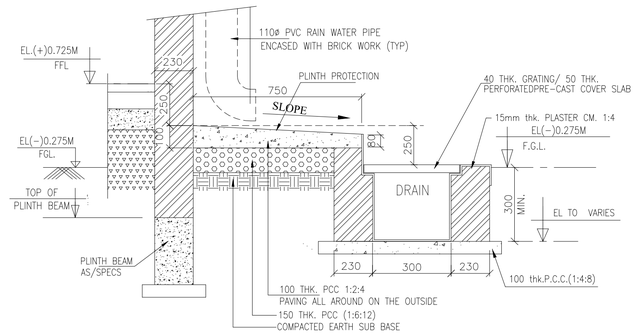
SIZE–A1



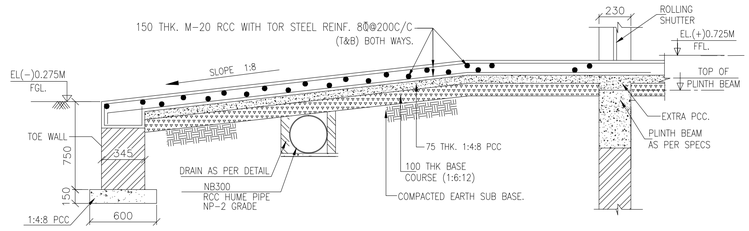
ELEVATION−C



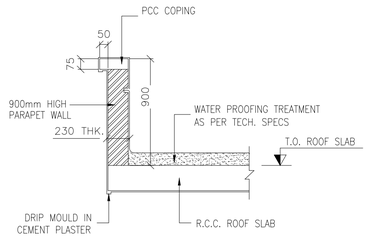
ELEVATION−D



PLINTH PROTECTION ALONG BUILDING
WITH DRAIN−TYPICAL



DETAIL OF RAMP



TYP. DETAIL OF PARAPET

NOTES:−

1 ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR−WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD WHICH IS +100.0M ABSOLUTE ELEVATION.
5. FINAL LOCATION OF CABLE TRENCHES REFER APPROVED ELECTRICAL DRAWINGS.

REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:−
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	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		26.03.19	N.A.
CHD.	Mukesh		26.03.19	
APPD.	Mukesh		26.03.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ₵/M/F	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: CONTROL ROOM BUILDING
ARCHITECTURAL ELEVATIONS

CARD CODE: NA

DRG. NO.: TB−1−406−607−620−2

REV.: 00

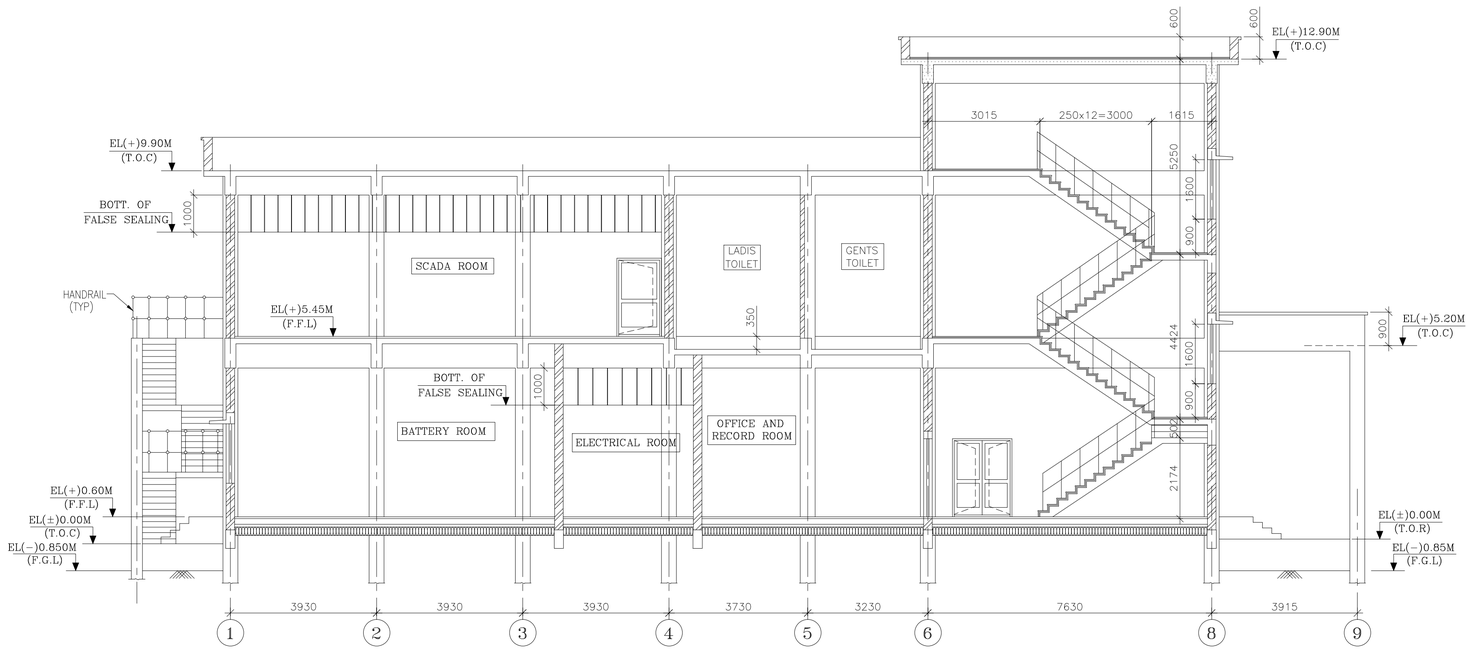
SHT. No 02 | NO. OF SHT. 02

SIZE−A1

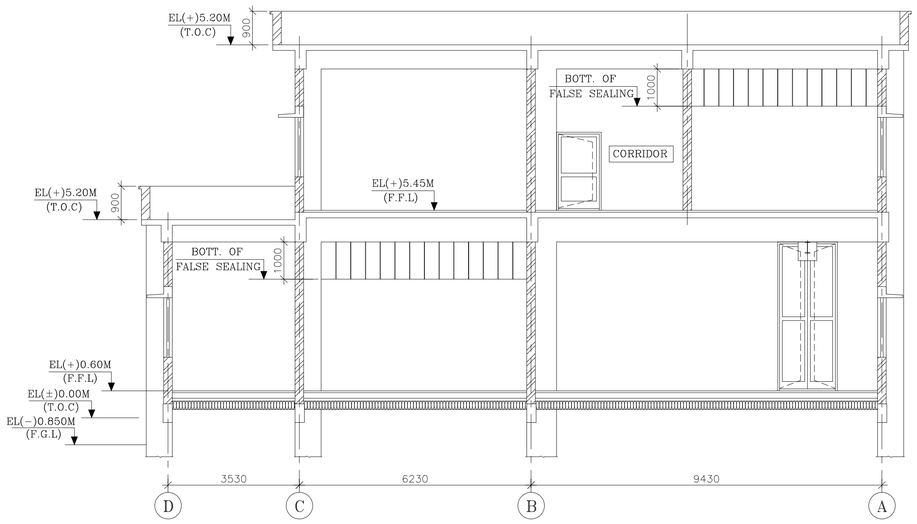
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-620-3



SECTION 1–1



SECTION 2–2

NOTES:–

1 ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR–WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD WHICH IS +100.0M ABSOLUTE ELEVATION.
5. FINAL LOCATION OF CABLE TRENCHES REFER APPROVED ELECTRICAL DRAWINGS.

REV.	DATE	ALTERED / CHD/APPD	REV.	DATE	ALTERED / CHD/APPD	REV.	DATE	ALTERED / CHD/APPD	REV.	DATE	ALTERED / CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
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	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		26.03.19	N.A.
CHD.	Mukesh		26.03.19	
APPD.	Mukesh		26.03.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. C/M/F	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE
CONTROL ROOM BUILDING
ARCHITECTURAL SECTIONS

CARD CODE: NA

DRG. NO. TB-1-406-607-620-3

REV. 00

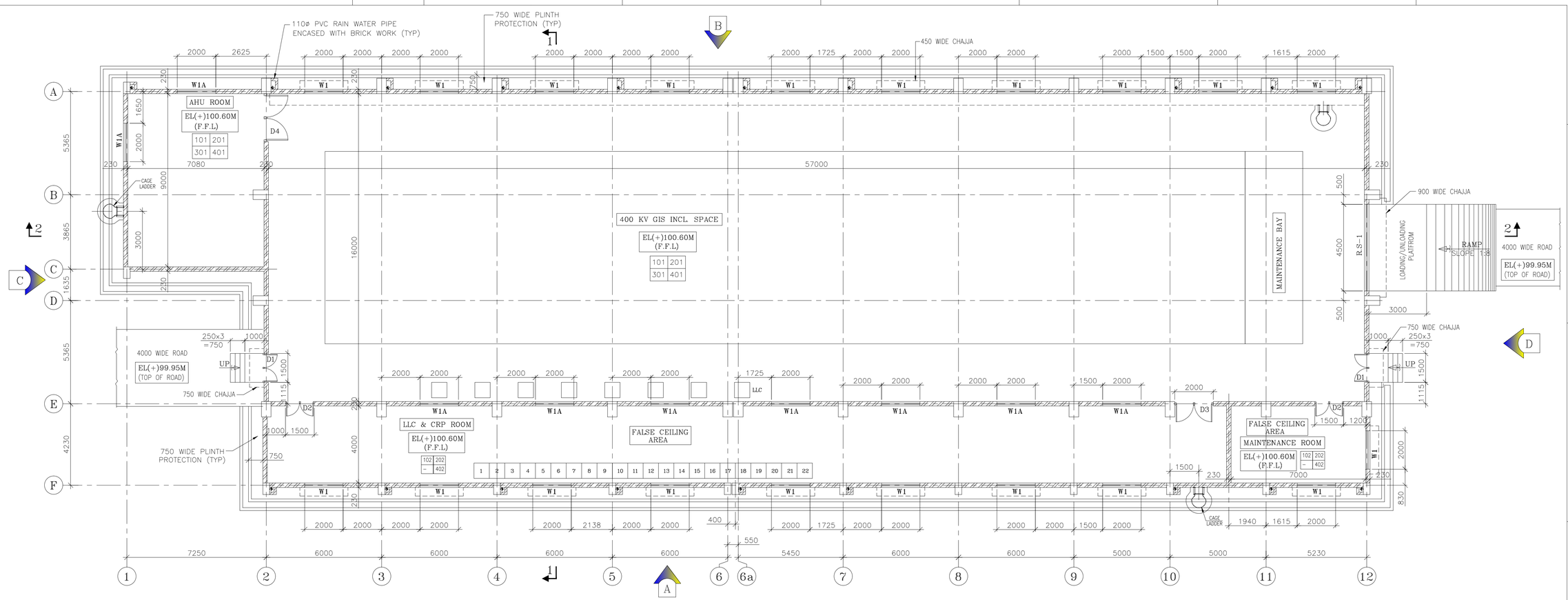
SHT. No 01 | NO. OF SHT. 01

SIZE–A1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-640-1



PLAN AT EL(+)100.60M (F.F.L)

(SCALE– 1:100)

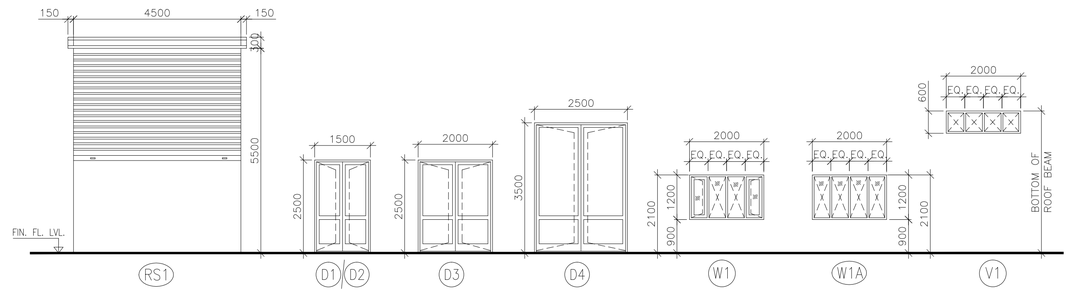


ILLUSTRATION OF FINISHES.			FINISHES OF SCHEDULE		
WALL SERIES 100 / FLOORING SERIES 200 / CEILING SERIES 300 / SKIRTING/ DADO SERIES 400			WALL FINISHES–		
			SR.NO.	CODE NO.	DESCRIPTION
			1.	101	ACRYLIC DISTEMPER EXTERNAL FINISHED OF WALL–WATER PROOF EXTERIOR EMULSION PAINT OF APEX ULTIMATE (ASIAN) / WEATHER SHIELD MAX (ICI) OR EQUIVALENT
			2.	102	ACRYLIC EMULSION PAINT
SKIRTING/DADO FINISHES			FLOORING FINISHES		
1.	401	20mm THK. (1:2) CEMENT PLASTER SKIRTING 150 MM HIGH	1.	201	CEMENT CONCRETE FLOORING(1:2:4) 40mm THK. WITH GLASS STRIP PANEL
2.	402	VITRIFIED TILES	2.	202	VITRIFIED TILES
CEILING FINISHES					
1.	301	ACRYLIC DISTEMPER			
2.	302	ARYLIC EMULSION PAINT			

PLASTER:

INTERNAL:
12mm THK. PLASTER (1:4 CEMENT : SAND)

EXTERNAL:
12mm THK. PLASTER (1:4 CEMENT : SAND)
CEILING EXCEPT FOR WHERE FALSE CEILING WILL BE PROVIDED.
6mm THK. PLAIN PLASTER (1:4 CEMENT : SAND)

REFFRENCE DRAWING:–

1 OVERALL GENERAL ARRANGEMENT DRAWING –
1 CONCEPTUAL DRAWING FOR 400kV GIS BUILDING – TB–1–406–316–005

LEGEND:–

SIDE HUNG OPENABLE PANEL

FIXED GLASS PANEL

FFL. = FINISH FLOOR LEVEL
FGL. = FINISH GRADE LEVEL
H.P. = HIGH POINT
L.P. = LOWER POINT
TOC = TOP OF CONCRETE
FFL = FINISH FLOOR LEVEL
FGL = FINISH GROUND LEVEL

WATER PROOFING ON ROOF

PROVIDING AND APPLYING FOUR COURSES OF WATER PROOFING TREATMENT AT ROOFS CONSISTING FIRST COURSE OF STRAIGHT RUN 85/25 GRADE BITUMEN CONFIRMING TO I.S. 73–1961@0.7 KG/SQM, SECOND COURSE OF ROOF GUARD CONSISTING OF POLYTHENE SHEETS WEIGHTING 0.12 KG/ SQM, WITH 75MM OVER LAPS, ALONG ROOF SLOPE, THIRD COURSE OF COLD CUT BACK BITUMEN B.S. GRADE @ 1.0 KG/ SQM AS PER I.S. 7290 AND THE FOURTH AND FINAL COURSE OF 1:1.5:3 CEMENT CONCRETE, 25MM THICK WITH WATER PROOFING COMPOUND (RECRON.3S) AS PER SPECIFICATIONS, INCLUDING ALL MATERIALS, LABOUR AND T & P ETC. REQUIRED FOR PROPER COMPLETION OF WORK.

NOTES:–

1 ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR–WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD (T.B.M.) WHICH IS (+)100.00M ABSOLUTE ELEVATION.
5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.
6. FOR GIS ROOM FLOORING REFER DETAIL DRAWING.

REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:–
STRUC MECH ENGINEERS PVT. LTD.
87, OLD A.G. COLONY, KADRU, RANCHI.
☎PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		27.03.19	N.A.
CHD.	Mukesh		27.03.19	
APPD.	Mukesh		27.03.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ∅/M/F		SCALE N.T.S	WEIGHT (KG) N.A.	REF. TO ASSY. DRG. N.A.	ITEM NO. N.A.	NO. OF ITEMS N.A.

TITLE: 400KV GIS BUILDING ARCHITECTURAL GROUND FLOOR PLAN & FINISHES SCHEDULE

CARD CODE: NA

DRG. NO. TB–1–406–607–640–1

REV. 00

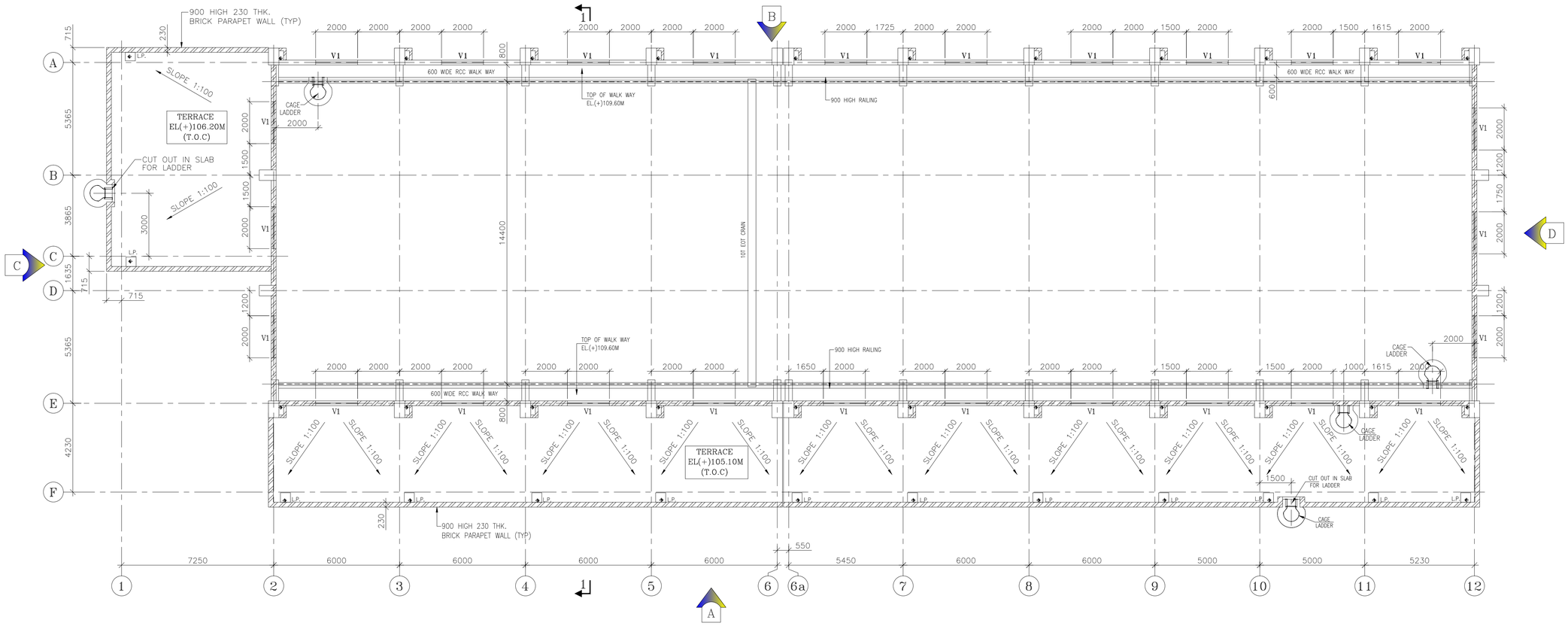
SHT. No 01 NO. OF SHT. 03

SIZE–A1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-640-1



PLAN AT CRAIN GIRDER LEVEL@ EL(+)109.60M

(SCALE– 1:100)

LEGEND:–

- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL
- FFL. = FINISH FLOOR LEVEL
- FGL. = FINISH GRADE LEVEL
- H.P. = HIGH POINT
- L.P. = LOWER POINT
- TOC = TOP OF CONCRETE
- FFL = FINISH FLOOR LEVEL
- FGL = FINISH GROUND LEVEL

NOTES:–

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2. ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR–WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD (T.B.M.) WHICH IS (+)100.00M ABSOLUTE ELEVATION.
5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.

REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:

400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:

UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:–

STRUC MECH ENGINEERS PVT. LTD.
87, OLD A.G. COLONY, KADRU, RANCHI.
☎PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		27.03.19	N.A.
CHD.	Mukesh		27.03.19	
APPD.	Mukesh		27.03.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ∅/M/₣	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 400KV GIS BUILDING ARCHITECTURAL PLAN AT CRAIN GIRDER LEVEL @ EL(+)109.60M

CARD CODE: NA

DRG. NO.: TB-1-406-607-640-1

REV.: 00

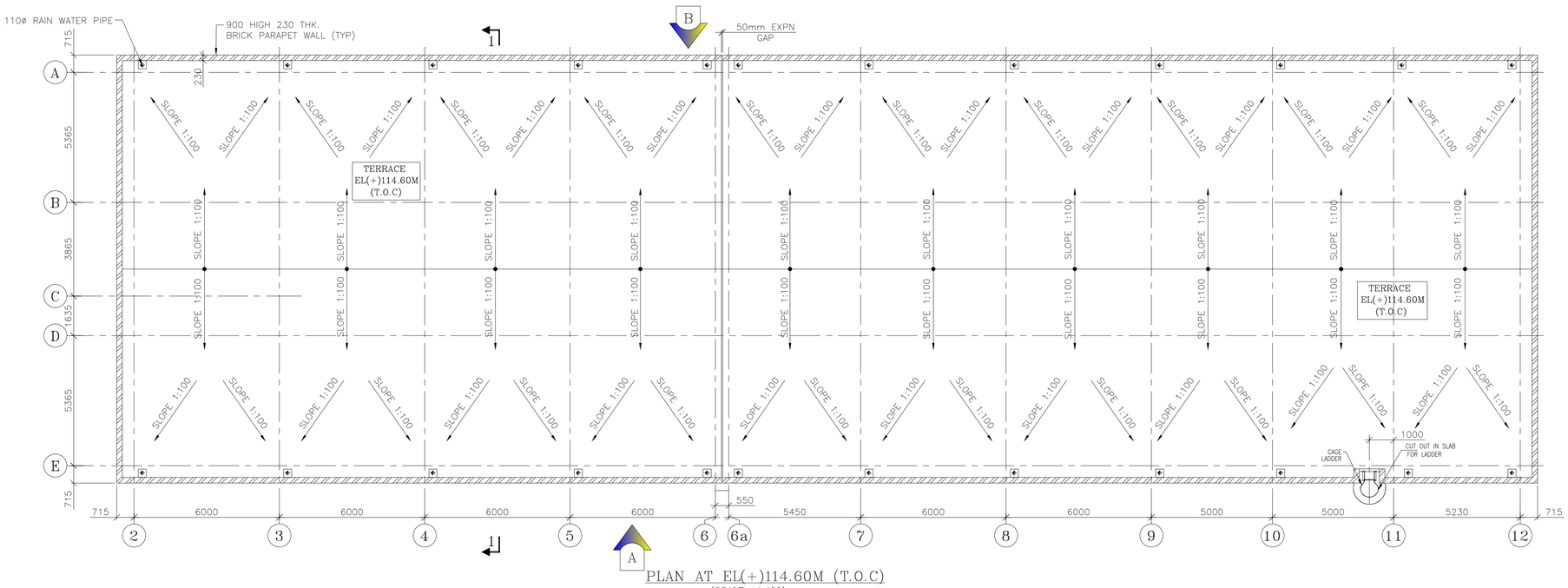
SHT. No 02 | NO. OF SHT. 03

SIZE–A1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-640-1



PLAN AT EL(+)114.60M (T.O.C)

(SCALE– 1:100)

LEGEND:–

- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL
- FFL. = FINISH FLOOR LEVEL
- FGL. = FINISH GRADE LEVEL
- H.P. = HIGH POINT
- L.P. = LOWER POINT
- TOC = TOP OF CONCRETE
- FFL = FINISH FLOOR LEVEL
- FGL = FINISH GROUND LEVEL

SCHEDULE OF DOORS & WINDOWS							REMARK
TYPE	OPENING SIZE	FRAME SIZE	CILL LEVEL	LINTEL LEVEL	NOS.	DESCRIPTION	
RS1	4500x5500	4480x5490	–	EL(+)105.60M	1	STEEL ROLLING SHUTTER	AS PER SPECIFICATION
D1	1500x2500	1480x2490	–	EL(+)103.10M	2	DOUBLE SHUTTER STEEL DOOR	
D2	1500x2500	1480x2490	–	EL(+)103.10M	2	DOUBLE SHUTTER ALUMINIUM DOOR	
D3	2000x2500	1980x2490	–	EL(+)103.10M	1	DOUBLE SHUTTER ALUMINIUM DOOR	
D4	2500x3500	2480x3490	–	EL(+)104.10M	1	DOUBLE SHUTTER STEEL DOOR	
W1	2000x1200	1980x1180	900	EL(+)102.70M	20	ALUMINIUM WINDOW FULLY GLAZED	
W1A	2000x1200	1980x1180	900	EL(+)102.70M	9	ALUMINIUM FIXED WINDOW FULLY GLAZED	
V1	2000x600	1980x580	–	SOFFIT OF ROOF BEAM	20	FIXED ALUMINIUM VENTILATOR	

NOTES:–

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6. FOR GIS ROOM FLOORING REFER DETAIL DRAWING.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:

400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:

UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:–

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87, OLD A.G. COLONY, KADRU, RANCHI.
☎PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		27.03.19	N.A.
CHD.	Mukesh		27.03.19	
APPD.	Mukesh		27.03.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ¢/M/₹	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 400KV GIS BUILDING ARCHITECTURAL TERRACE PLAN

CARD CODE: NA

DRG. NO. TB-1-406-607-640-1

REV. 00

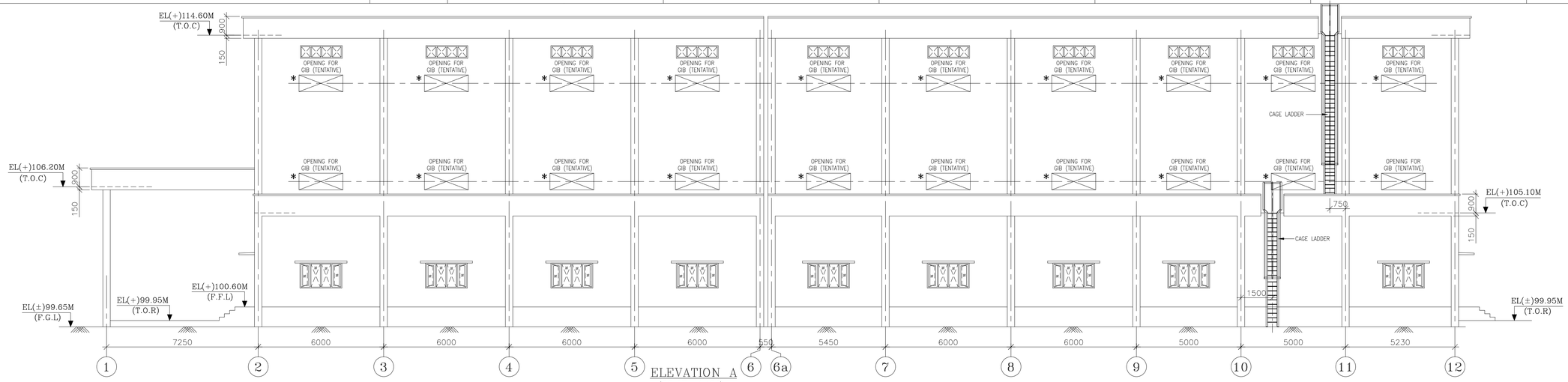
SHT. No 03 NO. OF SHT. 03

SIZE–A1

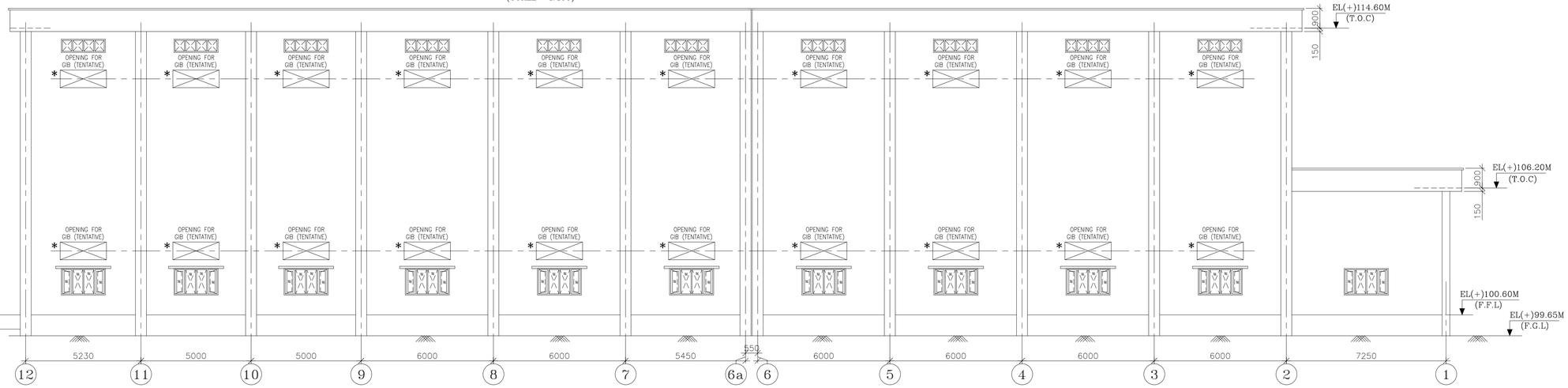
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

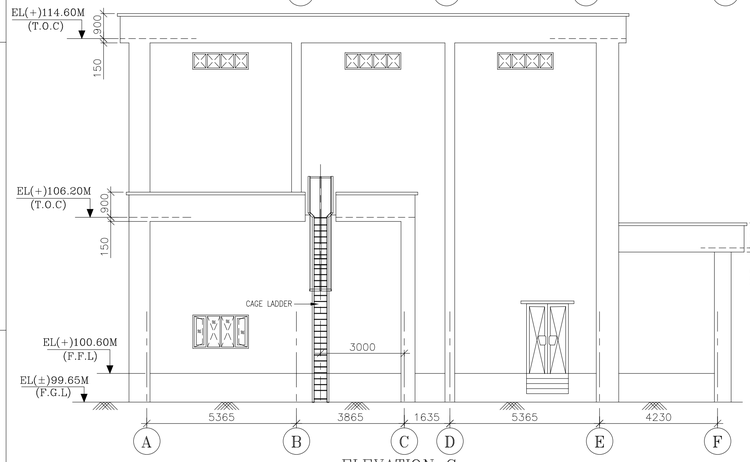
DRG. NO. TB-1-406-607-640-2



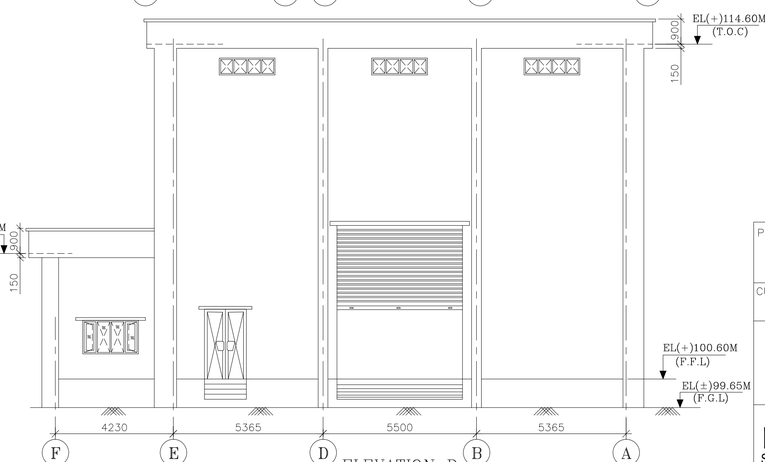
ELEVATION A
(SCALE– 1:100)



ELEVATION B
(SCALE– 1:100)



ELEVATION C
(SCALE– 1:100)



ELEVATION D
(SCALE– 1:100)

NOTES:–

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5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.
6. FOR GIS ROOM FLOORING REFER DETAIL DRAWING.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE			ZONE		

* RECTANGULAR CUTOUT TO BE PROVIDED CUTOUT DIMENSION & LOCATION SHALL BE PROVIDED AS PER GIS MANUFACTURE

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:–
STRUC MECH ENGINEERS PVT. LTD.
87, OLD A.G. COLONY, KADRU, RANCHI.
☎PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		27.03.19	N.A.
CHD.	Mukesh		27.03.19	
APPD.	Mukesh		27.03.19	

DEPT. TBG CODE	UNTOL DIMS. GR. ¢/M/₹	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 400KV GIS BUILDING ARCHITECTURAL ELEVATIONS

CARD CODE: NA

DRG. NO. TB-1-406-607-640-2

REV. 00

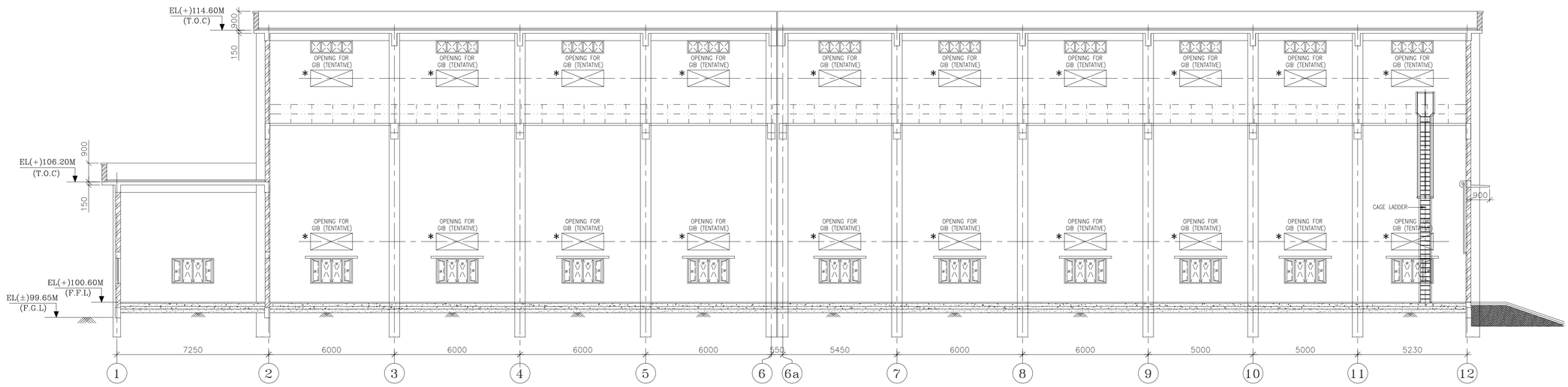
SHT. No 01 NO. OF SHT. 01

SIZE–A1

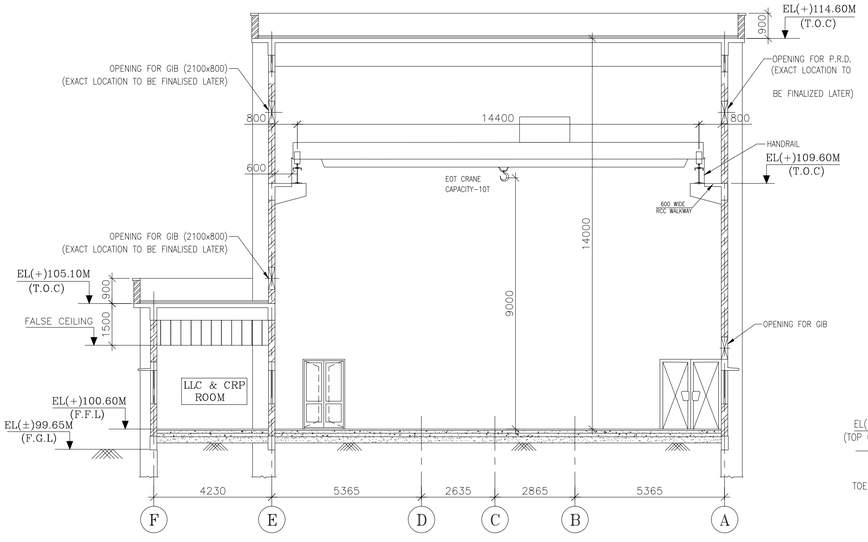
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

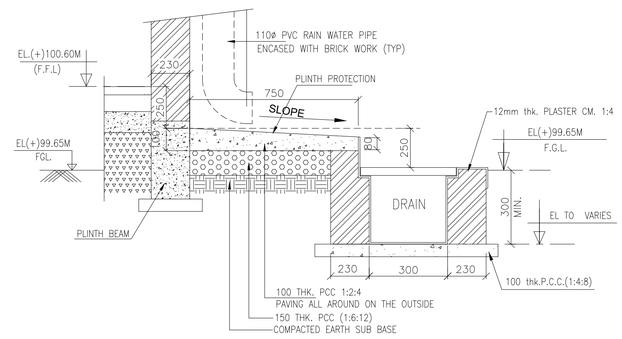
DRG. NO. TB-1-406-607-640-3



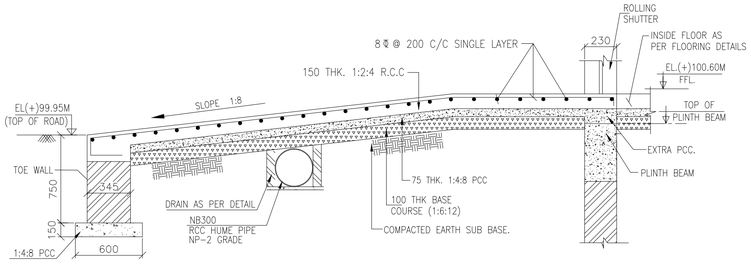
SECTION 2-2
(SCALE- 1:100)



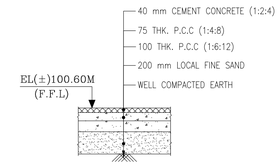
SECTION 1-1



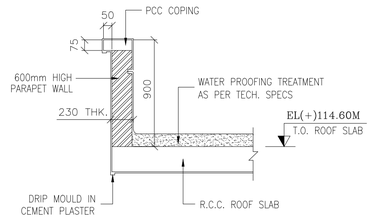
PLINTH PROTECTION ALONG BUILDING WITH DRAIN-TYPICAL



DETAIL OF RAMP



TYP. DETAIL OF FLOORING (OTHER THAN GIS ROOM)



TYP. DETAIL OF PARAPET

* RECTANGULAR CUTOUT TO BE PROVIDED CUTOUT DIMENSION & LOCATION SHALL BE PROVIDED AS PER GIS MANUFACTURE

NOTES:-

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2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD (T.B.M.) WHICH IS (+)100.00M ABSOLUTE ELEVATION.
5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.
6. FOR GIS ROOM FLOORING REFER DETAIL DRAWING.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:-
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☎PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		27.03.19	N.A.
CHD.	Mukesh		27.03.19	
APPD.	Mukesh		27.03.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. C/M/F		SCALE N.T.S	WEIGHT (KG) N.A.	REF. TO ASSY. DRG. N.A.	ITEM NO. N.A.	NO. OF ITEMS N.A.

TITLE: 400KV GIS BUILDING ARCHITECTURAL SECTIONS

CARD CODE: NA

DRG. NO.: TB-1-406-607-640-3

REV.: 00

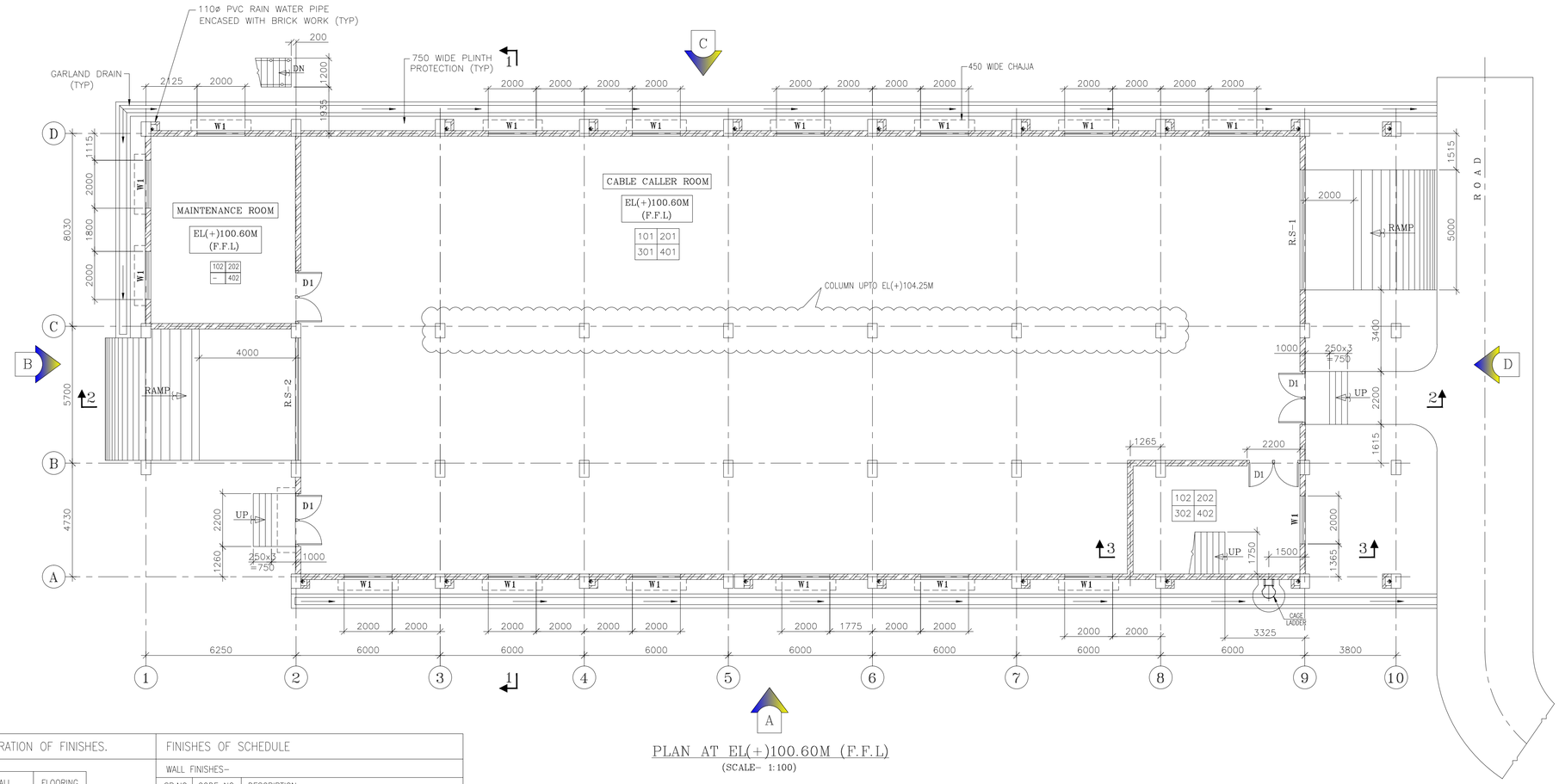
SHT. No 01 | NO. OF SHT. 01

SIZE-A1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-651-1



PLAN AT EL(+)100.60M (F.F.L)

(SCALE- 1:100)

LEGEND:-

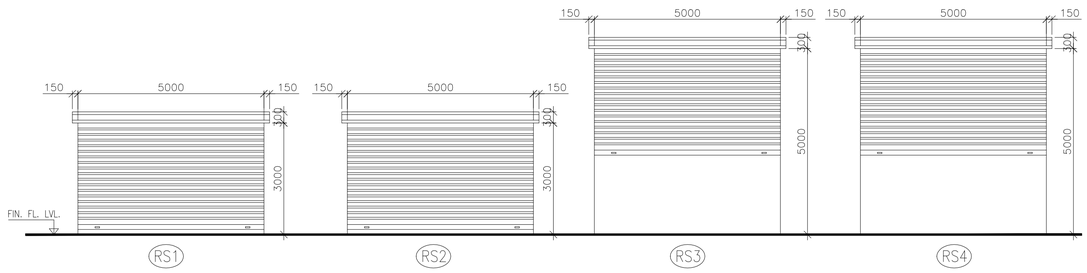
- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL
- FFL. = FINISH FLOOR LEVEL
- FGL. = FINISH GRADE LEVEL
- H.P. = HIGH POINT
- L.P. = LOWER POINT
- TOC = TOP OF CONCRETE
- FFL = FINISH FLOOR LEVEL
- FGL = FINISH GROUND LEVEL

ILLUSTRATION OF FINISHES.			FINISHES OF SCHEDULE			
WALL SERIES 100 / FLOORING SERIES 200 / CEILING SERIES 300 / SKIRTING/ DADO SERIES 400			WALL FINISHES-			
			SR.NO.	CODE NO.	DESCRIPTION	
			1.	101	ACRYLIC DISTEMPER EXTERNAL FINISHED OF WALL-WATER PROOF EXTERIOR EMULSION PAINT OF APEX ULTIMATE (ASIAN) / WEATHER SHIELD MAX (ICI) OR EQUIVALENT	
			2.	102	ACRYLIC EMULSION PAINT	
SKIRTING/DADO FINISHES			FLOORING FINISHES			
1.	401	20mm THK. (1:2) CEMENT PLASTER SKIRTING 150 MM HIGH	1.	201	CEMENT CONCRETE FLOORING(1:2:4) 40mm THK. WITH GLASS STRIP PANEL	
2.	402	VITRIFIED TILES	2.	202	VITRIFIED TILES	
CEILING FINISHES						
1.	301	ACRYLIC DISTEMPER				
2.	302	ARYLIC EMULSION PAINT				

PLASTER:

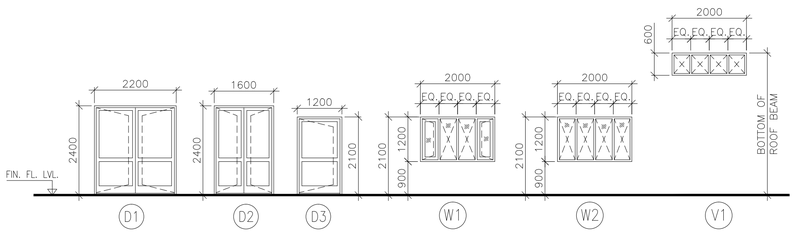
INTERNAL:
12mm THK. PLASTER (1:4 CEMENT : SAND)

EXTERNAL:
12mm THK. PLASTER (1:4 CEMENT : SAND)
CEILING EXCEPT FOR WHERE FALSE CEILING WILL BE PROVIDED.
6mm THK. PLAIN PLASTER (1:4 CEMENT : SAND)



WATER PROOFING ON ROOF

PROVIDING AND APPLYING FOUR COURSES OF WATER PROOFING TREATMENT AT ROOFS CONSISTING FIRST COURSE OF STRAIGHT RUN 85/25 GRADE BITUMEN CONFIRMING TO I.S. 73-1961@0.7 KG/SQM, SECOND COURSE OF ROOF GUARD CONSISTING OF POLYTHENE SHEETS WEIGHTING 0.12 KG/ SQM, WITH 75MM OVER LAPS, ALONG ROOF SLOPE, THIRD COURSE OF COLD CUT BACK BITUMEN B.S. GRADE @ 1.0 KG/ SQM AS PER I.S. 7290 AND THE FOURTH AND FINAL COURSE OF 1:1.5:3 CEMENT CONCRETE, 25MM THICK WITH WATER PROOFING COMPOUND (RECRON.3S) AS PER SPECIFICATIONS, INCLUDING ALL MATERIALS, LABOUR AND T & P ETC. REQUIRED FOR PROPER COMPLETION OF WORK.



NOTES:-

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5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.

REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:-
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PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		01.05.19	N.A.
CHD.	Mukesh		01.05.19	
APPD.	Mukesh		01.05.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ∅/M/₱	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 220KV GIS BUILDING ARCHITECTURAL GROUND FLOOR PLAN & FINISHING SCHEDULE

CARD CODE: NA

DRG. NO. TB-1-406-607-651-1 REV. 00

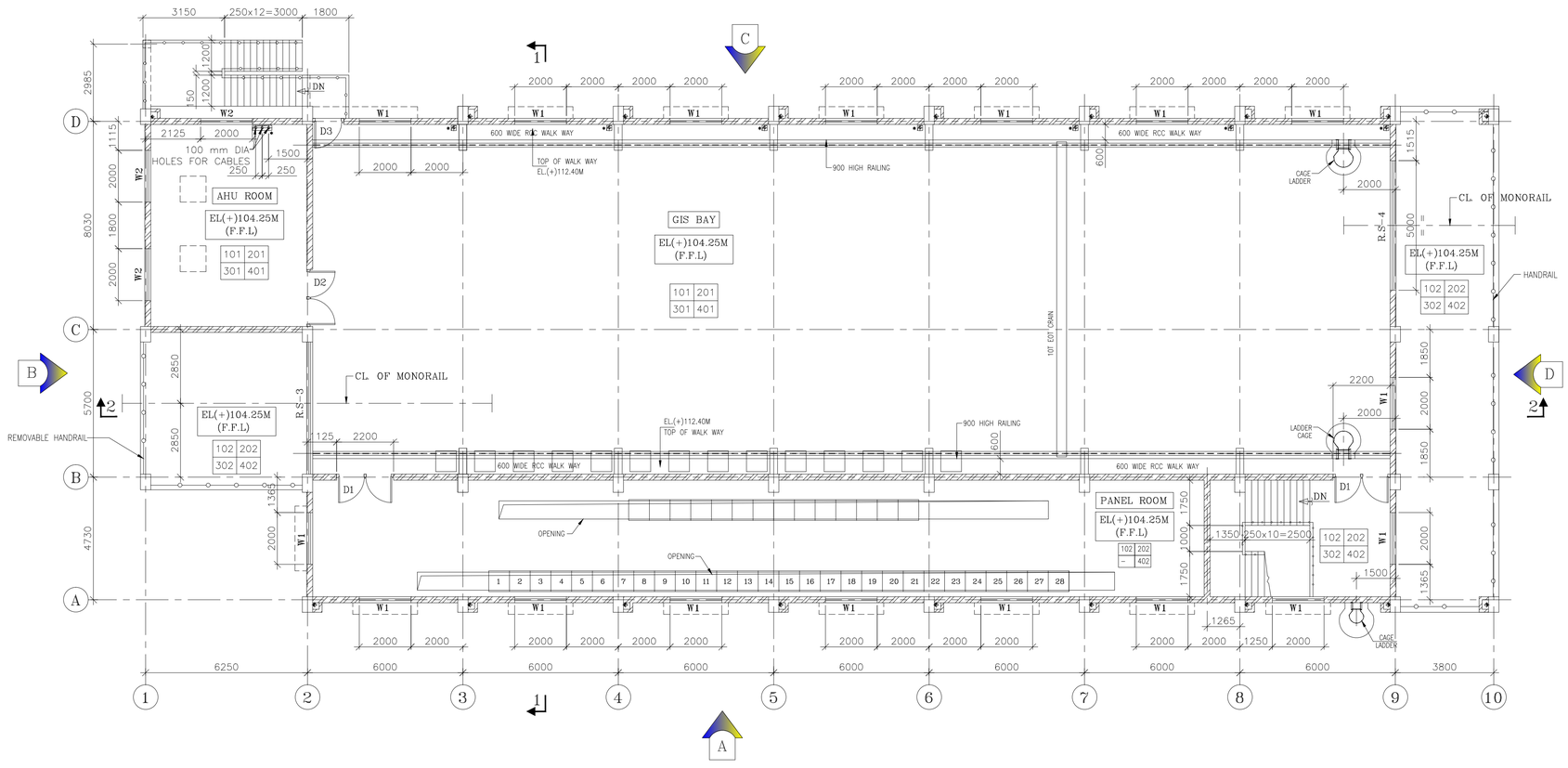
SHT. No 01 NO. OF SHT. 03

SIZE-A1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-651-1



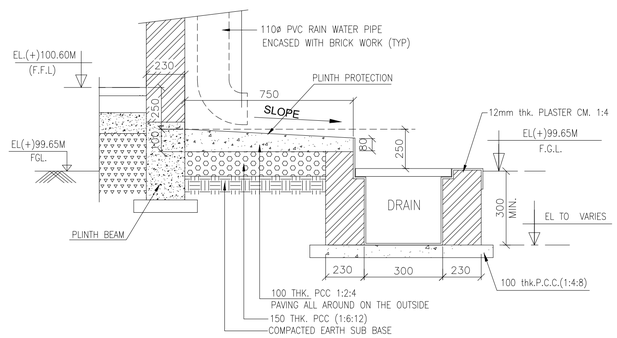
PLAN AT EL(+)104.25M (F.F.L)

(SCALE- 1:100)

LEGEND:-

- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL
- FFL. = FINISH FLOOR LEVEL
- FGL. = FINISH GRADE LEVEL
- H.P. = HIGH POINT
- L.P. = LOWER POINT
- TOC = TOP OF CONCRETE
- FFL = FINISH FLOOR LEVEL
- FGL = FINISH GROUND LEVEL

SCHEDULE OF DOORS & WINDOWS							REMARK
TYPE	OPENING SIZE	FRAME SIZE	CILL LEVEL	LINTEL LEVEL	NOS.	DESCRIPTION	
RS-1	5000x3000	4980x2990	–	EL(+)103.60M	1	STEEL ROLLING SHUTTER	AS PER SPECIFICATION
RS-2	5000x3000	4980x2990	–	EL(+)103.60M	1	STEEL ROLLING SHUTTER	
RS-3	5000x5000	4980x4990	–	EL(+)108.25M	1	STEEL ROLLING SHUTTER	
RS-4	5000x5000	4980x4990	–	EL(+)108.25M	1	STEEL ROLLING SHUTTER	
D1	2200x2400	2180x2390	–	EL(+)103.00M	6	DOUBLE SHUTTER STEEL DOOR	
D2	1600x2400	1580x2390	–	EL(+)103.00M	1	DOUBLE SHUTTER STEEL DOOR	
D3	1200x2100	1180x2090	–	EL(+)102.70M	1	SINGLE SHUTTER ALUMINIUM DOOR	
W1	2000x1200	1980x1180	900	EL(+)102.70M	37	ALUMINIUM WINDOW FULLY GLAZED	
W2	2000x1200	1980x1180	900	EL(+)102.70M	3	ALUMINIUM FIXED WINDOW FULLY GLAZED	
V1	2000x600	1980x580	–	SOFFIT OF ROOF BEAM		FIXED ALUMINIUM VENTILATOR	



PLINTH PROTECTION ALONG BUILDING WITH DRAIN-TYPICAL

* RECTANGULAR CUTOUT TO BE PROVIDED CUTOUT DIMENSION & LOCATION SHALL BE PROVIDED AS PER GIS MANUFACTURE

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2. ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD (T.B.M.) WHICH IS +100.0M ABSOLUTE ELEVATION.
5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.

REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:-
STRUC MECH ENGINEERS PVT. LTD.
87, OLD A.G. COLONY, KADRU, RANCHI.
PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		01.05.19	N.A.
CHD.	Mukesh		01.05.19	
APPD.	Mukesh		01.05.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ¢/M/F	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 220KV GIS BUILDING ARCHITECTURAL 1st FLOOR PLAN & CRAIN GIRDER LEVEL

CARD CODE: NA

DRG. NO. TB-1-406-607-651-1 REV. 00

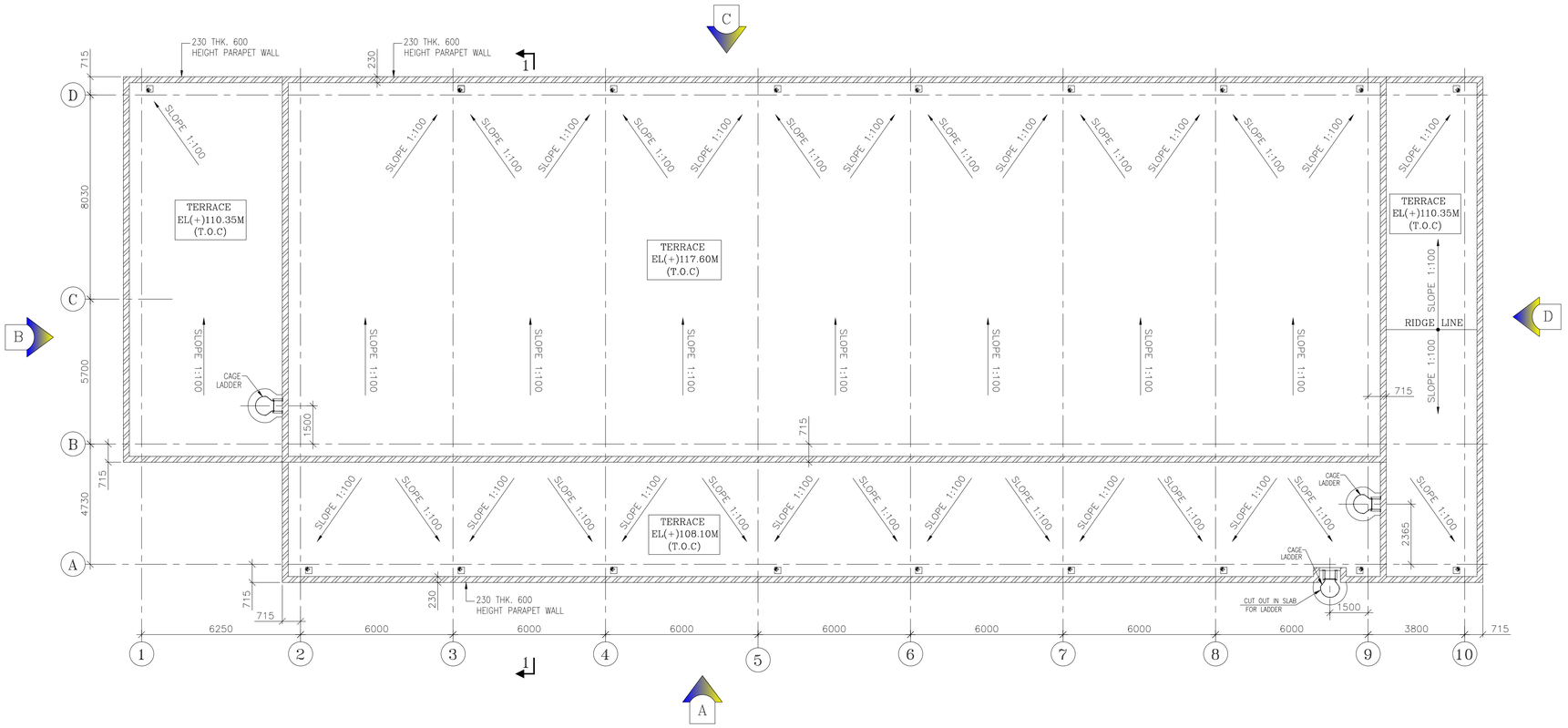
SHT. No 02 NO. OF SHT. 03

SIZE-A1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-651-1

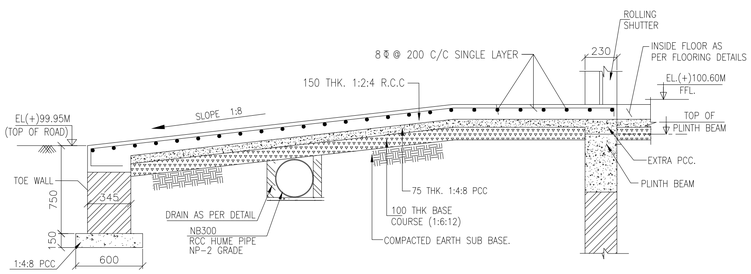


PLAN AT EL(+)117.60M (T.O.C)

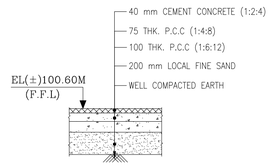
(SCALE- 1:100)

LEGEND:-

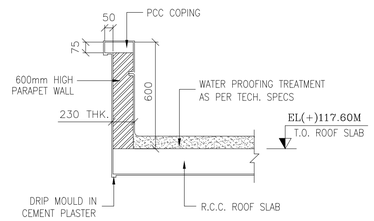
- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL
- FFL. = FINISH FLOOR LEVEL
- FGL. = FINISH GRADE LEVEL
- H.P. = HIGH POINT
- L.P. = LOWER POINT
- TOC = TOP OF CONCRETE
- FFL = FINISH FLOOR LEVEL
- FGL = FINISH GROUND LEVEL



DETAIL OF RAMP



TYP. DETAIL OF FLOORING



TYP. DETAIL OF PARAPET

NOTES:-

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2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD (T.B.M.) WHICH IS +100.0M ABSOLUTE ELEVATION.
5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:-
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PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		01.05.19	N.A.
CHD.	Mukesh		01.05.19	
APPD.	Mukesh		01.05.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ¢/M/₣	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE
220KV GIS BUILDING
ARCHITECTURAL TERRACE FLOOR PLAN

CARD CODE: NA

DRG. NO. TB-1-406-607-651-1

REV. 00

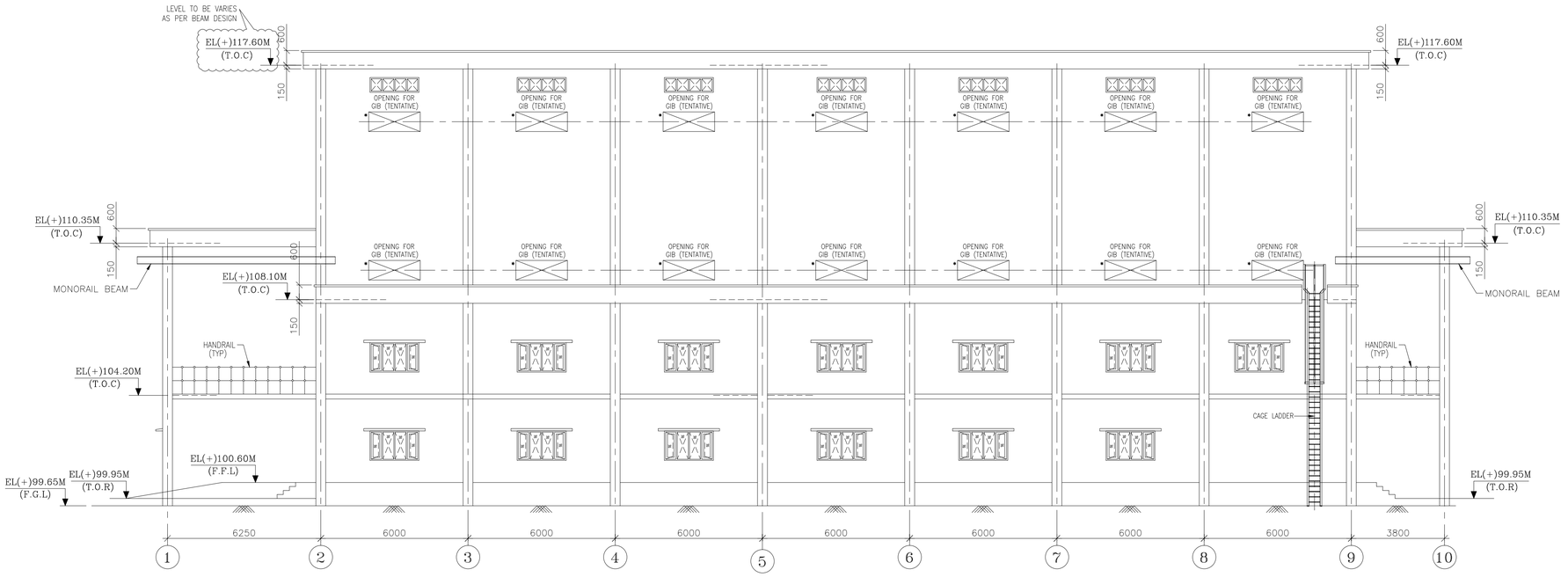
SHT. No 03 NO. OF SHT. 03

SIZE-A1

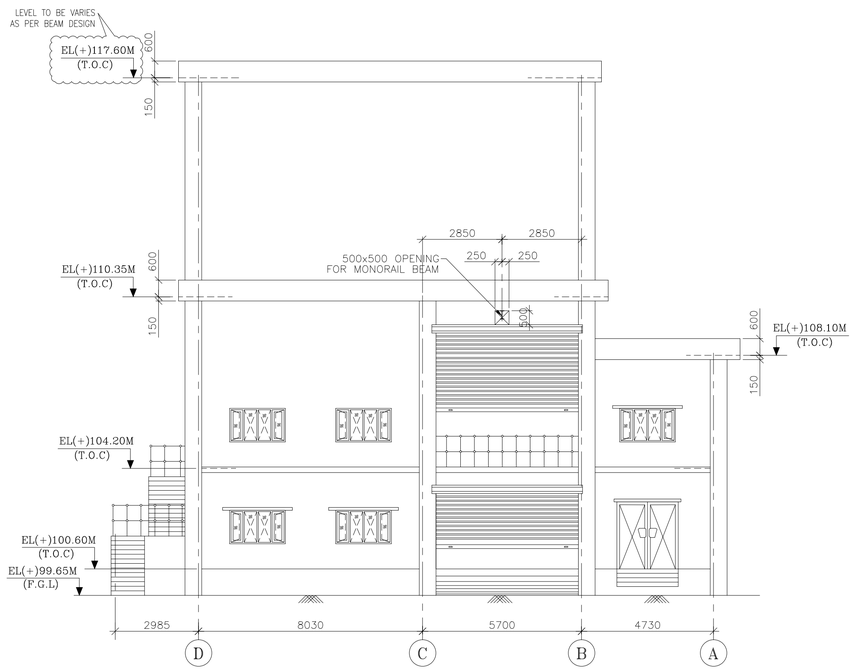
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-651-2



ELEVATION–A



ELEVATION–B

LEGEND:–

- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL
- FFL. = FINISH FLOOR LEVEL
- FGL. = FINISH GRADE LEVEL
- H.P. = HIGH POINT
- L.P. = LOWER POINT
- TOC = TOP OF CONCRETE
- FFL = FINISH FLOOR LEVEL
- FGL = FINISH GROUND LEVEL

* RECTANGULAR CUTOUT TO BE PROVIDED CUTOUT DIMENSION & LOCATION SHALL BE PROVIDED AS PER GIS MANUFACTURE

NOTES:–

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3. ALL DOOR–WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD (T.B.M.) WHICH IS +100.0M ABSOLUTE ELEVATION.
5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.

REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
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NOIDA

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DRN.	Subrata		01.05.19	N.A.
CHD.	Mukesh		01.05.19	
APPD.	Mukesh		01.05.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ∅/M/₣	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 220KV GIS BUILDING ARCHITECTURAL ELEVATION

CARD CODE: NA

DRG. NO.: TB-1-406-607-651-2

REV.: 00

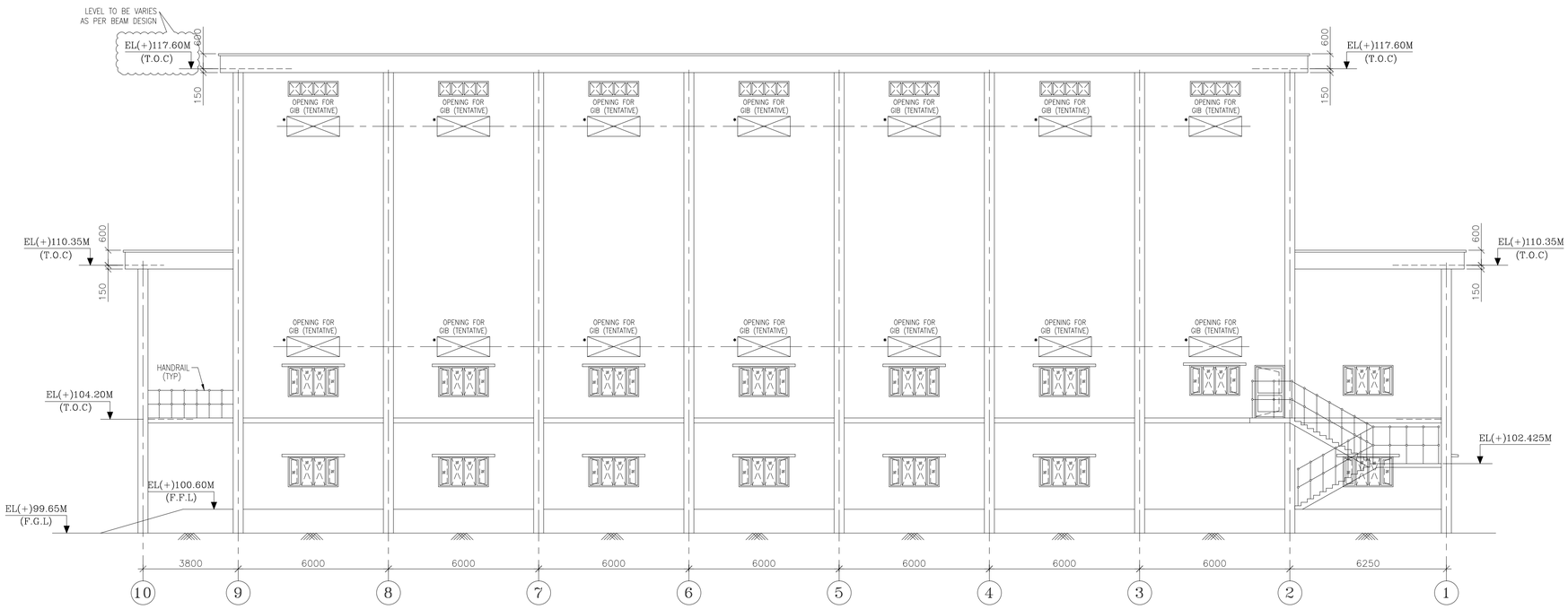
SHT. No 01 | NO. OF SHT. 02

SIZE–A1

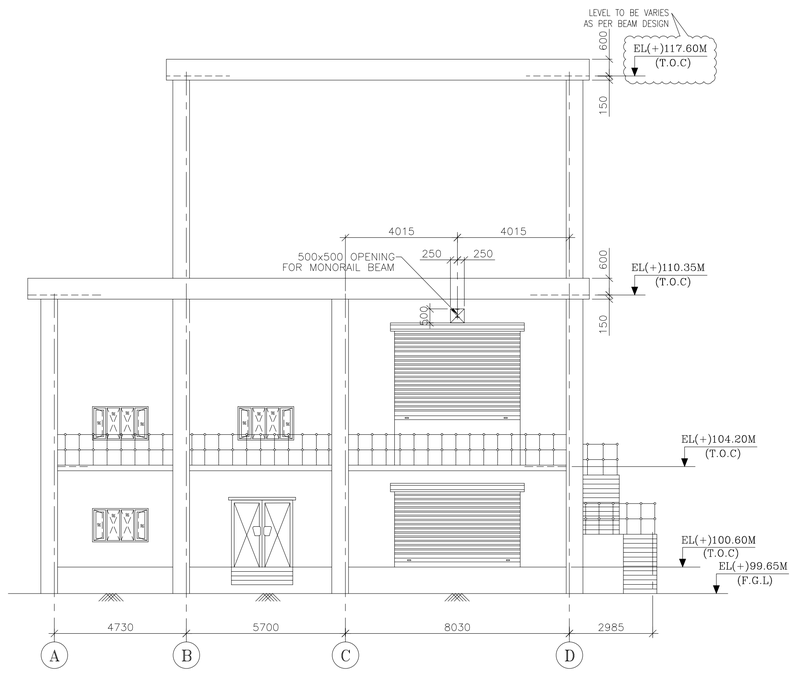
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-651-2



ELEVATION–C



ELEVATION–D

LEGEND:–

- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL
- FFL. = FINISH FLOOR LEVEL
- FGL. = FINISH GRADE LEVEL
- H.P. = HIGH POINT
- L.P. = LOWER POINT
- TOC = TOP OF CONCRETE
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REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
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STRUCTURAL CONSULTANTS:–
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	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		01.05.19	N.A.
CHD.	Mukesh		01.05.19	
APPD.	Mukesh		01.05.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. ∅/M/F	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 220KV GIS BUILDING ARCHITECTURAL ELEVATION

CARD CODE: NA

DRG. NO. TB-1-406-607-651-2

REV. 00

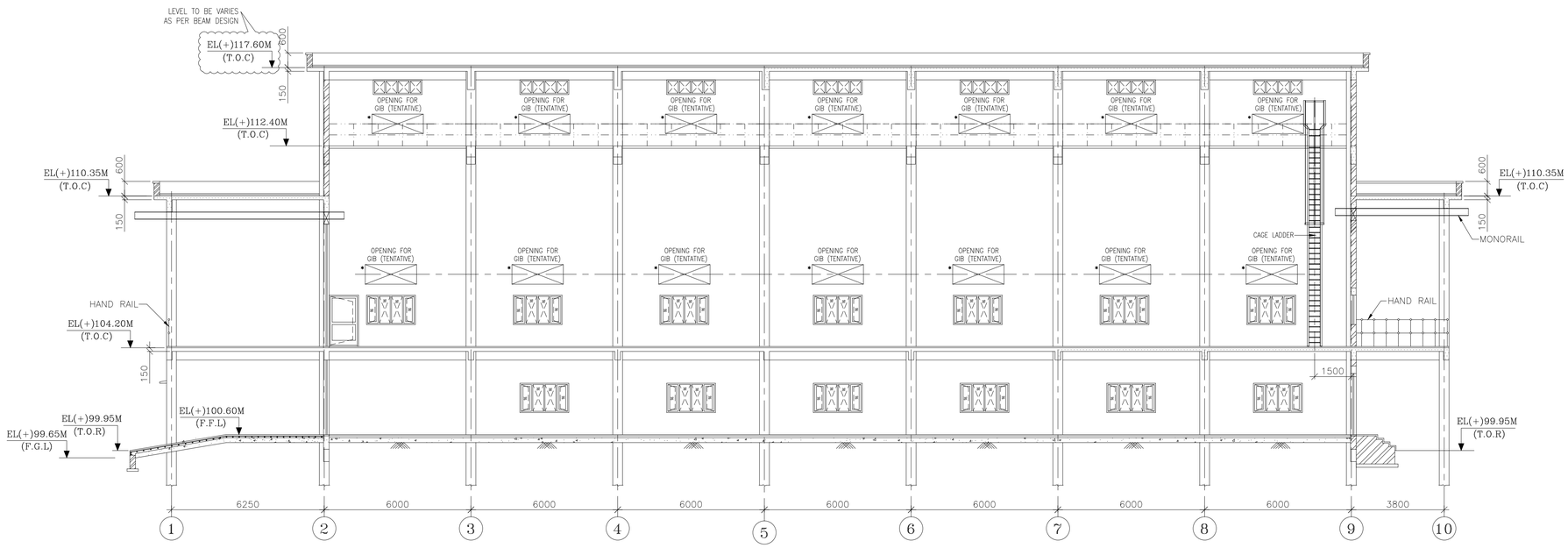
SHT. No 02 NO. OF SHT. 02

SIZE–A1

FIRST ANGLE PROJECTION

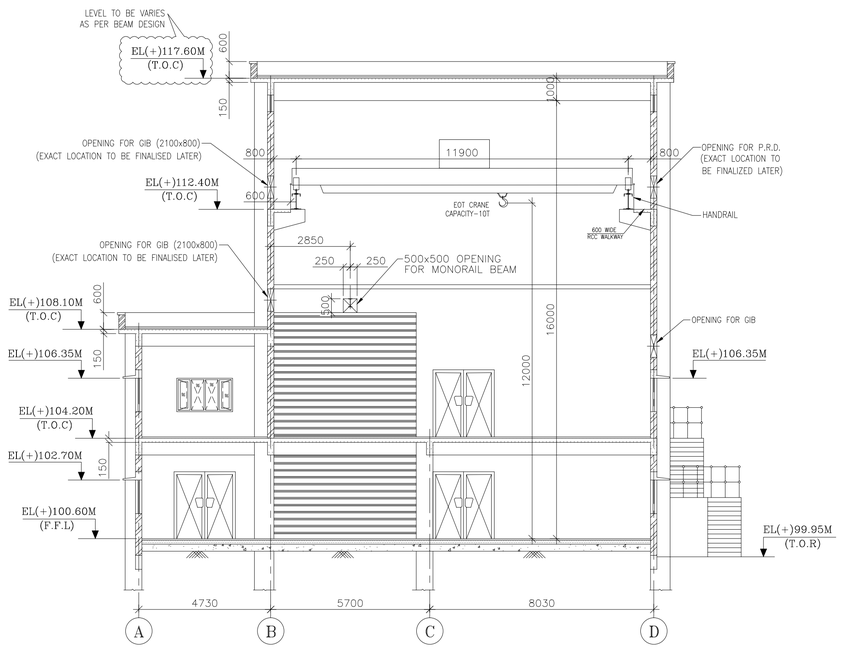
(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-651-3



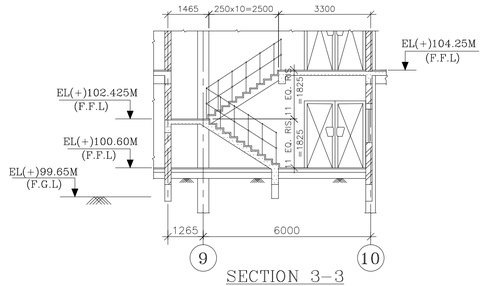
SECTION 2–2

(SCALE– 1:100)



SECTION 1–1

(SCALE– 1:100)



SECTION 3–3

(SCALE– 1:100)

LEGEND:–

- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL
- FFL. = FINISH FLOOR LEVEL
- FGL. = FINISH GRADE LEVEL
- H.P. = HIGH POINT
- L.P. = LOWER POINT
- TOC = TOP OF CONCRETE
- FFL = FINISH FLOOR LEVEL
- FGL = FINISH GROUND LEVEL

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5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:

400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:

UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
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	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		01.05.19	N.A.
CHD.	Mukesh		01.05.19	
APPD.	Mukesh		01.05.19	

DEPT. TBG	UNTOL. DIMS. GR. ¢/M/₱		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
CODE			N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 220KV GIS BUILDING ARCHITECTURAL SECTIONS

CARD CODE: NA

DRG. NO. TB-1-406-607-651-3

REV. 00

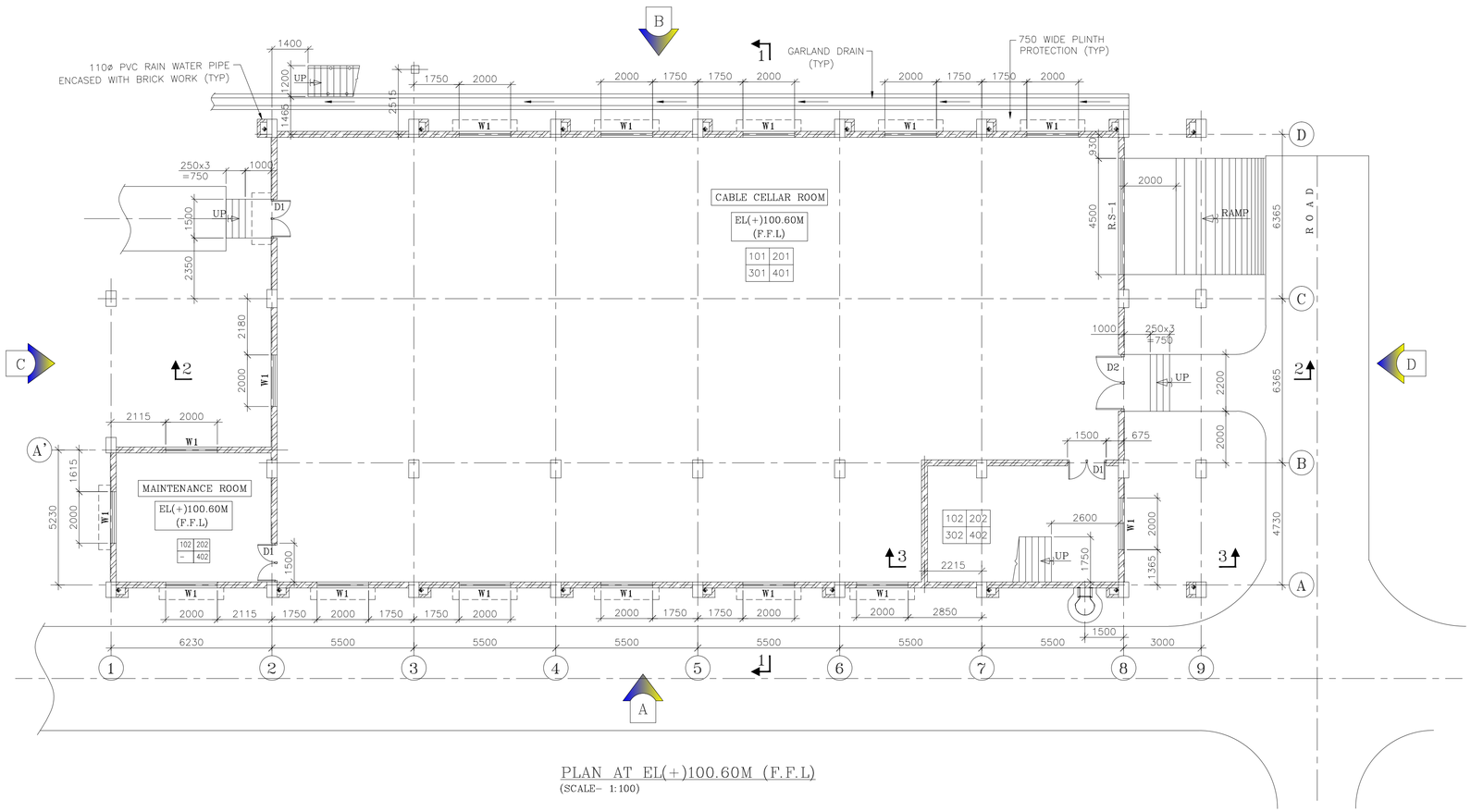
SHT. No 01 | NO. OF SHT. 01

SIZE–A1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-661-1



PLAN AT EL(+)100.60M (F.F.L)

(SCALE- 1:100)

LEGEND:-

- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL

FFL. = FINISH FLOOR LEVEL
FGL. = FINISH GRADE LEVEL
H.P. = HIGH POINT
L.P. = LOWER POINT
TOC = TOP OF CONCRETE
FFL = FINISH FLOOR LEVEL
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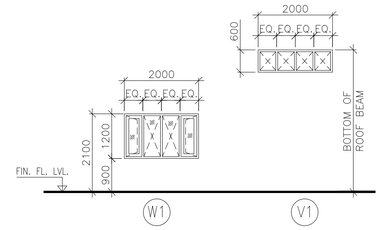
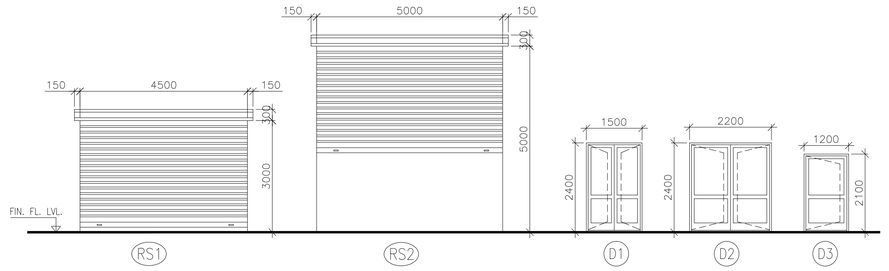


ILLUSTRATION OF FINISHES.			FINISHES OF SCHEDULE		
WALL SERIES 100 / FLOORING SERIES 200 / CEILING SERIES 300 / SKIRTING/DADO SERIES 400			WALL FINISHES-		
			SR.NO.	CODE NO.	DESCRIPTION
			1.	101	ACRYLIC DISTEMPER EXTERNAL FINISHED OF WALL-WATER PROOF EXTERIOR EMULSION PAINT OF APEX ULTIMATE (ASIAN) / WEATHER SHIELD MAX (ICI) OR EQUIVALENT
			2.	102	ACRYLIC EMULSION PAINT
SKIRTING/DADO FINISHES			FLOORING FINISHES		
1.	401	20mm THK. (1:2) CEMENT PLASTER SKIRTING 150 MM HIGH	1.	201	CEMENT CONCRETE FLOORING(1:2:4) 40mm THK. WITH GLASS STRIP PANEL
2.	402	VITRIFIED TILES	2.	202	VITRIFIED TILES
CEILING FINISHES					
1.	301	ACRYLIC DISTEMPER			
2.	302	ARYLIC EMULSION PAINT			

PLASTER:

INTERNAL:
12mm THK. PLASTER (1:4 CEMENT : SAND)
EXTERNAL:
12mm THK. PLASTER (1:4 CEMENT : SAND)
CEILING EXCEPT FOR WHERE FALSE CEILING WILL BE PROVIDED.
6mm THK. PLAIN PLASTER (1:4 CEMENT : SAND)



WATER PROOFING ON ROOF

PROVIDING AND APPLYING FOUR COURSES OF WATER PROOFING TREATMENT AT ROOFS CONSISTING FIRST COURSE OF STRAIGHT RUN 85/25 GRADE BITUMEN CONFIRMING TO I.S. 73-1961@0.7 KG/SQM, SECOND COURSE OF ROOF GUARD CONSISTING OF POLYTHENE SHEETS WEIGHTING 0.12 KG/ SQM, WITH 75MM OVER LAPS, ALONG ROOF SLOPE, THIRD COURSE OF COLD CUT BACK BITUMEN B.S. GRADE @ 1.0 KG/ SQM AS PER I.S. 7290 AND THE FOURTH AND FINAL COURSE OF 1:1.5:3 CEMENT CONCRETE, 25MM THICK WITH WATER PROOFING COMPOUND (RECRON.3S) AS PER SPECIFICATIONS, INCLUDING ALL MATERIALS, LABOUR AND T & P ETC. REQUIRED FOR PROPER COMPLETION OF WORK.

NOTES:-

1 ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD (T.B.M.) WHICH IS +100.0M ABSOLUTE ELEVATION.
5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
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STRUCTURAL CONSULTANTS:-
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	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		20.05.19	N.A.
CHD.	Mukesh		20.05.19	
APPD.	Mukesh		20.05.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. C/M/F	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 132KV GIS BUILDING ARCHITECTURAL GROUND FLOOR PLAN & FINISHING SCHEDULE

CARD CODE: NA

DRG. NO. TB-1-406-607-661-1

REV. 00

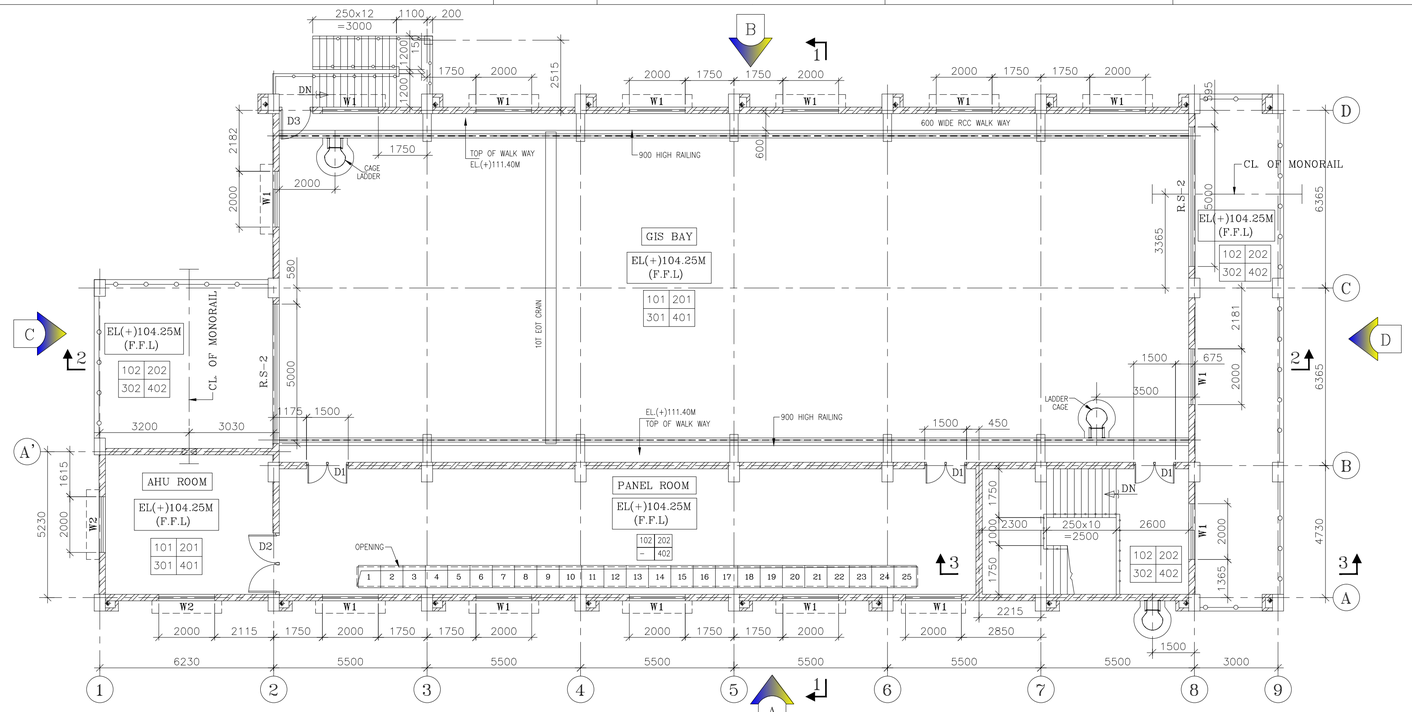
SHT. No 01 NO. OF SHT. 02

SIZE-A1

FIRST ANGLE PROJECTION

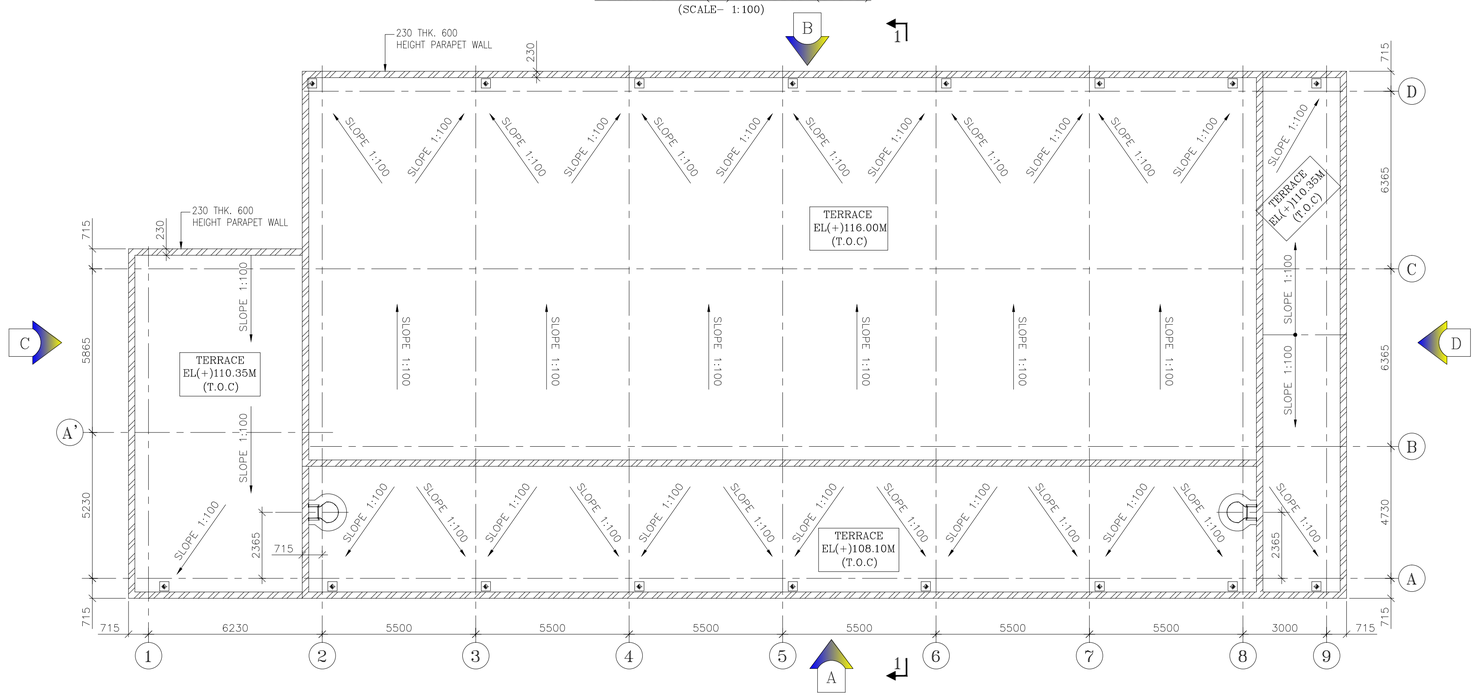
(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-661-1



PLAN AT EL(+)104.25M (F.F.L)

(SCALE- 1:100)



PLAN AT EL(+)108.10, 110.35, 116.00M (F.F.L)

(SCALE- 1:100)

SCHEDULE OF DOORS & WINDOWS							REMARK
TYPE	OPENING SIZE	FRAME SIZE	CILL LEVEL	LINTEL LEVEL	NOS.	DESCRIPTION	
RS-1	4500x3000	4480x2990	–	EL(+)103.60M	1	STEEL ROLLING SHUTTER	AS PER SPECIFICATION
RS-2	5000x5000	4980x4990	–	EL(+)109.25M	2	STEEL ROLLING SHUTTER	
D1	2200x2400	2180x2390	–	EL(+)103.00M EL(+)106.65M	6	DOUBLE SHUTTER STEEL DOOR	
D2	1600x2400	1580x2390	–	EL(+)103.00M EL(+)106.65M	2	DOUBLE SHUTTER STEEL DOOR	
D3	1200x2100	1180x2090	–	EL(+)106.35M	1	SINGLE SHUTTER ALUMINIUM DOOR	
W1	2000x1200	1980x1180	900	EL(+)102.70M EL(+)106.35M	31	ALUMINIUM WINDOW FULLY GLAZED	
V1	2000x600	1980x580	–	SOFFIT OF ROOF BEAM		FIXED ALUMINIUM VENTILATOR	

LEGEND:–

SIDE HUNG OPENABLE PANEL

FIXED GLASS PANEL

FFL. = FINISH FLOOR LEVEL
FGL. = FINISH GRADE LEVEL
H.P. = HIGH POINT
L.P. = LOWER POINT
TOC = TOP OF CONCRETE
FFL = FINISH FLOOR LEVEL
FGL = FINISH GROUND LEVEL

NOTES:–

1 ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2 ALL WINDOWS AND VENTILATORS ON GROUND FLOOR OF ALL BUILDINGS SHALL BE PROVIDED WITH SUITABLE MS GRILL.
3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD (T.B.M.) WHICH IS +100.0M ABSOLUTE ELEVATION.
5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.

REV.	DATE	ALTERED CHD/APPD
ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:–
STRUC MECH ENGINEERS PVT. LTD.
87, OLD A.G. COLONY, KADRU, RANCHI.
☎PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		20.05.19	N.A.
CHD.	Mukesh		20.05.19	
APPD.	Mukesh		20.05.19	

DEPT. TBG CODE	UNTOL DIMS. GR. ¢/M/₹	SCALE N.T.S	WEIGHT (KG) N.A.	REF. TO ASSY. DRG. N.A.	ITEM NO. N.A.	NO. OF ITEMS N.A.

TITLE: 132KV GIS BUILDING ARCHITECTURAL 1st FLOOR PLAN, CRAIN GIRDER LEVEL & TERRACE FLOOR PLAN

CARD CODE: NA

DRG. NO. TB-1-406-607-661-1

REV. 00

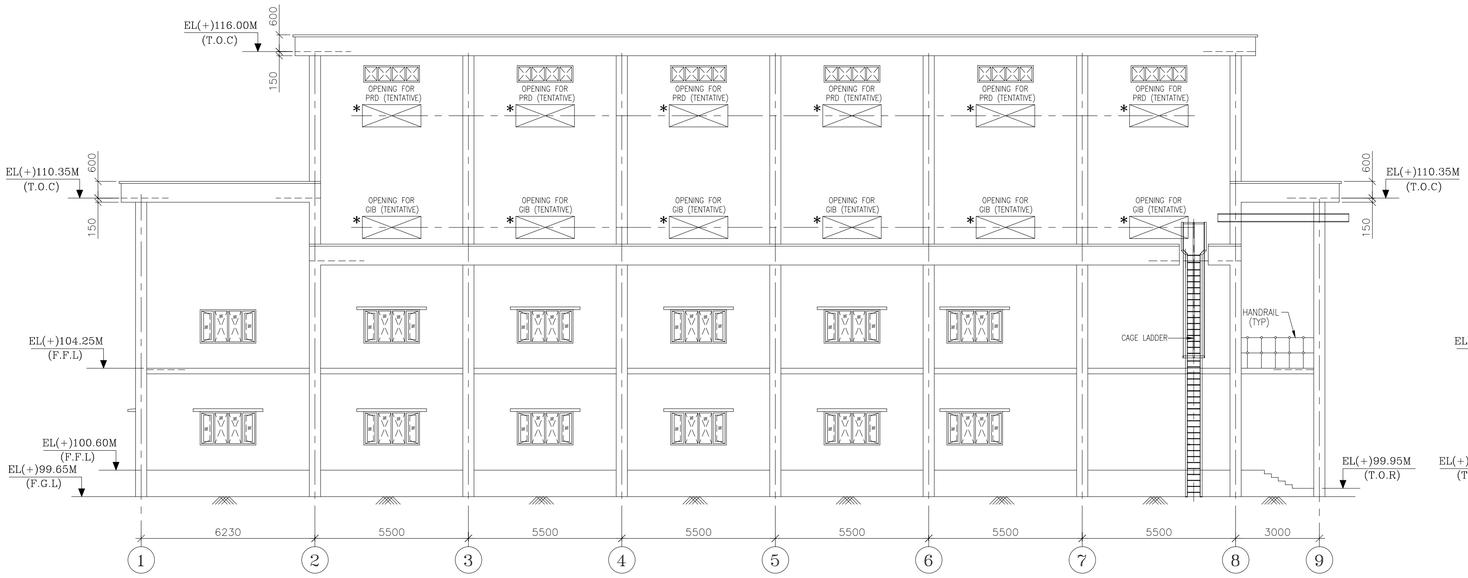
SHT. No 02 NO. OF SHT. 02

SIZE-A1

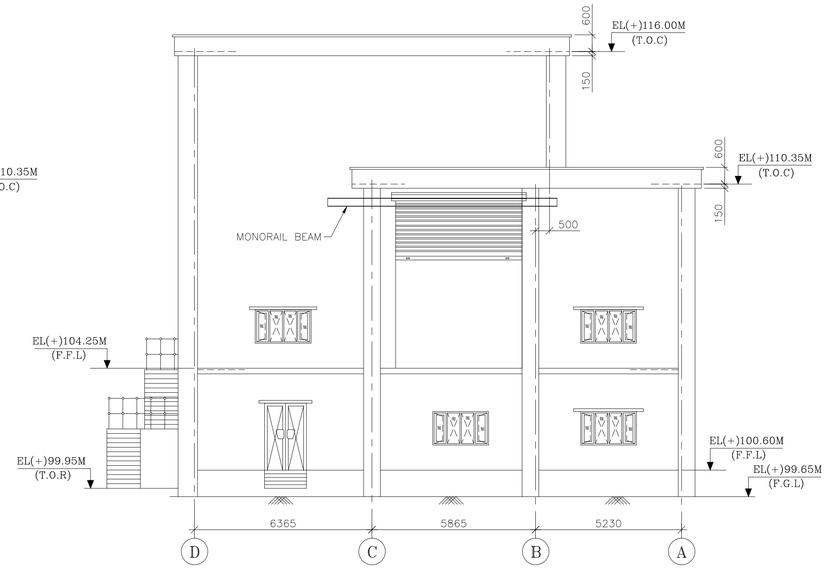
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

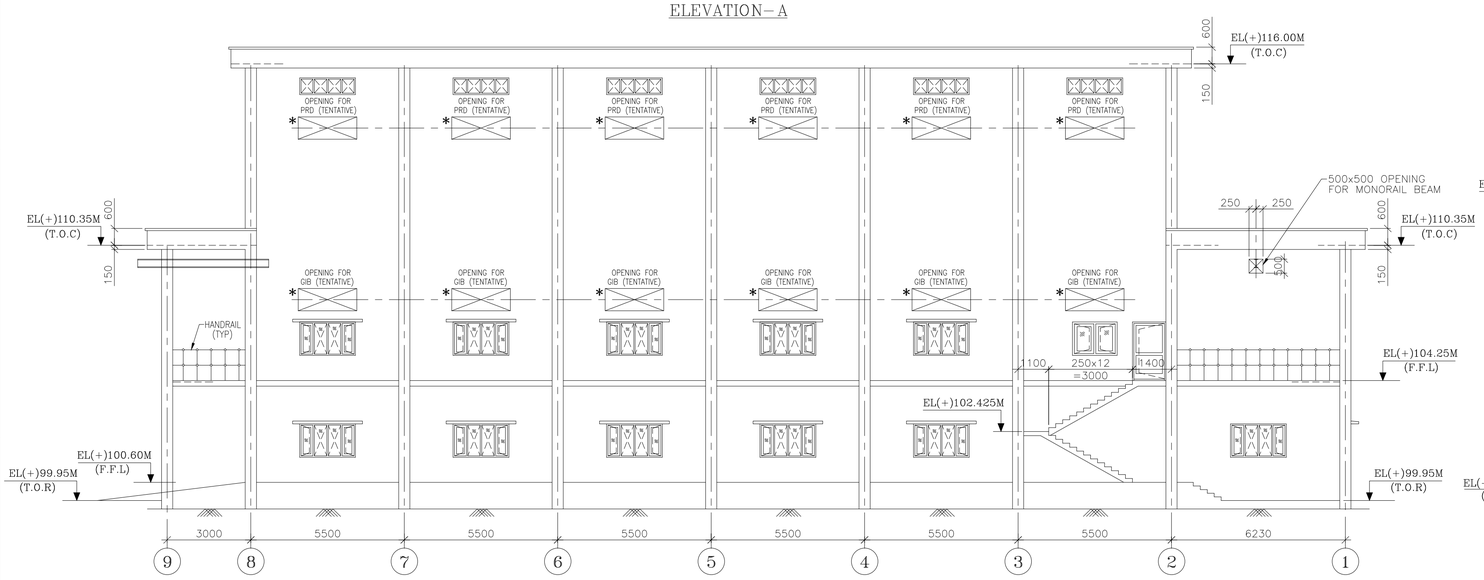
DRG. NO. TB-1-406-607-661-2



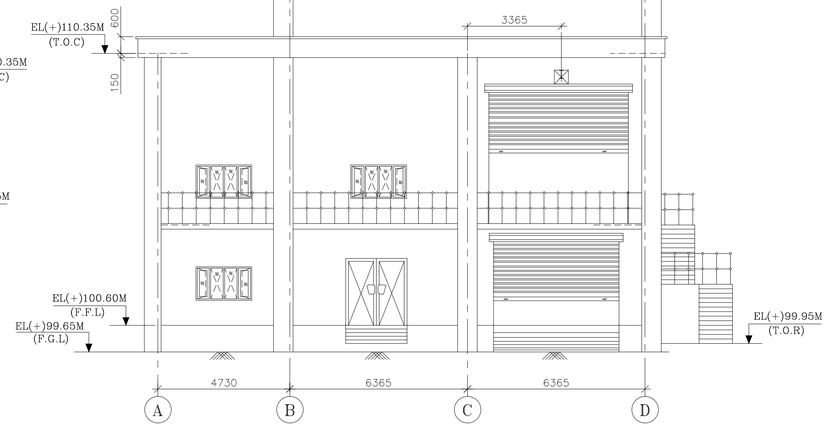
ELEVATION–A



ELEVATION–C



ELEVATION–B



ELEVATION–D

LEGEND:–

- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL
- FFL. = FINISH FLOOR LEVEL
- FGL. = FINISH GRADE LEVEL
- H.P. = HIGH POINT
- L.P. = LOWER POINT
- TOC = TOP OF CONCRETE
- FFL = FINISH FLOOR LEVEL
- FGL = FINISH GROUND LEVEL

* RECTANGULAR CUTOUT TO BE PROVIDED CUTOUT DIMENSION & LOCATION SHALL BE PROVIDED AS PER GIS MANUFACTURE

NOTES:–

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REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:–
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87, OLD A.G. COLONY, KADRU, RANCHI.
PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		20.05.19	N.A.
CHD.	Mukesh		20.05.19	
APPD.	Mukesh		20.05.19	

DEPT. TBG / CODE	UNTOL. DIMS. GR. ∅/M/F	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 132KV GIS BUILDING ARCHITECTURAL ELEVATION

CARD CODE: NA

DRG. NO. TB-1-406-607-661-2

REV. 00

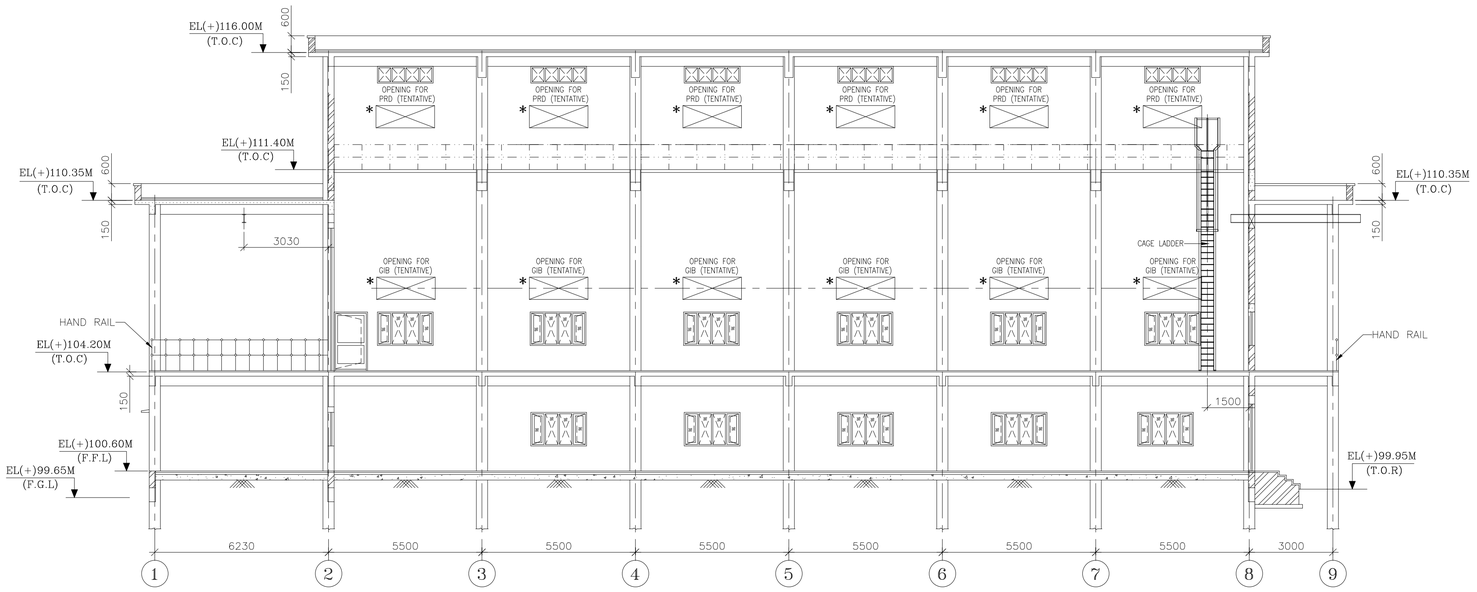
SHT. No 01 NO. OF SHT. 01

SIZE–A1

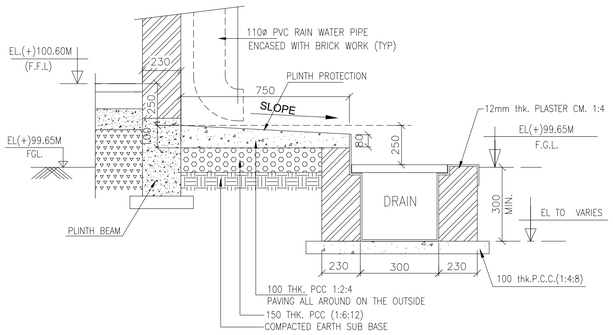
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

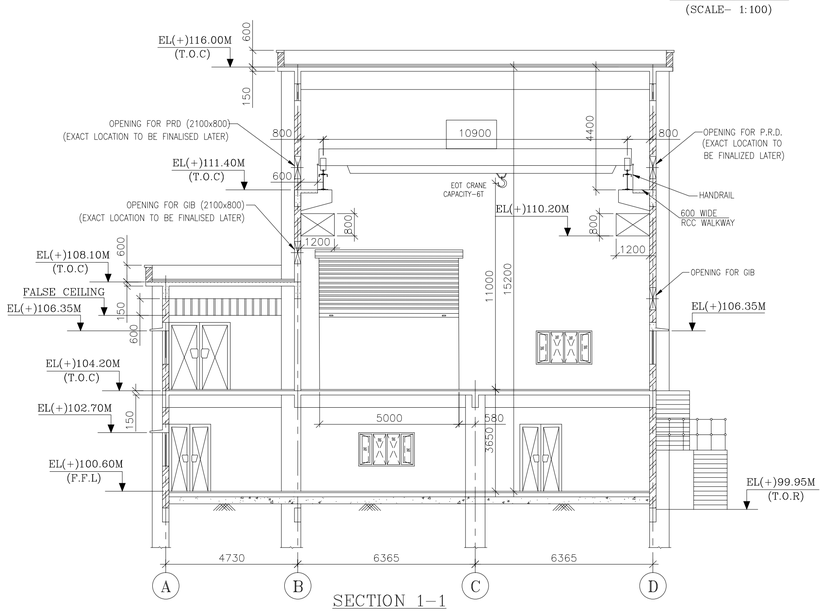
DRG. NO. TB-1-406-607-661-3



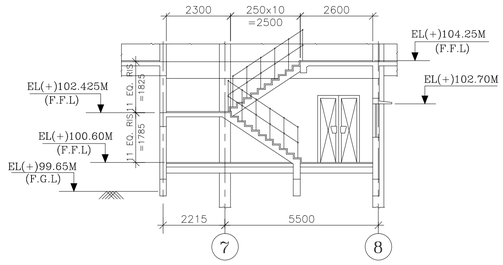
SECTION 2-2
(SCALE- 1:100)



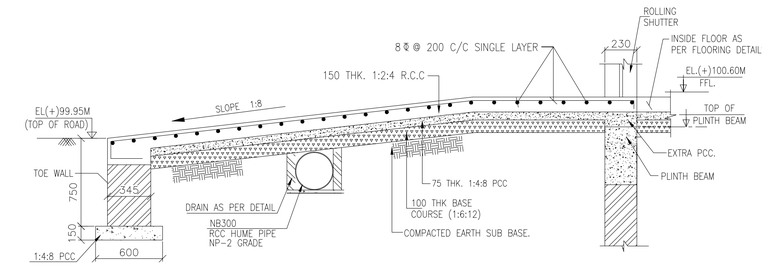
PLINTH PROTECTION ALONG BUILDING WITH DRAIN-TYPICAL



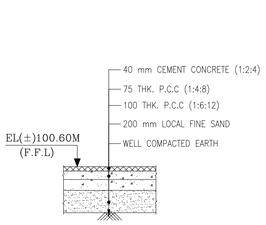
SECTION 1-1
(SCALE- 1:100)



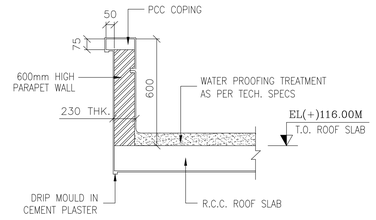
SECTION 3-3
(SCALE- 1:100)



DETAIL OF RAMP



TYP. DETAIL OF FLOORING



TYP. DETAIL OF PARAPET

LEGEND:-

- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL

FFL. = FINISH FLOOR LEVEL
FGL. = FINISH GRADE LEVEL
H.P. = HIGH POINT
L.P. = LOWER POINT
TOC = TOP OF CONCRETE
FFL = FINISH FLOOR LEVEL
FGL = FINISH GROUND LEVEL

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NOTES:-

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REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
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	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		20.05.19	N.A.
CHD.	Mukesh		20.05.19	
APPD.	Mukesh		20.05.19	

DEPT. TBG CODE	UNTOL. DIMS. GR. C/M/F	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 132KV GIS BUILDING ARCHITECTURAL SECTIONS

CARD CODE: NA

DRG. NO.: TB-1-406-607-661-3

REV.: 00

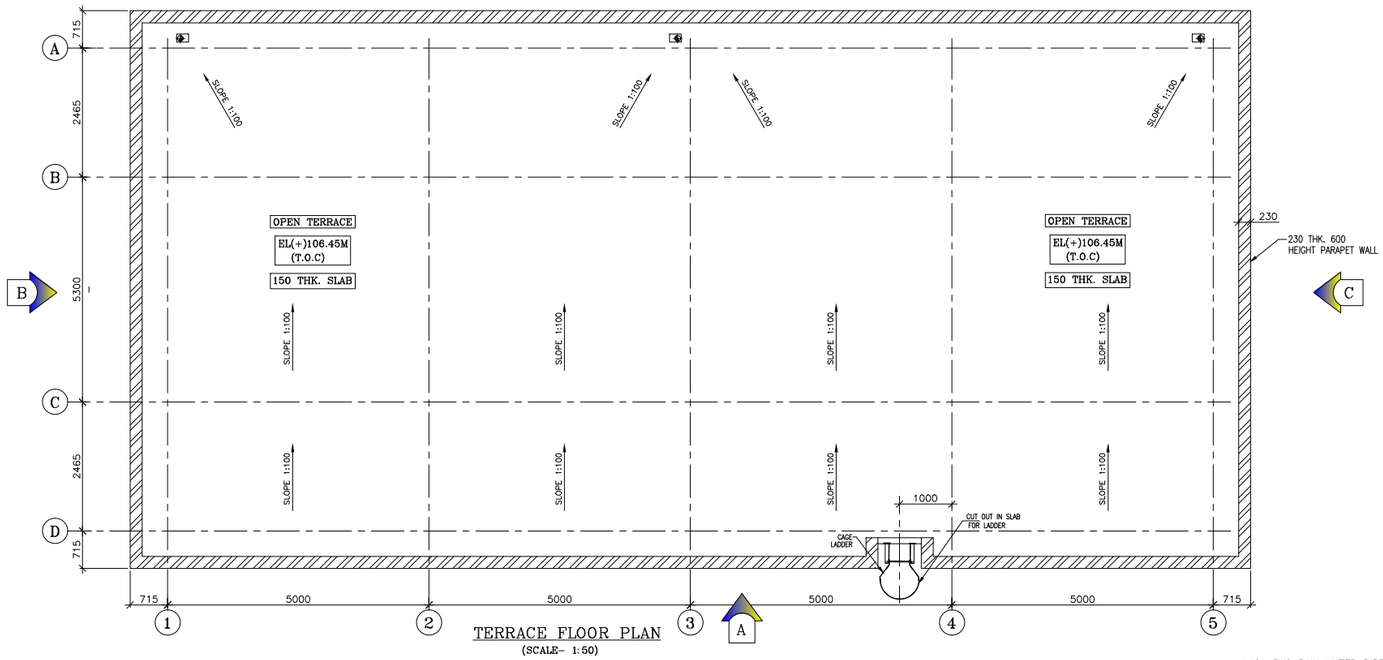
SHT. No 01 | NO. OF SHT. 01

SIZE-A1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-1-406-607-671



TERRACE FLOOR PLAN

(SCALE- 1:50)

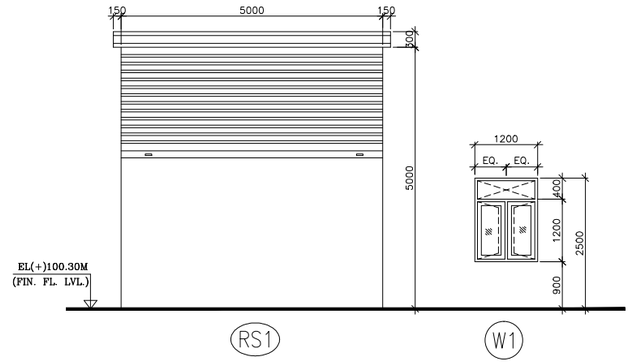
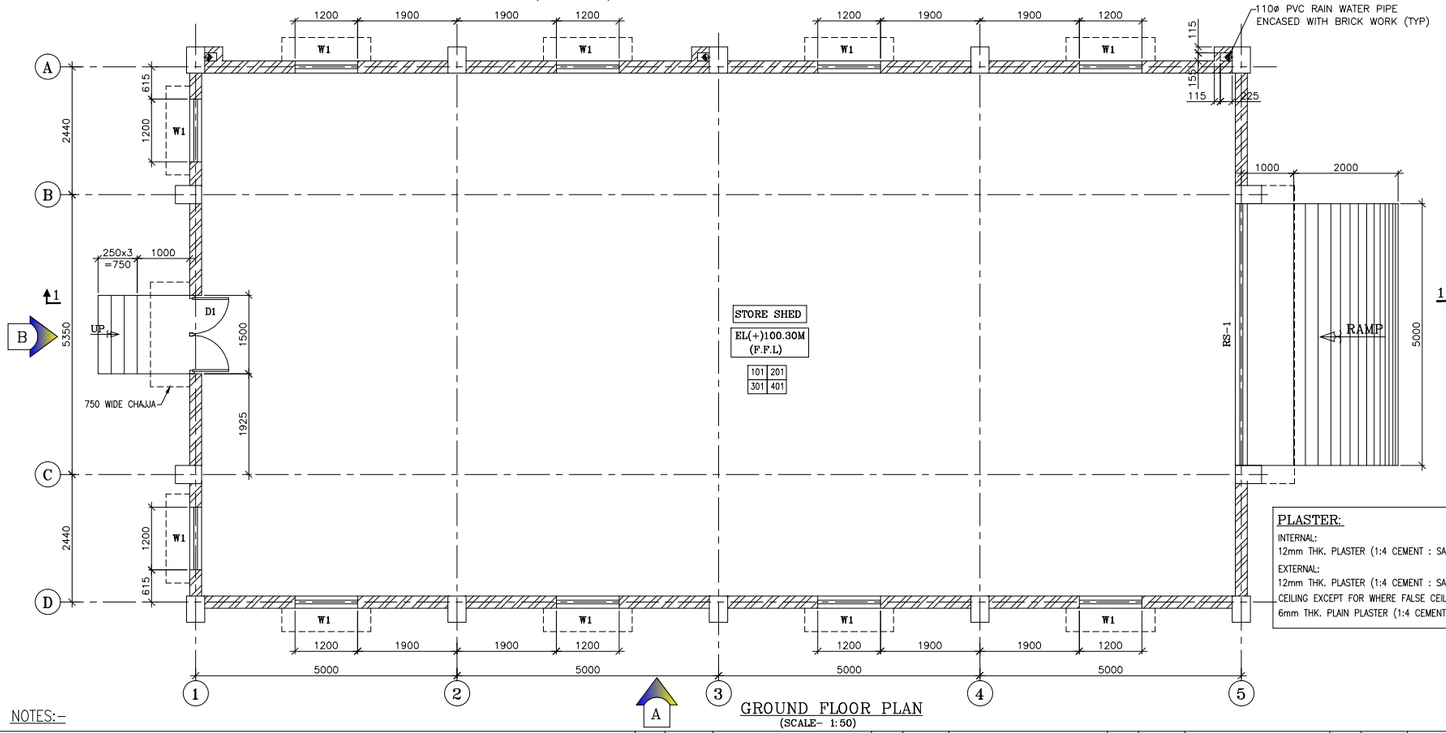


ILLUSTRATION OF FINISHES.		FINISHES OF SCHEDULE		
WALL SERIES 100 / FLOORING SERIES 200 / CEILING SERIES 300 / SKIRTING/ DADO SERIES 400		WALL FINISHES–		
		SR.NO.	CODE NO.	DESCRIPTION
		1.	101	ACRYLIC DISTEMPER
				EXTERNAL FINISHED OF WALL–WATER PROOF CEMENT PAINT SNOWCEM PLUS
SKIRTING/DADO FINISHES		FLOORING FINISHES		
1.	401 20mm THK. (1:2) CEMENT PLASTER SKIRTING 150 MM HIGH	1.	201	CEMENT CONCRETE FLOORING(1:2:4) 40mm THK. WITH GLASS STRIP PANEL
CEILING FINISHES				
1.	301 ACRYLIC DISTEMPER			

WATER PROOFING ON ROOF

PROVIDING AND APPLYING FOUR COURSES OF WATER PROOFING TREATMENT AT ROOFS CONSISTING FIRST COURSE OF STRAIGHT RUN 85/25 GRADE BITUMEN CONFIRMING TO I.S. 73–1961@0.7 KG/SQM, SECOND COURSE OF ROOF GUARD CONSISTING OF POLYTHENE SHEETS WEIGHTING 0.12 KG/ SQM, WITH 75MM OVER LAPS, ALONG ROOF SLOPE, THIRD COURSE OF COLD CUT BACK BITUMEN B.S. GRADE @ 1.0 KG/ SQM AS PER I.S. 7290 AND THE FOURTH AND FINAL COURSE OF 1:1.5:3 CEMENT CONCRETE, 25MM THICK WITH WATER PROOFING COMPOUND (RECRON.3S) AS PER SPECIFICATIONS, INCLUDING ALL MATERIALS, LABOUR AND T & P ETC. REQUIRED FOR PROPER COMPLETION OF WORK.



GROUND FLOOR PLAN

(SCALE- 1:50)

SCHEDULE OF DOORS & WINDOWS

TYPE	OPENING SIZE	FRAME SIZE	CILL LEVEL	LINTEL LEVEL	NOS.	DESCRIPTION
RS1	5000x5000	5000x5000	–	+105.30M	1	STEEL ROLLING SHUTTER
W1	1200x1600	1180x1580	900	+102.80M	10	STEEL WINDOW FULLY GLAZED
D1	1500x2500	1480x2490	–	+102.80M	1	DOUBLE SHUTTER STEEL DOOR

PLASTER:

INTERNAL:
12mm THK. PLASTER (1:4 CEMENT : SAND)

EXTERNAL:
12mm THK. PLASTER (1:4 CEMENT : SAND)
CEILING EXCEPT FOR WHERE FALSE CEILING WILL BE PROVIDED.
6mm THK. PLAIN PLASTER (1:4 CEMENT : SAND)

NOTES:–

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3. ALL DOOR–WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.
4. EL(±)0.00M CORRESPONDS TO TOP LEVEL OF ROAD (T.B.M.) WHICH IS +100.0M ABSOLUTE ELEVATION.
5. EL. (+)99.95 M CORRESPONDS TO TOP OF SWITCHYARD ROAD.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
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STRUCTURAL CONSULTANTS:–
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PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	Subrata		01.05.19	N.A.
CHD.	Mukesh		01.05.19	
APPD.	Mukesh		01.05.19	

DEPT. TBG	UNTOL. DIMS. GR. ¢/M/F		SCALE N.T.S	WEIGHT (KG) N.A.	REF. TO ASSY. DRG. N.A.	ITEM NO. N.A.	NO.OF ITEMS N.A.
CODE							

TITLE
STORE SHED ARCHITECTURAL
GROUND FLOOR & TERRACE FLOOR PLAN

CARD CODE NA

DRG.NO. TB-3-406-607-671

REV. 00

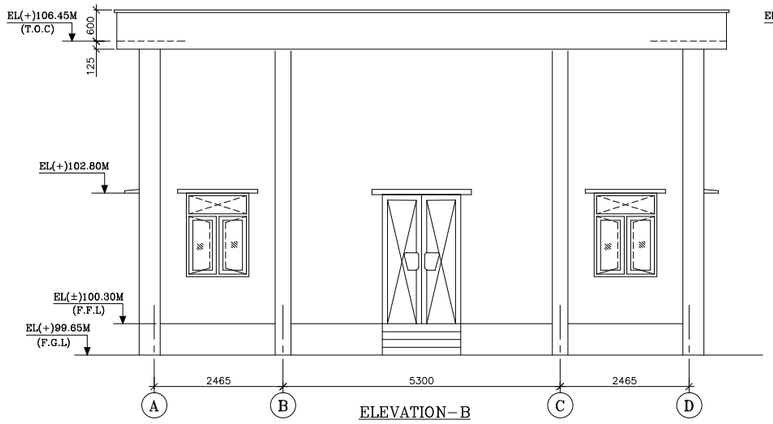
SHT. No 01 NO. OF SHT. 01

SIZE–A3

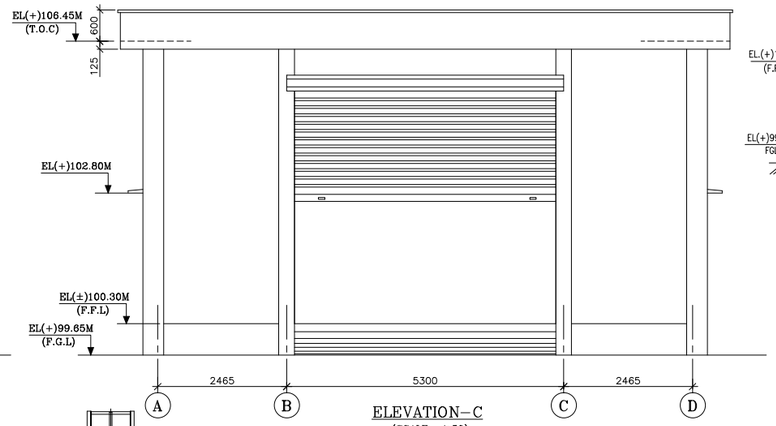
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

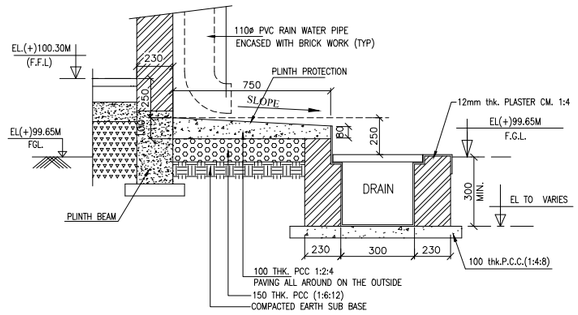
DRG. NO. TB-1-406-607-672



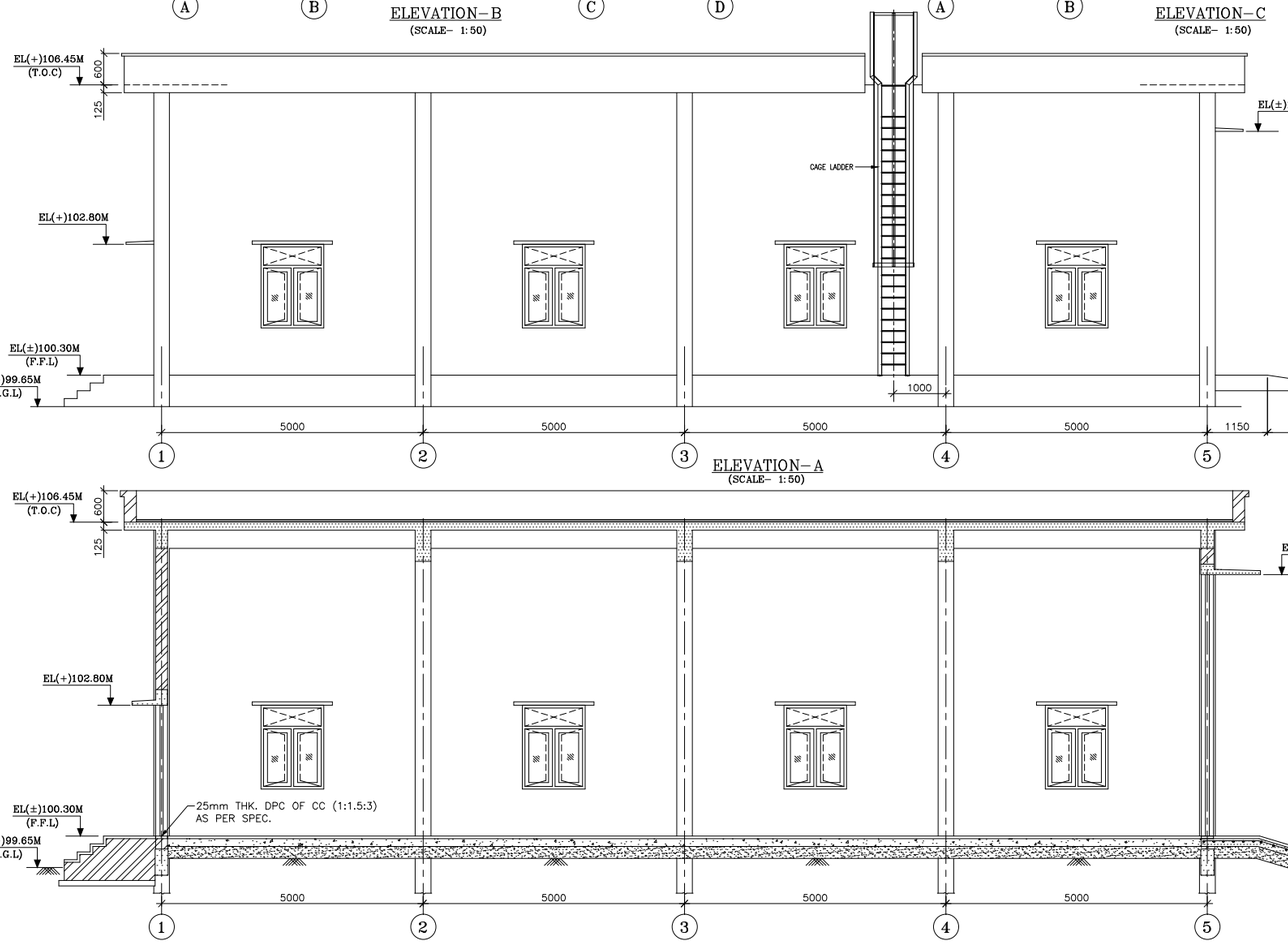
ELEVATION–B
(SCALE– 1:50)



ELEVATION–C
(SCALE– 1:50)

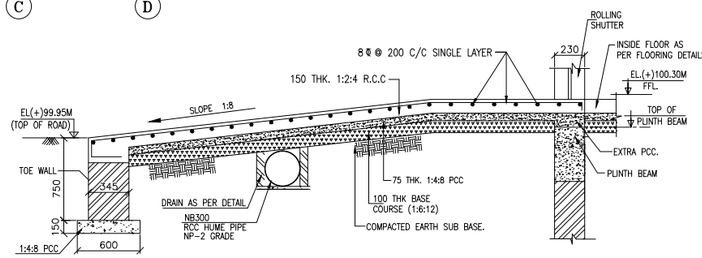


PLINTH PROTECTION ALONG BUILDING WITH DRAIN–TYPICAL

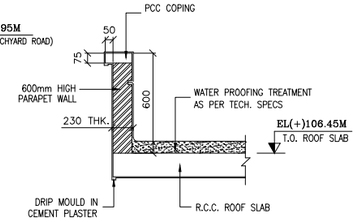


ELEVATION–A
(SCALE– 1:50)

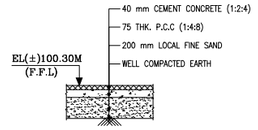
SECTION 1–1
(SCALE– 1:50)



DETAIL OF RAMP



TYP. DETAIL OF PARAPET



TYP. DETAIL OF FLOORING

LEGEND:–

- SIDE HUNG OPENABLE PANEL
- FIXED GLASS PANEL

FFL. = FINISH FLOOR LEVEL
FGL. = FINISH GRADE LEVEL
H.P. = HIGH POINT
L.P. = LOWER POINT
TOC = TOP OF CONCRETE
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FGL = FINISH GROUND LEVEL

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		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE			ZONE		

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

STRUCTURAL CONSULTANTS:–
STRUC MECH ENGINEERS PVT. LTD.
87, OLD A.G. COLONY, KADRU, RANCHI.
PH. 0651 2340631, FAX 0651 2340631

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	Subrata		01.05.19	N.A.
CHD.	Mukesh		01.05.19	
APPD.	Mukesh		01.05.19	

DEPT. TBG	UNTOL. DIMS.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
CODE	GR. ¢/M/F		N.T.S	N.A.	N.A.	N.A.	N.A.

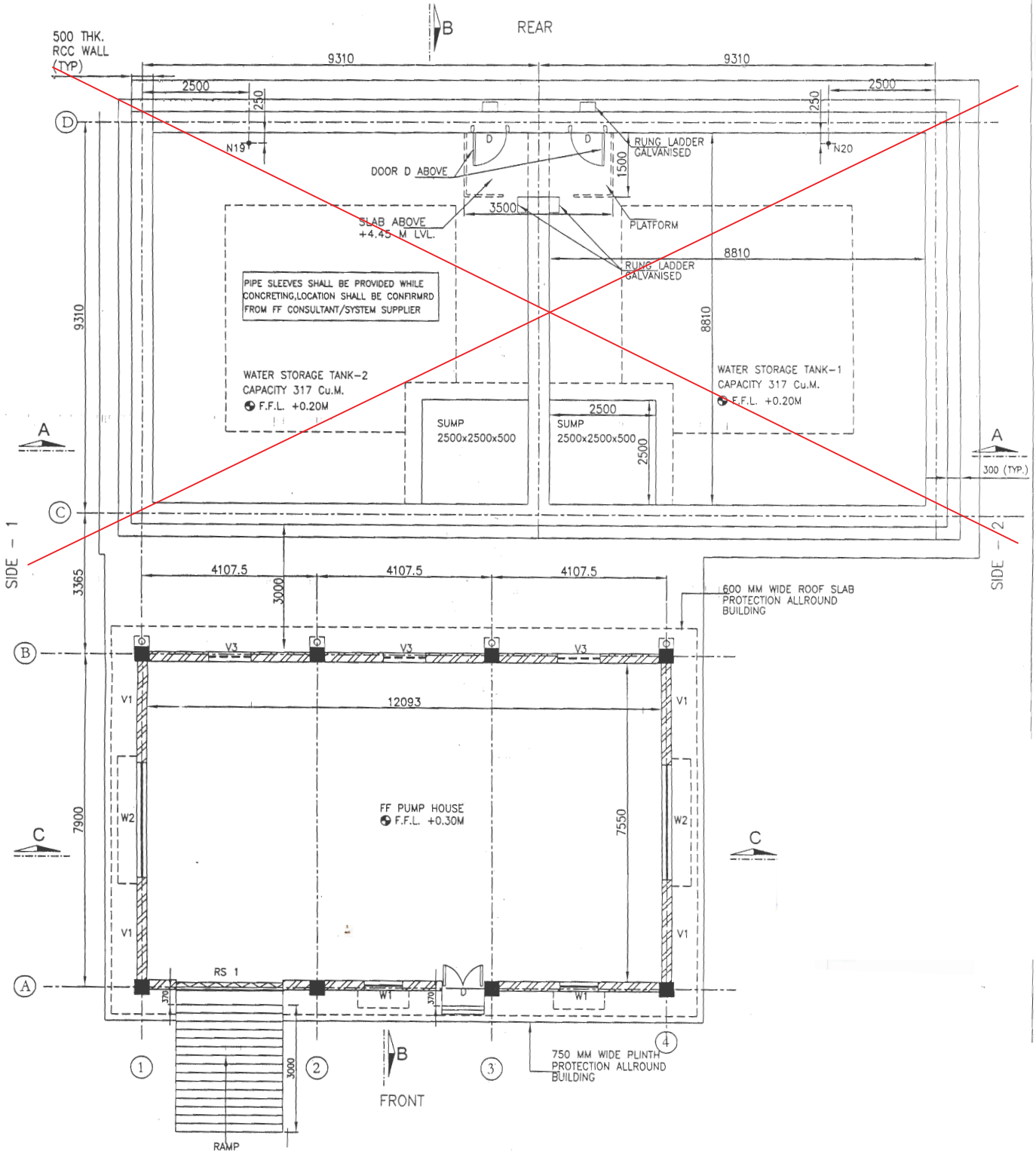
TITLE: STORE SHED ARCHITECTURAL ELEVATION & SECTION

CARD CODE: NA

DRG.NO. TB–3–406–607–672 REV. 00

SHT. No 01 NO. OF SHT. 01

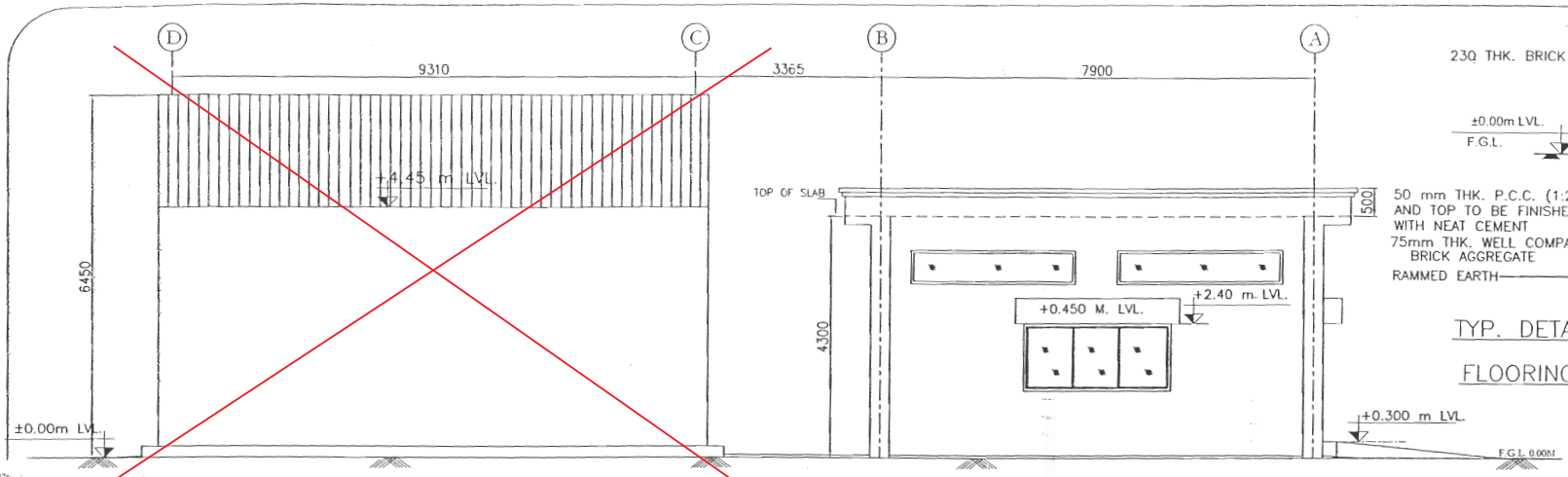
SIZE–A3



GROUND FLOOR PLAN FOR FFPH & WATER TANK

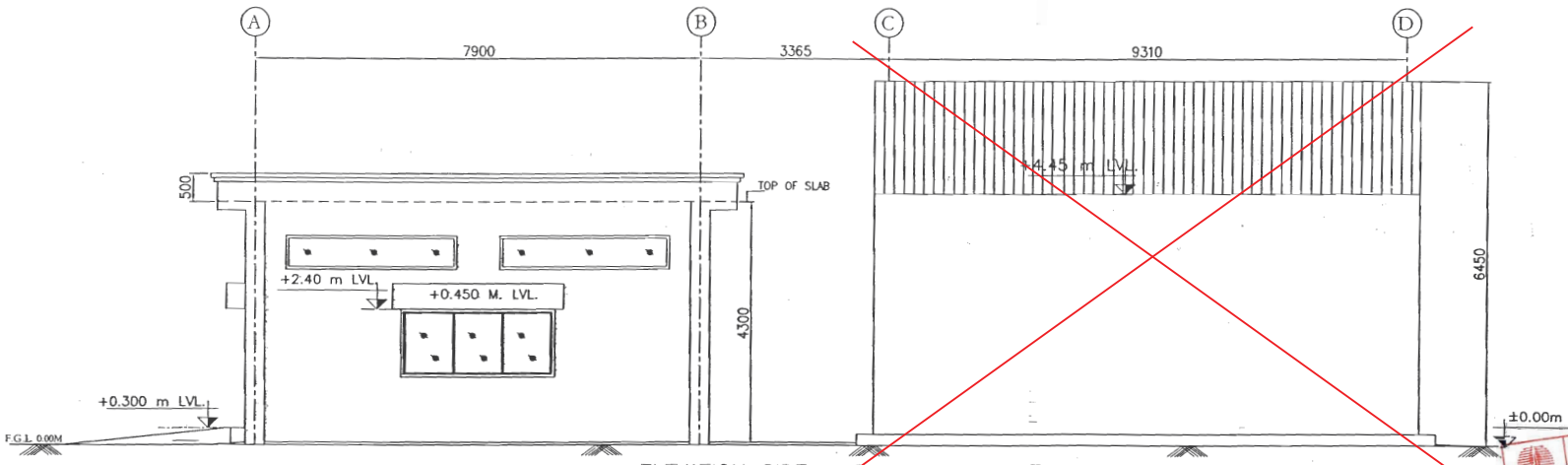
APPROVED BY ED (ENGG.TL-SS-CIVIL) VIDE NOTE REFERENCE NO. C/ENGG/STD.DRG. /Civil Works/ 03/2016.DTD. 20.12.2016

REV.	DESCRIPTION	PREP.	REVD.	REVD.	REVD.	REVD.	REVD.	REVD.	APPD.	DATE
		JE(ENGG-CML)	ACDE(ENGG-CML)	(ENGG-ELECT.)	CDE (ENGG-CML)	ASTT.GM (ENGG-CML)	GM (ENGG-CML)	(ENGG-ELECT.)	GM (ENGG-CML)	
0.	REVISED AS WITNESS									

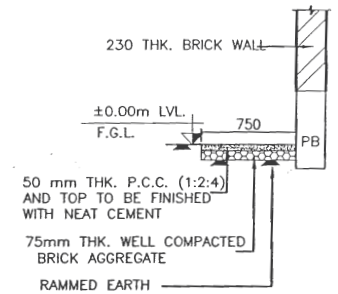


ELEVATION SIDE – 1

TYP. DETAILS FOR PLINTH PROTECTION AND FLOORING DETAILS FOR FFPH BUILIDING



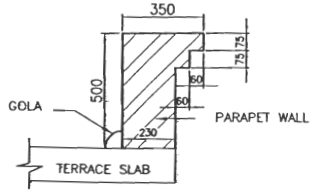
ELEVATION SIDE – 2



TYP. DETAILS FOR PLINTH PROTECTION

SCHEDULE OF OPENING:-

SR. NO.	OPENING MARK	SIZE WXD mm	CILL LVL. mts.	LINTEL LVL. mts.	NOS.	DESCRIPTION
01	ROLLING SHUTTER RS1	2500X3400	+0.300	+3.70	01	STANDERED STEEL ROLLING SHUTTER
02	DOOR D	1000X2100	+0.300	+2.40	01	M.S. DOOR FRAME WITH M.S. SHEET DOUBLE SHUTTER
03	DOOR D1	900X1850	+4.45	+6.3	02	Aluminm glazed With 5.5mm,Thik Glass Separately under relevant BPS item along with hydralic floor spring & martic lock
04	WINDOW W1	900X1200	+1.20	+2.40	02	Sliding Glazed Windows With Aluminium Grill
05	WINDOW W2	2700X1200	+1.20	+2.40	02	Sliding Glazed Windows With Aluminium Grill
06	VENTILATOR V1	3010X600	AT BEAM	BOTTOM	04	as per manufacture speciation
07	VENTILATOR V3	1000X600	AT BEAM	BOTTOM	03	as per manufacture speciation



TYP. DETAILS OF CORBELLING FOR PARAPET AT ROOF LEVEL

निर्माण हेतु जारी
उपकेन्द्र के लिए! Jeerat &
Mediniपुर S/S.
(हस्ताक्षर)
(नाम)
(तिथि)
पावरग्रिड कारपोरेशन ऑफ इंडिया लि० अभियांत्रिकी (सिविल), गुड़गाँव, हरियाणा

APPROVED BY ED (ENGG.TL-SS-CIVIL) VIDE NOTE REFERENCE NO. C/ENGG/STD.DRG. /Civil Works/03/2016. DTD. 20.12.2016

RELEASED FOR TENDER/CONSTRUCTION.

FOR NOTES REFER DRG. NO.:- C/ENGG/STD/FFPH/16 OF 16

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

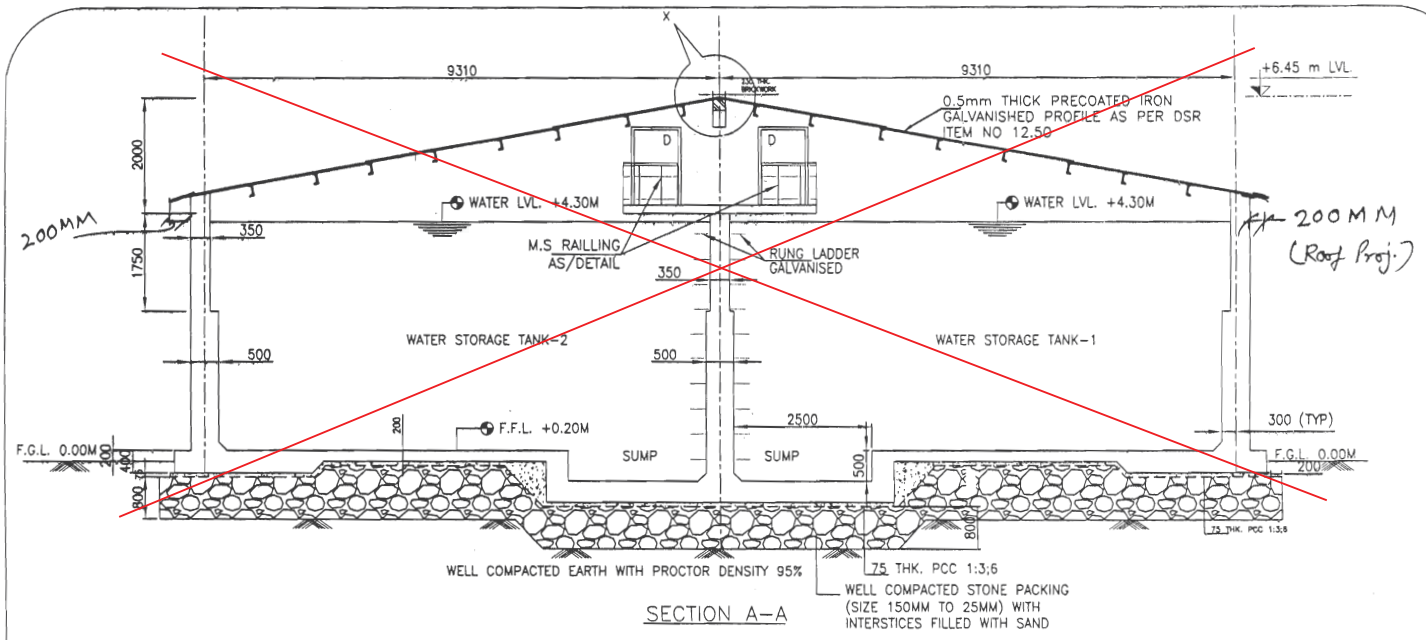
TITLE: STANDARD FIRE FIGHTING PUMP HOUSE & WATER TANK.

SUB TITLE: ELEVATION FOR FIRE FIGHTING PUMP HOUSE & WATER TANK

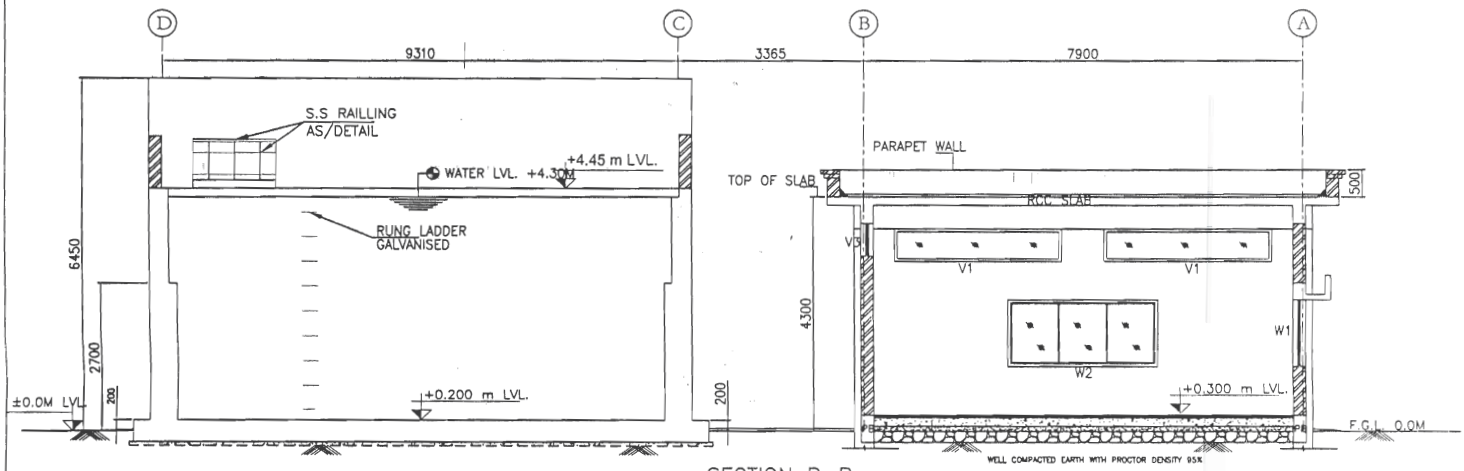
DRAWING NO: C/ENGG/STD/FFPH/2016/2 OF 16

REV.	DESCRIPTION	PREP.	REVD.	REVD.	REVD.	REVD.	REVD.	REVD.	APPD.	DATE
0.	REVISED AS MARKED									

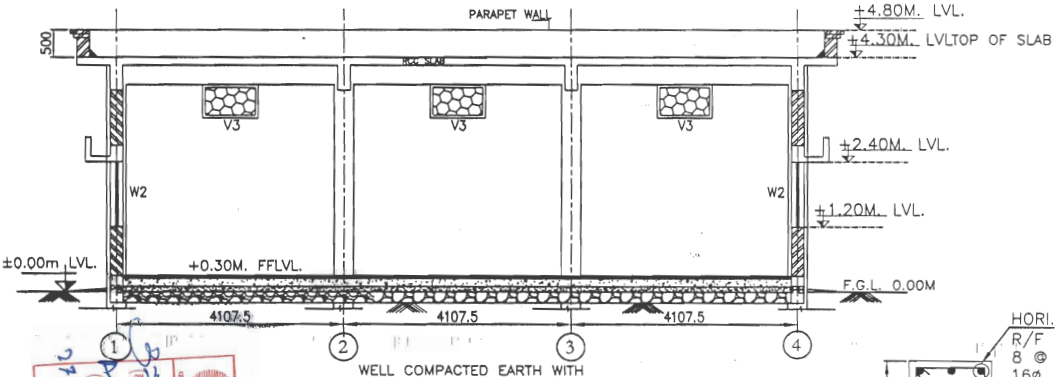
SCALE NTS | REV 0



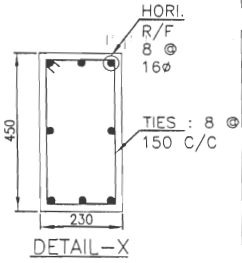
SECTION A–A



SECTION B–B



SECTION C–C



DETAIL–X

APPROVED BY ED (ENGG.TL-SS-CIVIL) VIDE NOTE REFERENCE NO. C/ENGG/STD.DRG. /Civil Works/03/2016DTD. 20.12.2016

RELEASED FOR TENDER/CONSTRUCTION.

FOR NOTES REFER DRG. NO.:- C/ENGG/STD/FFPH/16 OF 16

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

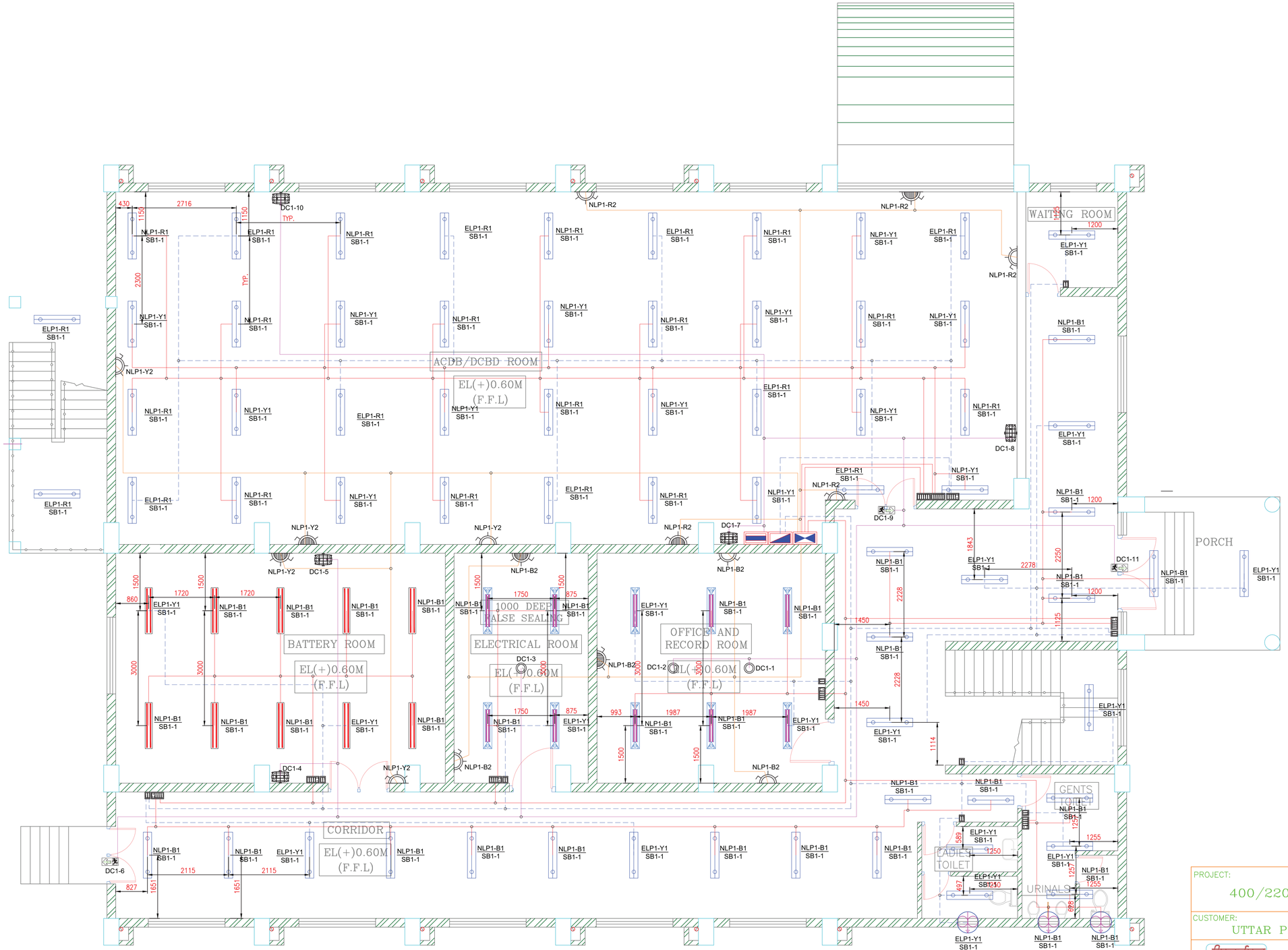
TITLE:
STANDARD FIRE FIGHTING PUMP HOUSE & WATER TANK.

SUB TITLE:
SECTION FOR FIRE FIGHTING PUMP HOUSE & WATER TANK

DRAWING NO:
C/ENGG/STD/FFPH/2016/4 OF 16

SCALE NTS | REV 0

REV.	DESCRIPTION	PREP. JE(ENGG-CIVIL)	REVD. ACDE(ENGG-CIVIL)	REVD. (ENGG-ELECT.)	REVD. CDE (ENGG-CIVIL)	REVD. ASTT.GM (ENGG-CIVIL)	REVD. AGM (ENGG-CIVIL)	REVD. (ENGG-ELECT.)	APPD. GM (ENGG-CIVIL)	DATE
0.	REVISED AS MARKED									10/1/17



CONDUIT IDENTIFICATION:

LIGHTING CONDUIT (NORMAL)
DC CONDUIT
POWER CONDUIT
LIGHTING CONDUIT (EMERGENCY)

GROUND FLOOR PLAN

(SCALE– 1:75)

PROJECT:
400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:
UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

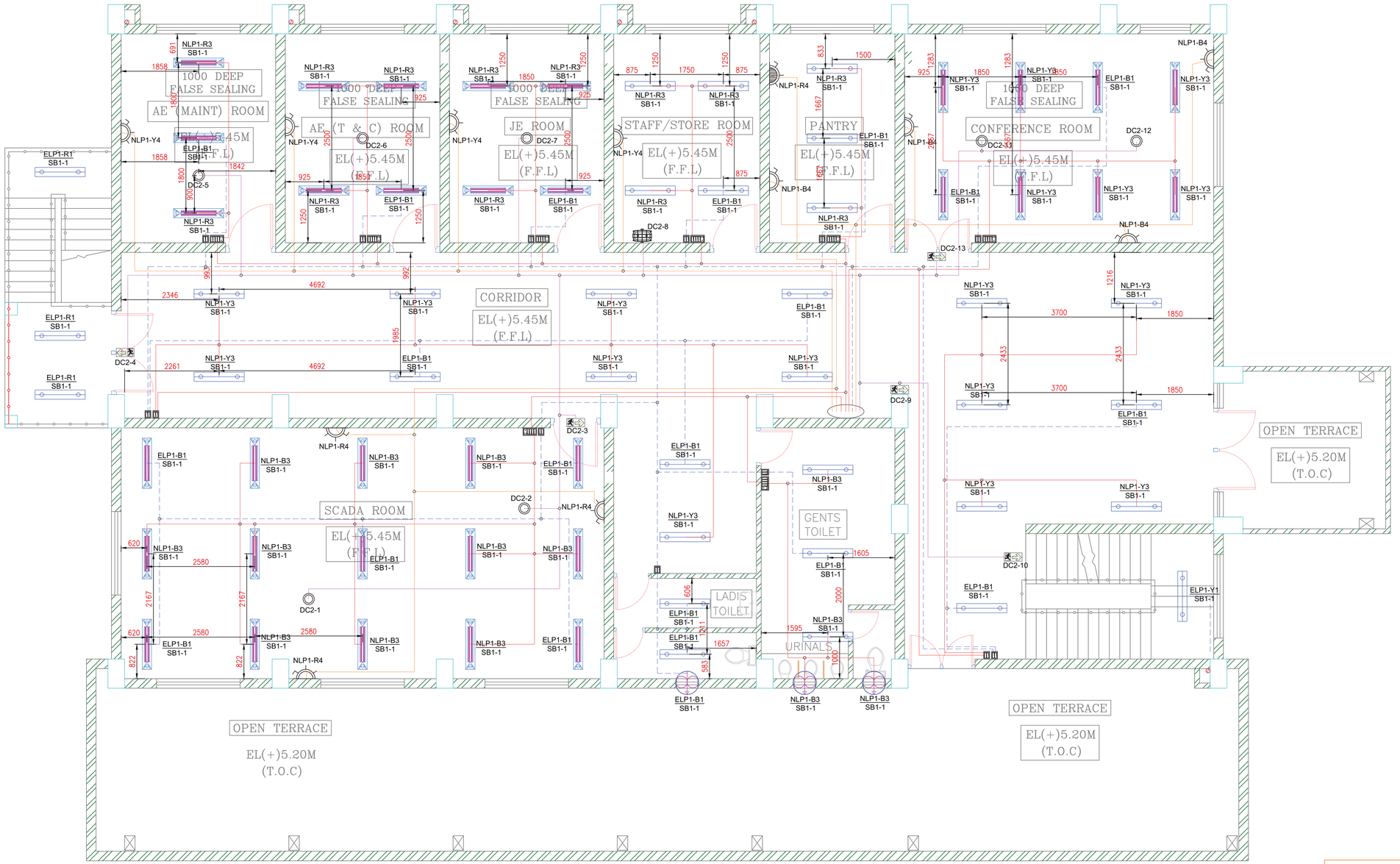
	NAME	SIGN.	DATE
DRN.			
CHD.			
APPD.			

TITLE: CONTROL ROOM BUILDING CONDUIT LAYOUT

DRG. NO.: ATV-BHEL-UPPTCL-S-L-101

REV.: 00

SCALE: N.T.S | SHEET: 01 OF 02



CONDUIT IDENTIFICATION:

LIGHTING CONDUIT (NORMAL)
DC CONDUIT
POWER CONDUIT
LIGHTING CONDUIT (EMERGENCY)

A

FIRST FLOOR PLAN

(SCALE– 1:75)

PROJECT:

400/220/132kV GIS SUBSTATION AT SHAMLI (U.P.)

CUSTOMER:

UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

	NAME	SIGN.	DATE
DRN.			
CHD.			
APPD.			

TITLE: CONTROL ROOM BUILDING CONDUIT LAYOUT

DRG. NO.: ATV-BHEL-UPPTCL-S-L-101

REV.: 00

SCALE: N.T.S

SHEET: 02 OF 02