Technical Specification for

11 kV Packaged Substation

(With 250 / 400 / 630/ 1000 kVA Distribution Transformer - Hermetically Sealed Oil Type / Dry Type Transformer)

Specification no – SP-PSSC-38-R7

Prepared by		Reviewed by		Approved by		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
Rohit Patil		Amit Tomar		K Sheshadri		R7	23/04/2020

Index

Record of Revision

Revision No	Item / clause no.	Nature of Change/Clause Descriptions	Approved By
R3	4.2.13, 14.24	Added- 02 no's Smoke detectors for each compartment	DS
R3	4.2.15	Fire extinguisher position is added.	DS
R3	5.2.5	Anti-theft hinges are changed to Internal anti-theft hinges with opening angle of 120 deg. minimum.	DS
R3	5.2.6	Added – Operating Handle support	DS
R3	5.2.15.2	Bus bar short time withstand capacity changed to 20kA for 3 sec	DS
R3	5.2.18	Routing of control / auxiliary wiring is added	DS
R3	5.2.24.1	Added – Avoid any type of Gaps or holes on the cable termination chamber wall.	DS
R3	5.2.24.2,3	Added – internal arc rating	DS
R3	5.3.3	Separate ON/OFF switching for each motor is added	DS
R3	5.3.9	LBS short time withstand capacity revised to 20kA for 3 sec	DS
R3	5.3.10	LBS fault making capacity revised to 50kA peak	DS
R3	5.3.11	Mechanism endurance class M1 and Electrical Endurance class E3 specified	DS
R3	5.3.12	Minimum no. of operations at rated fault current specified – Electrical endurance class E3	DS
R3	5.4.2	CB arc interruption medium only in Vacuum bottle	DS
R3	5.4.4	Added – Protective flap on Emergency PB	DS
R3	5.4.6	20kA short time withstand capacity specified	DS
R3	5.4.7	Mechanical – M1 & Electrical-E2 endurance class specified for circuit breaker module	DS
R3	5.4.8	CB fault making capacity revised to 50kAspecified	DS
R3	5.4.9	CB fault breaking capacity revised to 20kA	DS
R3	5.4.10	Electrical Endurance – Class E2 specified for CB at fault current	DS
R3	5.4.12	Protection CT type specified- cast resin ring type	DS
R3	5.5.7	No load mechanical endurance class M0 specified for earth switch	DS
R3	5.5.8	Making capacity endurance class E2 specified	DS
R3	5.7.5.1	Added – Prevent electrical operation if handle is inserted for manual operation	DS
R3	5.7.5.2	Added – Supply to the motor shall be disconnected after certain time period if LBS fails to operate.	DS

R3	5.9.0	Sticker type mimic diagram non acceptance specified	DS
R3	5.9.2.5, 7.3.1.5, 7.19.1.5, 14.2	Added – Ref. IS / IEC No. on name plate	DS
R3	6.8, 7.3.8.1, 8.3.4.7	HV side bushings of transformer- Epoxy cast, 630 A, Interface type 'C'	
R3	7.2.2.6.5	Delta connection leads for Oil type transformer are defined to be with flexible cable connection	DS
R3	7.3.10.4, 5 and 8.3.5.3 and 4	Accuracy class and VA rating of the LTCT changed to 0.5s and 5 VA respectively.	DS
R3	8.5	Control / Auxiliary cables are changed to FRLS.	DS
R3	13.23	Specified – Internal arc classification	DS
R3	15.1.1, 15.2	Name plate materials are defined to be of SS material including BSES insignia and danger plate.	DS
R3	4.6, 9.2.0	Number of outgoing feeders specified Type I- 07 No's Type II- 05 No's Type III- 03 No's	DS
R3	4.2.2, 5.1.1	Requirement of 4 way RMU has been added for PSS type – I	DS
R4	2	IS 1180(2014) added	KKA
R4	7.2.1	Rating 990KVA changed to 1000KVA as per IS 1180 (2014)	KKA
R4	7.2.4	Impedance of 400KVA & 630KVA changed 4.5 %	KKA
R4	7.2.5.1 & 7.2.5.2	Total losses at 50% & 100% load updated as per IS 1180(2014)	KKA
R4	7.2.8	Flux density at 10% over excitation changed to 12.5% over excitation	KKA
R4	7.2.10	Tapping range changed to +5% to -10%	KKA
R4	7.3.5.2	Core material M4 to M3	KKA
R4	7.3.11.1	Range /Step changed to +5% to -10% in step of 2.5%	KKA
R4	8.3.1.2 & 8.3.1.3	Core material grade changed to M4 to M3 & Max Lamination Thickness changed .27mm to .23mm	KKA
R4	8.3.2.1 & 8.3.2.2	Winding material changed Electolytic ALuminum and Max Current density 1.5A/Sqmm	KKA
R5	7.2.5.1 & 7.2.5.2	Total losses at 50% & 100% load changed to Energy Efficiency level 1 from Energy Efficiency level 3 as per IS 1180(2014)	KKA

R6	10.2.2 & 10.2.10-13	MCCB Specifications revised	AT/VP
R6	7.2.5	Max losses revised	AT/VP
R6	13	Inspection expenses added	AT/VP
R7	4.0	PSS Configuration-added PSS type –IV	AT/KS
R7	9.0	Low Voltage Bus bar system-Bus bar rating of PSS-IV added	AT/KS
R7	10.0	Low Voltage switchgear, ACB,MCCB & fuses added	AT/KS
R7	13	Enclosure for package substation modified	AT/KS
R7	16	Approved Makes list added	AT/KS
R7	Annexure C	GTP added	AT/KS
R7	Annexure F	BOM for 250 kVA PSS added	AT/KS
R7	5.1.0	RMU Configuration clarified	AT/KS
R7	5.2.0	RMU panel construction –GI sheet added, sheet thickness specified from 2 to 2.5 mm.	AT/KS
R7	5.3.0	Load break switch / Isolator (LBS)-elaborated	AT/KS
R7	5.4.0	Circuit Breaker-parameters specified	AT/KS
R7	5.5.0	Earth switch-three position concept added.	AT/KS
R7	5.7.0	RMU operation interlocks- mechanical interlock mentioned	AT/KS
R7	5.8.0	Indication and signals modified	AT/KS
R7	5.10.0	Quality assurance-added	AT/KS
R7	5.11.0	Inspection and testing –specified	AT/KS
R7	5.13.0	Special Technical requirement-added	AT/KS

R7	5.14.0	Make List of RMU's Accessories-fixed and added	AT/KS
R7	7.2.4	Impedance at 75 deg C for 250 KVA added	AT/KS
R7	7.2.5	Losses at 75 deg C updated and 250 KVA added	AT/KS
R7	7.2.8	Flux density at rated conditions	AT/KS
R7	7.3.5.3 8.3.1.6	Core Design Features-Type of core added	AT/KS
R7	7.3.6.5	Winding Design features-Type of windind added	AT/KS
R7	7.3.10.7 8.3.5.6	CT ratio for 250 KVA added	AT/KS
R7	7.3.11.4	Rated Current for tap Switch for 250 KVA added	AT/KS
R7	8.1.13 8.1.14 8.1.15	E2C2F1 Certification for dry Type DT added	AT/KS
R7	8.2.5	Temperature for losses revised and 250 KVA added	AT/KS
R7	8.2.7 8.3.1.5	Flux density-maximum value at overfluxing revised	AT/KS
R7	8.3.1.4	Design Flux Density at rated conditions at principal tap	AT/KS
R7	18.1	Type test and special test details for transformer added	AT/KS
R7	18.3.2.2	IR value revised	AT/KS
R7	13.14	Degree of ingress protection against solids & water for transformer compartment revised	AT/KS
R7	16.0	Approved makes revised	AT/KS
R7	Annexure B	Properties of transformer oil revised	AT/KS
R7	Annexure D	CRGO & Testing Points added	AT/KS

1.0 Scope

i. Design, manufacture, testing at manufacturer works before dispatch, packing, and delivery of Packaged Substation (PSS) as per this specification and supply of commissioning spares.
ii. Supply of all installation/commissioning accessories for PSS.
iii. Submission of documentation of PSS.
iv. Supervision of testing & commissioning of PSS at site.

2.0 Codes & standards

Materials, equipment and methods used in the manufacture of 11kV Packaged Substation shall conform to the latest edition of following –

Standard	Title
Indian Electricity Rules	With latest amendments
Indian electricity act	IE act 2003
	CBIP manual on transformers
IEC 60076	Power transformers
IEC:60616	Terminal and Tapping Markings for Power Transformers
IEC:60726	Dry-Type Power Transformers
IEC: 60529	Degrees of Protection Provided by Enclosures (IP Code).
IEC:60905	Loading Guide for Dry-Type Power Transformers
IEC 60694	Specification for high voltage switchgear
IEC 60439-1	Low voltage switchgear & control gear assemblies
IEC 60529	Degree of enclosures provided by enclosures
IEC 60664-1	Insulation coordination for low voltage systems
IEC 62262	Degree of protection provided by enclosure against mechanical shocks
IEC 62271-202	High voltage switchgear & control gear - prefabricated substation
IEC 60044	Instrument transformers - Current & voltage transformers
IEC 60225	Electrical relays
IEC 60625	High voltage switches
IEC 60502	Power cables
IEC 60947-2	Low-voltage switchgear and control gear : Circuit-breakers
IS 1180	Outdoor Type Oil Immersed Distribution Transformers Up to and Including 2500 kVA, 33kVSpecification **[R4]**
IS 2026	Power transformers
IS 11171	Dry type transformers

IS 6600	Loading of power transformers
IS 13947	Low voltage switchgear & control gear
IS 2099	Bushings for voltages above 1000v
IS 3156	Voltage transformers
IS 2705	Current transformers
IS 1554	PVC cables
IS 7098	XLPE cables
IS 2629	Recommended Practice for Hot-Dip Galvanizing of Iron and Steel
IS 4759	Hot-dip zinc coatings on structural steel and other allied products
IS 13585	Shunt capacitors
IS 13340	Shunt capacitors
IS 3043	Code of practice for Earthing
IS 335-2018	Insulating oils
IS 8130	Conductors for insulated cables
IS 5	Ready mixed paints
IS 9920 part 1,3 & 4	High voltage switches above rated voltage 1kv
IS 13118	General requirements of circuit breakers above rated voltage 1kv
IEC 60694	Specification for high voltage switchgear
IEC 60298	AC metal enclosed switchgear
IEC 60694	Specification for high voltage switchgear
IEC 60056	High voltage alternating current circuit breakers
IEC 60265 part 1	High voltage switches

In the event of direct conflict between various order documents, the precedence of authority of documents shall be as follows -

i. Guaranteed Technical Particulars (GTP)

ii. Specification including applicable codes & standards

iii. Approved Vendor Drawings

iv. Other documents

3.0 Electrical Distribution System Data

3.1.1	HT supply System	3 phase AC, 3 wire
3.1.2	Voltage	11000 volt ±10%
3.1.3	Frequency	50 Hz ± 5%
3.1.4	Fault level	350MVA – 18.5kA
3.1.5	System neutral	Earthed at upstream 11kV source

3.2.1	LT supply system	3 phase AC, 4 wire
3.2.2	Rated voltage	415V +/-10%
3.2.3	Rated frequency	50 Hz ± 5%
3.2.4	Fault level	35MVA – 50kA

4.0 PSS Configuration

4.1	PSS Type	On the basis of transformer rating
4.1.1	PSS Type – I	With 1000kVA oil filled transformer / 1000KVA cast resin transformer
4.1.2	PSS Type – II	With 630kVA oil filled transformer / 630KVA cast resin transformer
4.1.3	PSS Type – III	With 400kVA oil filled transformer / 400KVA cast resin transformer
4.1.4	PSS Type – IV	With 250kVA oil filled transformer / 250KVA cast resin transformer **[R7]**
4.1.4	Transformer type	As per enquiry
4.2	Major Components	For all PSS Types
4.2.1	Enclosure	Metallic painted GI enclosure with steel base frame for overall package
4.2.2	11kV Ring main unit	
4.2.2.1	PSS Type – I	1. The 3 Way with 02 nos. load break switches (LBS) + 01 no. circuit breaker (CB). Or 2. The 4 Way with 02 nos. Load break switches (LBS) + 02 nos. Circuit breaker (CB).**[R3]**
4.2.2.2	PSS Type – II , III & IV	The 3 Way with 02 nos. load break switches (LBS) + 01 no. circuit breaker (CB).
4.2.3	11kV XLPE Aluminium cable with termination kit along with cold applied boots	For CB feeder termination & transformer side termination.
4.2.4	Low voltage bus bar system	Insulated /sleeved with epoxy insulators

4.2.5	Low voltage system configuration for PSS type-I	1600A ACB incomer and 07 nos. 400A MCCB (utilization category- B) as outgoing.
4.2.6	Low voltage system configuration for PSS type-II	1600A ACB incomer and 05 nos. 400A MCCB (utilization category- B) as outgoing. Provisions shall also be made in LT panel to increase LT outgoing by 02 no's by adding MCCB's in future.
4.2.7	Low voltage system configuration for PSS type-III	1250A ACB incomer and 03 nos. 400A MCCB (utilization category- B) as outgoing. Provisions shall also be made in LT panel to increase LT outgoing by 02 no's by adding MCCB's in future.
4.2.8	Low voltage system configuration for PSS type-IV	400A ACB incomer and 02 nos. 250A MCCB (utilization category- B) as outgoing. **[R7]**
4.2.9	APFC system for PSS type-I	300kVAR APFC system with control relay & 630amp incomer MCCB (utilization category- B)
4.2.10	APFC system for PSS type-II	200kVAR APFC system with control relay & 630amp incomer MCCB (utilization category- B)
4.2.11	APFC system for PSS type-III	200kVAR APFC system with control relay & 630amp incomer MCCB (utilization category- B)
4.2.12	APFC system for PSS type-IV	Not Required **[R7]**
4.2.13	Energy meter box	To be provided on transformer LT side along with wiring.
4.2.14	Space for customer FRTU	300D x 600W x 900H (mm) space to be provided in HV or LV compartment.
4.2.15	Smoke detectors	Minimum 02 nos. in each LT, HT and Transformer compartment. These detectors shall be connected to local controller / alarm module. **[R3].**
4.2.16	Hooter with automatic timer reset	For operator alarm in case of PSS door open position
4.2.17	Fire Extinguisher	2Kg CO^2 Type shall be placed in HT Compartment **[R3]**.
4.2.18	Other requirements	Substation internal cabling, lighting & earthing system along with required hardware, gaskets, gland plates etc.
4.2.19	Fire ball	3 nos. of fire ball require in each compartment of all types of PSS **[R7]**
4.2.20	Cable Sealing compound	Cable sealing compound (Roxtec or any other make) require in LT & HT compartment as per cable size **[R7]**

5.0 11 kV Ring Main Unit

5.1.0	**RMU Configuration**	
5.1.1	RMU Configuration	
5.1.1.1	PSS Type – I	1. Two Load break switches (LBS) + one transformer circuit breaker (TCB) or 2. Two Load break switches (LBS) + two transformer circuit breaker (TCB). **[R3]** Selection between the above configurations shall depend upon the purchaser's requirement.
5.1.1.2	PSS Type – II, III & IV {R7}	The 3 Way with 02 nos. load break switches (LBS) + 01 no. circuit breaker (CB).
5.1.2	Extensibility	Non extensible type
5.1.3	Load break switch, Circuit breaker & earth switch in RMU panel	All shall be non draw out type, fixed position
5.1.4	Insulation Medium	
5.1.4.1	For panel	SF6 gas or Dry air in sealed metallic tank
5.1.4.2	For Breakers	SF6 gas or Vacuum type (with disconnector & earth switch)
5.1.4.3	For load break switches	SF6 gas or Vacuum type (With Earth Switch)
5.1.5	Arc interruption chamber for breaker	Arc interruption chamber of breakers shall be separate from the main insulated tank. (Desirable feature)
5.1.6	Maximum dimensions of 3 Way (2LBS+1VCB) RMU and for 4 Way(2LBS+2VCB)**[R7]**	3 Way-1250 mm(W) X 800 mm (D) X 2000 mm (H) 4 Way- dimension of 3 way+ one VCB compartment shall be added
5.2.0	**RMU Panel Construction**	
5.2.1	Panel type	CRCA/ GI Metal enclosed, framed, Compartmentalized panel construction **[R7]**
5.2.2	Service Location	Indoor and outdoor, non air conditioned environment **[R7]**
5.2.3	Mounting	Free Standing
5.2.4	Overall Enclosure Protection	IP54X minimum, vermin proof **[R7]**
5.2.5	Doors	Front access with internal anti theft hinge arrangement with minimum opening angle of 120º **[R3]**, minimum three hinges (desirable)
5.2.6	Covers	Bolted for rear access, with handles. Support for handle shall be provided at suitable place on RMU body. All the accessible bolts / screws shall be vandal proof stainless steel (except termination bolt, washer

		and reducer which is brass). One set of required Special tools per RMU (if any) shall be in the scope of supply. **[R7]**
5.2.7	Construction	CRCA/GI Metal enclosed, framed, Compartmentalized panel construction. CRCA/GI thickness shall be 2 to 2.5 mm subject to type test report from CPRI/ERDA**. Sheet thickness below 2 mm in any part of RMU shall not be accepted [R7]**
5.2.8	Base frame	Base frame shall be made with 75mm ISMC/ISA channel. Proper Bolted fixing arrangement shall be provided. Also, base frame shall be painted with 2 coats of anti rust red oxide and 2 coats of bitumen paint shall be provided. Adjustable HDPE clits as cable supporting clamps for each power cable (to suit the cable size from 11kV, 3CX150 to 400 sq mm PILC / XLPE cable. Exact size shall be provided during drawing approval stage.), also cleat shall be adjustable vertically. **[R7]**
5.2.9	Lifting lugs	Four numbers
5.2.10	Cable Entry	Bottom 3mm metallic, removable type & split type in two parts, with 1no. 90 mm diameter knocks out punch/hole in the centre (For double cable boxes, Un-drilled gland plate to be supplied. Approval should be taken for the same during drawing submission)
5.2.11	Cable termination	
5.2.11.1	Cable type & size	11kV, 3C X 150 / 240 / 300/ 400 sq mm Aluminium conductor XLPE/ PILC with armor & PVC outer sheath
5.2.11.2	Terminals for 11kV cable termination	With right angled cold applied boots (3M,Raychem or K.D. Joshi make), set of required size of Brass Nut bolt – M 16 size, Bimetallic washers and reducer for different size of cable termination to be provided. **[R7]**
5.2.11.3	Termination type	Suitable for heat shrinkable type
5.2.11.4	Termination height	900mm minimum from gland plate to center of bushing **[R7]**
5.2.12	Bus bar	Copper/Tinned copper (Sizing Calculation to be submitted in support of its Guaranteed S.C. rating / Capability) **[R7]**
5.2.12.1	Bus bar continuous rated current	630amp
5.2.12.2	Bus bar short time withstand capacity	20 KA for 3 sec **[R3]**
5.2.12.3	Bus bar support insulator material	SMC / DMC resin
5.2.12.4	Maximum temperature rise above reference ambient	In line with Table 3 of IEC60694

5.2.13	Earth bus bar	Tinned Copper sized for rated fault duty for 3 sec **[R7]**
5.2.13.1	Earth bus internal connection to all noncurrent carrying metal parts	By 2.5 sq mm copper flexible green PVC wire, Earth connection point maximum 1 meter away from cable test facility
5.2.13.2	Earth bus external connection to owners earth	Studs on both sides with holes and with M10 bolt + hardware to readily receive purchaser earth connection
5.2.14	Cooling arrangement	By natural air without fan
5.2.15	Panel internal wiring	Multi strand flexible color coded PVC insulated Cu wire 1 sq mm (SCADA) / 2.5 sq mm (for CT's) 1100 volt grade (R phase - Red, Y phase – Yellow, B phase – Blue, AC- black, DC – grey, Earth – green) with ferrules at both ends. All the internal control / auxiliary wiring shall be routed through proper conduit. **[R3]**
5.2.16	Hardware (Nut, bolts & handle)	Stainless steel (Except termination nut-bolts-washers-reducer which are Brass / Tinned Copper) **[R7]**
5.2.17	Gasket	Neoprene rubber
5.2.18	Marshalling terminal blocks	1 Sq mm, Nylon 66 material, screw type + 20% spare in each row of TB.
5.2.19	Panel cover fixing bolts	Allen head 6mm with hexagonal slot
5.2.20	Padlock facility	Required for all earth switches & all handles
5.2.21	Internal Arc classification	
5.2.21.1	Explosion vents	To ensure operator's safety, design should ensure that gases / flames generated during flash over / blast in any of the compartment, must not come out from the front of RMU as well shall not go to adjacent cable compartment. Internal arc test report (for Cable compartment & other compartments) must be submitted to support above, along with RMU GA drawing indicating these vents. There shall not be any type of holes, gaps etc on the walls of cable termination compartment. **[R3]**
5.2.21.2	Internal Arc rating	20 kA for 1s **[R3]**
5.2.21.3	Internal arc classification	IAC AFLR **[R3]**
5.2.22	SF6 gas annual Loss	< 0.1% of total mass. Pressure of SF6 gas shall be above the operating limit throughout the life of the equipment. **[R7]**
5.3.0	**Load break switch / Isolator (LBS) [R7]**	
5.3.1	Type	Three poles operated simultaneously by a common shaft

5.3.2	Arc interruption in dielectric medium	SF6 or Vacuum
5.3.3	Operating mechanism for close / open	Manual as per enquiry.
5.3.4	Addition / removal of motor	Without overhaul of operating mechanism **[R7]**
5.3.5	RMU without motor	Complete with power & control wiring so that only motor can be added at later date
5.3.6	Motor rated voltage	NA
5.3.7	Battery type & size	a) NA
5.3.8	Continuous rating of LBS	630 Amp at design 40 deg C ambient
5.3.9	Short time withstand capacity	20 KA for 3 sec **[R3]**
5.3.10	Fault making capacity	50 kA peak **[R3]**
5.3.11	Minimum number of operations at rated current (as per IEC 62271-102)	Mechanical Endurance – Class M1(1000 operations) Electrical Endurance – Class E3 (100 operations) **[R3]**
5.3.12	Minimum number of operations at rated fault current (as per IEC IEC 62271-102)	Class E3 (Min 10 operations) **[R3]**
5.3.13	Fault passage indicator (FPI) (For both Earth fault and Over Current Protection) {R7}	To be provided on incommer side of one LBS for panel type 1CB + 2 LBS. For all other configuration of RMU, FPI to be provided on all LBS.
5.3.14	Earth Fault Indicator	CBCT – Split open type suitable for mounting without disconnection of cable.
5.3.15	Connection of CBCT with FPI	Cable connection of FPI with CBCT shall be of pre moulded type on the CBCT side. Cable shall be 2.5 sq.mm cu PVC insulated cable only. {R7}
5.3.16	Fault Passage Indicator (For both Earth Fault and Over Current Protection)	Digital type and shall operate as the current exceeds the set value. Flash indication for identifying faults with red LED with one flash for every one sec. Test & rest button 1 NO + 1 NC potential free contact for remote indication FPI power supply unit shall use lithium battery with minimum life of 1000 blinking hours , so that FPI shall continue to function even after main feeder has tripped. **[R7]**
5.3.17	Data by Purchaser **[R7]**	
5.3.17.1	System Fault Level	2kA – 8.75kA
5.3.17.2	Type of Grounding	Solidly Grounded
5.3.17.3	Fault clearing time	100ms

5.3.17.4	Cable Type	PILC / XLPE , 11Kv, 3CX150 sq.mm to 400 sq.mm
5.3.18	Earth Fault Indicator	
5.3.18.1	Sensing Current	100 to 400A
5.3.18.2	Sensing Time	30 to 100 ms in steps of 10ms.
5.3.18.3	Reset Time	0.5 -1-2-3-4 hr
5.3.18.4	Resetting Facility	a) Self rest after reset time b) Self rest after restoration of voltage c) Manual d) Remote resetting
5.3.18.5	Contact Rating	1A at 230 V
5.3.18.6	Degree of Protection	IP 54
5.3.18.7	Mounting Arrangement	Surface or Flush Mounting
5.3.18.8	Ambient Temperature	-0 to 50 Deg C
5.4.0	**Circuit breaker [R7]**	
5.4.1	Type	Three pole, operated simultaneously by a common shaft
5.4.2	Transformer circuit breaker - TCB	For controlling transformer, manual operation only
5.4.3	Feeder circuit breaker - FCB	For controlling cable feeder, manual operation. Remote trip operation by SCADA possible
5.4.4	Arc interruption in dielectric medium	Vacuum Bottle
5.4.5	Operating mechanism - TCB	Manual spring charged stored energy type
5.4.6	Operating mechanism - FCB	Manual spring charged stored energy type, remote electrical close / open operation possible.
5.4.7	Emergency trip / open push button	On panel front with Protective flap to prevent any accidental tripping of breaker.
5.4.8	Continuous rating at design 40 deg C ambient	630amp
5.4.9	Short time withstand capacity	20 KA for 3 sec
5.4.10	Minimum number of operations at rated current (as per IEC 62271-100)	Mechanical Endurance – Class M1(2000 operations) Electrical Endurance – Class E2
5.4.11	Fault making capacity	50 KA peak
5.4.12	Fault breaking capacity	a) 20 KA Minimum
5.4.13	Maximum number of operations at rated Fault current *(as per IEC 62271-*	Electrical Endurance – Class E2 . To be guaranteed by manufacturer with authorized lab test reports

	100)	
5.4.14	Breaker status auxiliary contact	2NO + 2NC wired to terminal block
5.4.15	Current transformer	b) 75-400 / 1 amp for TCB/ FCB. c) Considering three core cable terminations, mounting flexibility shall be provided for CT's (in horizontal & vertical direction both). Additionally, CAUTION marking (by sticker/ paint) shall be provided to avoid CT's installation above the screen of cable. (I.e. earth potential point.) d) Position of CTs inside compartment shall be adjustable in vertical and horizontal direction
5.4.16	CT accuracy class	5P10 minimum
5.4.17	Protection relay	Self powered, Microprocessor based Numerical relay (with LCD display), IDMT over current / earth fault protection with high set element, manual reset type Relay mounting flush to panel front. Relay shall be communicable for automation purposes
5.4.18	Relay auxiliary contacts for remote indication	Potential free contact 1NO + 1NC wired to terminal block
5.4.19	Shunt trip 230v AC (for WTI trip & door limit switch of Dry type transformer) & for remote trip from SCADA.	To be wired to terminal blocks (If the functional requirement is achieved by the Protection relay, then shunt trip is not required.
5.4.20	Breaking Timing	40 to 60 ms
5.5.0	**Earth switch [R7]**	
5.5.1	Type	Three Pole (ON, OFF and Earth), operated simultaneously by a common shaft, for each Circuit breaker & Load break switch.
5.5.2	Switching in dielectric medium	Dry Air in sealed medium or SF6 gas
5.5.3	Operating mechanism for close & open	Manual
5.5.4	Fault making capacity	50 kA (Desirable)
5.5.5	Auxiliary contacts	1NO+1NC wired to terminal block
5.5.6	Disconnect switch (if provided in series with vacuum bottle)	Desirable to be located on purchaser cable connection side of vacuum bottle
5.5.7	Minimum number of operations at no load (as per IEC 62271-102)	Mechanical Endurance – Class M0(1000 operations)

5.5.8	Making capacity endurance of earth switch (as per IEC 62271-102)	Class E2 (Min 5 operations)
5.6.0	**Requirements of sealed housing live parts**	
5.6.1	Enclosure	Stainless steel enclosure suitable for IP67. Metal thickness shall be 3mm.
5.6.2	SF6 gas pressure low alarm	To be given
5.6.3	Provision for SF6 gas filling	To be given (For 'sealed for life' design of RMU, this is not applicable)
5.6.4	Provision for SF6 gas pressure indication	Digital/Analog Manometer with non return valve
5.6.5	Arc interruption method for SF6 breaker / Load break switch	Puffer type / rotating arc type
5.6.7	Potential free contacts for SF6 gas pressure low	1NO +1NC (Desirable)
5.7.0	**RMU operation interlocks [R7]**	
5.7.1	Interlock type	Mechanical
5.7.2	Load break switch & respective earth switch	Only one in 'close' condition at a time
5.7.3	Circuit breaker & respective earth switch	Only one in 'close' condition at a time
5.7.4	Prevent the removal of respective cable covers if load break switch or circuit breaker is 'ON'	Electrical / Mechanical
5.7.5	Prevent the closure of load break switch or circuit breaker if respective cable cover is open	Electrical / Mechanical
5.7.6	Cable test plug for LBS/CB accessible only if Earth switch connected to earth	Mechanical
5.8.0	**Indication & signals [R7]**	for SCADA / Local
5.8.1	Operation counter on front / Inside the RMU LT chamber	To be provided for each LBS & Circuit breaker, with minimum four digits & non resettable type
5.8.2	Cable charge status indication for all LBS & CB	Capacitor type voltage indicators with LED on all the phases (Shall be clearly visible in day light)
5.8.3	Spring charge status indication	On front for breaker
5.8.4	Earth switch closed indication (For Each LBS)	On front

5.8.5	Load break switch ON/OFF indication	Green for OFF / Red for ON
5.8.6	Circuit breaker On/OFF indication	Green for OFF / Red for ON
5.8.7	Circuit breaker protection relay operated on fault	Flag
5.8.8	Fault passage indication on LBS	Flag
5.8.9	Status signals to SCADA-to be wired to marshalling terminal block	2NO + 2NC
5.8.9.1	LBS close / open	potential free contacts
5.8.9.2	LBS & CB Earth Switch close /open	potential free contacts
5.8.9.3	CB close / open	potential free contacts
5.8.9.4	Protection relay operated	potential free contacts
5.8.9.5	FPI operated	potential free contacts
5.8.9.6	SF6 gas pressure low	potential free contacts - to be provided.
5.9.0	**Mimic diagram, labels & finish**	a) Mimic diagram (Shall not be accepted with Stickers) **[R3]** b) On panel front with description of function & direction of operation of handles/buttons
5.9.1	Operating Instructions	Operating instruction chart and Do's & Don'ts in Hindi / local language to be displayed on left / front side of panel enclosure on anodized Al Sheet 16SWG, duly affixed on panel.
5.9.2	Name plate on panel front	Fixing by rivet only
5.9.2.1	Material	Anodized aluminum 16SWG / SS
5.9.2.2	Background	SATIN SILVER
5.9.2.3	Letters, diagram & border	Black
5.9.2.4	Process	Etching
5.9.2.5	Name plate details	Month & year of manufacture, equipment type, input & output rating, purchaser name & order number, guarantee period
5.9.3	Labels for meters & indications	Anodized aluminum with white character on black background OR 3 ply lamicoid
5.9.4	Danger plate on front & rear side	Anodized aluminum 16 SWG with white letters on red background
5.9.5	Painting surface preparation	Shot blasting or chemical 7 tank process

5.9.6	Painting external finish	Powder coated epoxy polyester base grade A, shade - RAL 7032, uniform thickness 60 micron minimum
5.9.7	Painting internal finish	Powder coated epoxy polyester base grade A, shade - white, uniform thickness 60 micron minimum Printed copy shall be fixed/mounted inside each and every compartment.
5.10.0	**Quality Assurance [R7]**	
5.10.1	Vendor quality plan	To be submitted for purchaser approval
5.10.2	Inspection points in quality plan	To be mutually identified & agreed
5.10.3	Quality – Process Audits	BSES shall carryout vendor process audits.
5.10.4	Field quality plan	Bidder to submit field quality plan along with the bid
5.10.5	Spare part list	Bidder to submit detailed spare part list along with the bid
5.10.6	Maintenance manual	Bidder to submit maintenance manual along with the bid
5.10.7	Self Powered O/C & E/F Relay	Ashida ADR241S-761
5.10.8	Boots	3M / Raychem/K.D.Joshi
5.11.0	**Inspection and Testing [R7]**	
	Type test	1. Equipment of type tested quality only, including internal arc test (AFLR) shall be accepted as specified in the specification on various compartments like cable chamber, SF6 gas tank etc.(refer IS/IEC mentioned in the clause no 2.) 2. All Type test certificate along with AFLR internal test report from CPRI/ERDA/Any other reputed independent international Lab equivalent or better than CPRI/ERDA to be submitted along with offer for scrutiny. Type test more than 5 years old will not be acceptable. In case type test is more than 5 years old, bidder shall conduct type test from CPRI/ERDA/Any other reputed independent international Lab equivalent or better than CPRI/ERDA as per standard without any cost implication to BRPL. In this regards if BRPL want to witness the test , all the expenses of BRPL inspector shall be borne by bidder.
	Routine test	As per relevant Indian standard (refer IS …)
	Acceptance test	To be performed in presence of purchaser at manufacturer works
		Physical inspection & BOM, wiring check

		Insulation resistance test (Before & after HV test)
		HV test for one minute,
		Operation & interlock check
		Measurement of resistance of main circuit
		Voltage Indication check
		Functional testing of Fault passage Indicator for Alarm
		Primary current injection test for each circuit breaker feeder with relay
		Breaker closing & opening time measurement
		PD Test and CRM phase wise
5.12.0	**Deviations**	
	a) Deviations from this specification shall be listed separately by bidder clause wise (format given below) along with optional offer and has to submit the list along with bid/quotation. BRPL will review the deviations and if BRPL is agreed with the deviation, seller has to take written confirmation from BRPL on deviation during tender evaluation. b) In the absence of any separate list of deviations from the bidders with bid as well as written confirmation from BRPL on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully. c) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BRPL old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.	
5.13.0	**Special Technical Requirement [R7]**	
5.13.1	Self Powered Relay Protection setting (min 10%)	
5.13.2	NA".	
5.13.3	All the communicable accessories shall have Latch contact	
5.13.4	NO/NC contact for manometer shall be provided	
5.13.5	Each RMU shall be supplied with 2 sets of Operating Handle	
5.13.6	1. Cable termination drawing, cable termination instruction, dia wise bolt tighten torque range chat shall be fixed by sticker inside the termination compartment of each and every RMU. 2. Operation instruction manual of RMU shall be given with each and every RMU by OEM.	
5.13.7	In case of Motorized RMU required along with PSS in the place of Manual RMU (If requirement given by BRPL),bidder may refer technical specification only for motorized RMU- GN101-03-SP-76-01 or latest version of the same.	

5.14.0	Make List of RMU's Accessories [R7]	
Sl. No.	**Descriptions**	**Make**
1	Relay (Self Power+ AUX DC/AC Supply+ Communicable)	Ashida 241S-761
2	CT	Narayan Power Tech (NPT)/Gilbert Maxwell, 400/75-1/1, 5P10, 2.5 VA, Pragati, Nortex
3	FPI (Both for Earth Fault and Over Current Protection)	EMG/C&S/Schneider/SIEMENS
4	CBCT (Both for Earth fault and Over current protection)	EMG/C&S/Schneider/SIEMENS
5	Boot	3M/Raychem/K.D.Joshi
6	Wire	Polycab/Havells/Finolex/KEI
7	AC & DC MCB	SIEMENS/Havells/C&S/ Schneider
8	Disconnecting type fuses	Connectwell/Wago/Phoenix/Elmex
9	TB (disconnecting type)	Connectwell/Wago/Phoenix/Elmex
10	Vacuum Interrupter	CG/ ABB/Schneider/SIEMENS/other type tested

6.0 11KV XLPE Cable & termination kit

The 11kV XLPE cable connection from RMU to distribution transformer shall be conforming to IS 7098 and shall have all the following features -

6.1	Cable type & size	XLPE insulated armoured / un armoured cable 3C x 150 sqmm to 400 sqmm Aluminium conductor
6.2	Cable voltage grade	11KV
6.3	XLPE insulation thickness	3.14 mm minimum
6.4	Aluminium conductor no of strands	As per Table 2 of IS 8130
6.5	Insulation screen	With semi conducting extrusion, copper tape & water swellable tape
6.6	Type of armour	GI flat as per table 4 of 7098 part 2
6.7	11KV end termination at RMU	By 11kv grade end termination kit, heat shrink type
6.8	11KV end termination at Distribution transformer	By screened separable connector kit suitable for 630 A 'C'-interface epoxy cast bushings. **[R3]**
6.9	Cable support from RMU to transformer HT side cable	GI cable tray 300mm wide

	box	

7.0 Oil Type Sealed Distribution Transformer

7.1.0	Major Design criteria	
7.1.1	Voltage variation on supply side	+ / - 10 %
7.1.2	Frequency variation on supply side	+/ - 5 %
7.1.3	Combined variation of voltage and frequency	- 20 % or + 10 %
7.1.4	Service Condition	Refer Annexure B
7.1.5	Insulation level	
	One minute power frequency withstand voltage	3KV for 415V system & 28KV for 11KV system
	Lightning impulse withstand voltage	75KV peak for 11KV system
7.1.6	Short Circuit withstand level	
	Three phase dead short circuit at secondary terminal with rated voltage maintained on the other side	For 3 sec
7.1.7	Overload capability	As per IS 6600
7.1.8	Noise level	Shall not exceed limits as per NEMA TR-1 with all accessories running measured as per IEC 551 / NEMA standard running measured as per IEC 551 / NEMA standard
7.1.9	Radio Influence Voltage	Maximum 250 microvolt
7.1.10	Harmonic currents	Transformer to be designed for suppression of 3rd, 5th, 7th harmonic voltages and high frequency disturbances.
7.1.11	Partial Discharges	Transformer to be free from partial discharge up to 120% of rated voltage as the voltage is reduced from 150% of rated voltage i.e. there shall be no significant rise above background level.
7.1.12	Parallel operation with existing transformer z= 5%	Shall be designed to operate in parallel
7.2.0	Major Parameters	
7.2.1	Rating	**[R4]** 1000KVA/ 630 KVA/ 400 KVA/250 KVA [R7]
7.2.2	Voltage Ratio	11kv / 433 volts

7.2.3	Vector Group	Dyn11			
7.2.4	Impedance at 75 deg C	4.5 % for 250 KVA [R7] 400KVA & 630KVA tolerance as per IS **[R4]** 5% for 1000KVA tolerance as per IS **[R4]**			
7.2.5	Losses at 75 deg C	With ONAN cooling			
7.2.5.1	Total Loss –Max in KW at 50% Load	1000KVA	630KVA	400KVA	250KVA[R7]
		2.79 **[R7]**	1.86 **[R7]**	1.225 **[R7]**	0.98 **[R7]**
7.2.5.2	Total Loss –Max in KW at 100% Load	1000KVA	630KVA	400KVA	KVA[R7]
		7.70 **[R7]**	5.30 **[R7]**	3.45 **[R7]**	2.93 **[R7]**
7.2.6	Temperature rise top oil – without enclosure	35 Deg C max over ambient 40 Deg C			
7.2.7	Temperature rise winding – without enclosure	40 Deg C max over ambient 40 Deg C			
7.2.8	Flux density	1.6 Tesla **[R7]** at 100% rated voltage 1.9 Tesla at 112.5% rated voltage **[R4]**			
7.2.9	Current density	3 amp / sqmm for HV & LV winding			
7.2.10	Tapping on HV winding	Off circuit + 5% to -10% in 2.5% step **[R4]**			
7.2.11	Design Clearances	Phase - phase	Phase – earth		
	11kv system	180mm	120mm		
	415v system	25mm	25mm		
7.3.0	Transformer construction				
7.3.1	Type	Double Copper wound, three phase, oil immersed, with ONAN cooling			
7.3.2	Tank	Type tested design			
7.3.2.1	Design	a) Completely sealed type with corrugated fins and without conservator b) Completely oil filled or N2 cushion at top filled with positive pressure. N2 shall be technical grade in accordance with IS:1747 c) With bolted / welded cover			
7.3.2.2	Plate / Corrugated fin / tank features	a) Adequate for meeting mechanical & electrical withstand requirements, as per applicable standard. b) The tank and its sealing (gaskets, o-rings, etc.) shall be of adequate strength to withstand positive and negative pressures built-up inside the tank while the transformer is in operation. The maximum pressure generated inside the tank should not exceed 40kPa, positive or negative. c) Corrugated fins shall be built up of CRCA sheets of minimum 1.2mm thick. d) The corrugated tank wall shall ensure sufficient cooling of the transformer and compensate for the			

		changes in the oil volume during operation. e) The transformer shall be capable of giving continuous rated output, without exceeding the specified temperature rise. f) Internal clearance of tank shall be such that, it shall facilitate easy lifting of core with coils from the tank and HV & LV bushings mounted on Top cover. g) All joints of tank and fittings shall be oil tight. The tank design shall be such that the core and windings can be lifted freely with cover. The tank plate shall be of such strength that the complete transformers when filled with oil may be lifted bodily by means of lifting lugs. h) Tanks with corrugations & without conservator shall be tested for leakage at a pressure as per the applicable standard.
7.3.2.3	Material of Construction	Mild steel plate with low carbon
7.3.2.4	Plate Thickness	To meet the requirements of pressure and vacuum type tests as per CBIP manual
7.3.2.5	Welding features	a) All seams and joints shall be double welded b) All welding shall be stress relieved for sheet thickness greater than 35 mm c) All pipes, stiffeners, welded to the tank shall be welded externally d) All corrugated fins or expansion bellows provided shall be double welded.
7.3.2.6	Tank features	a) Bottom with stiffeners & adequate space for collection of sediments b) No external pocket in which water can lodge c) Tank bottom with welded skid base d) Strength to prevent permanent deformation during lifting, jacking, transportation with oil filled. e) Minimum disconnection of pipe work and accessories for cover lifting f) Tank to be designed for oil filling under vacuum g) Tank cover fitted with lifting lug
7.3.3	Inspection cover for bushing & Core / Wind	As per manufacturer standard
7.3.4	Fittings and accessories on main tank	As per clause 7.3.0
7.3.5	Core	
7.3.5.1	Material	High grade , non ageing, low loss, high permeability, grain oriented, cold rolled silicon steel lamination
7.3.5.2	Grade	Minimum M3 or better **[R4]**
7.3.5.3	Core Design Features	a) Magnetic circuit designed to avoid short circuit paths within core or to the earthed clamping structures. b) Magnetic circuit shall not produce flux components

		at right angles to the plane of lamination to avoid local heating. c) Least possible air gap and rigid clamping for minimum core loss and noise generation. d) Adequately braced to withstand bolted faults on secondary terminals without mechanical damage and damage/ displacement during transportation and positioning. e) Percentage harmonic potential with the maximum flux density under any condition limited to avoid capacitor overloading in the system. f) All steel sections used for supporting the core shall be thoroughly sand blasted after cutting, drilling, welding. g) Provision of lifting lugs for core coil assembly. h) Supporting framework designed not to obstruct complete drainage of oil from transformer i) Core shall be in the form of step and stack in three limb format **[R7].** Note: No wound core shall be acceptable
7.3.6.0	Winding	
7.3.6.1	Material	Electrolytic Copper
7.3.6.2	Maximum Current Density allowed	Maximum 3 amp / sqmm
7.3.6.3	Winding Insulating material	Class A, non catalytic, inert to transformer oil, free from compounds liable to ooze out, shrink or collapse.
7.3.6.4	Winding Insulation	Uniform
7.3.6.5	Design features	a) Type of winding **[R7]:** LV: Spiral/Helical HV: Crossover/Disc Note: No foil winding shall be acceptable b) Stacks of winding to receive adequate shrinkage treatment. c) Connections braced to withstand shock during transport, switching, short circuit, or other transients. d) Minimum out of balance force in the winding at all voltage ratios. e) Conductor width on edge exceeding six times its thickness. f) Transposed at sufficient intervals. g) Coil assembly shall be suitably supported between adjacent sections by insulating spacers + barriers. h) Winding leads rigidly supported, using guide tubes if practicable. i) Winding structure & insulation not to obstruct free flow of oil through ducts.

		j) Delta connection shall be done using Flexible cable. **[R3]**
7.3.7.0	Transformer Oil	As per Annexure – C, Class 1 new mineral insulating oil, shall be certified not to contain PCBs. Naphthalene base with anti oxidant inhibitor subject to Purchaser's specification in Annexure - C
7.3.8.0	Bushings and Terminations	
7.3.8.1	Type of HV side bushing	Epoxy cast bushing, 630 Amp, interface type 'C' as per EN50180 and EN50181. **[R3]**
7.3.8.2	Type of LV side bushing	Indoor, Epoxy resin cast, 1kv voltage class and creepage 31mm/KV
7.3.8.2.1	Essential provision for LV side line bushing	It shall be complete with copper palm suitable for tinned copper bus bar of size 100x12 mm
7.3.8.2.2	Essential provision for LV side neutral bushing	In case of neutral bushing the stem and bus bar palm shall be integral without bolted, threaded, brazed joints. Bus bar size shall be 100x12 mm
7.3.8.3	Arcing Horns	Not required
7.3.8.4	Support insulators inside HV cable box if provided	Epoxy resin cast, 12KV rated voltage
7.3.8.5	Termination on HV side bushing	Cable connection by screened separable connector kit. **[R3]**
7.3.8.6	Termination of LV side bushing	Bus bar connection
7.3.8.7	Minimum creepage distance of all bushings and support insulators.	31mm/kv
7.3.8.8	Protected creepage distance	At least 50 % of total creepage distance
7.3.8.9	Continuous Current rating	Minimum 20 % higher than the current corresponding to the minimum tap of the transformer
7.3.8.10	Rated thermal short time current	26.3kA for 3 sec
7.3.8.11	Atmospheric protection for clamp and fitting of iron and steel	Hot dip galvanizing as per IS 2633
7.3.8.12	Bushing terminal lugs in oil and air	Tinned copper
7.3.8.13	Sealing washers /Gasket ring	Nitrile rubber/ Expanded TEFLON (PTFE) as applicable
7.3.9.0	HV cable box	N.A
7.3.9.1	Material of Construction	N.A
7.3.9.2	Cable entry	As per design
7.3.9.3	Cable size for HV	3C X150sqmm A2XWY 11KV

7.3.9.4	Connection on LV phase	Bus bar 100x12mm copper
7.3.9.5	Bus bar size for LV Neutral	Same as phase bus
7.3.9.6	Detachable Gland Plate material for HV cable box	N.A
7.3.9.7	Gland plate thickness for HV	N.A
7.3.9.8	Cable gland for HV	N.A
7.3.9.9	Cable lug for HV	Suitable for cable 3CX150 mm^2 11KV
7.3.9.10	Essential parts for HV cable box	N.A
		a) Flange type removable front cover with handles min two no's b) Tinned Cu Bus bar c) Earthing boss for the HV cable box. d) Earthing link for the gasketed joints at two point for each joint e) Earthing provision for cable Armour/ Screen f) Drain plug g) Danger / caution plate
7.3.9.11	Terminal Clearances HV phase – phase & phase - earth	180mm / 120mm
7.3.9.12	Termination height required for cable termination	750mm
7.3.10.0	Current Transformers	
7.3.10.1	Requirement	All three phases and neutral on LV side
7.3.10.2	Mounting	LV side bushings on all three phases and neutral with the help of fibre glass mounting plate affixed to main tank by nut bolt arrangement
7.3.10.3	Maintenance requirements	Replacement should be possible by removing fixing nut of mounting plate without disturbing LT bushing
7.3.10.4	Accuracy Class & ISF	0.5s / 10
7.3.10.5	Burden	5 VA
7.3.10.6	Type	Resin Cast Ring type suitable for outdoor use
7.3.10.7	CT ratio	a) 250 KVA-400/5 Amps **[R7]** b) 400/630KVA -1000/5 Amps c) 1000KVA -1500/5 Amp
7.3.11	Off Circuit tap Switch	On HV winding
7.3.11.1	Range /Step	+ 5 % to -10% in steps of 2.5 % **[R4]**
7.3.11.2	Type	Rotary type, 3 pole gang operated,
7.3.11.3	Operating Voltage	11kV

7.3.11.4	Rated Current for tap Switch	a) 100amp for 1000KVA /630KVA b) 60 amps for 400KVA /250KVA**[R7]**
7.3.11.5	Operating Handle	External at suitable height to be operated from ground level.
7.3.11.6	Tap position indicator	With direction changing facility, locking arrangement, caution plate metallic fixed by rivet.
7.3.12	Pressure Relief Device	Required
7.4.0	Hardware	
7.4.1	External	Stainless Steel
7.4.2	Internal	Cadmium plated except special hardware for frame parts and core assembly as per manufacturer's design
7.5.0	Gasket	
7.5.1	For Transformer, surfaces interfacing with oil like inspection cover etc.	Nitrile rubber based / cork
7.5.2	For Cable boxes, Marshalling box, etc.	Neoprene rubber
7.6.0	Valves	
7.6.1	Material of construction	Brass / gun metal
7.6.2	Type	Both end flanged gate valve / butterfly valve depending on application
7.6.3	Size	As per manufacturer's standard
7.6.4	Essential provision	Position indicator, locking rod, padlocking facility, valve guard, cover plate.
7.7.0	Painting of transformer.	
7.7.1	Surface preparation	By shot blasting method
7.7.2	Finish on internal surfaces of the transformer	Bright Yellow heat resistant and oil resistant paint two coats. Paint shall neither react nor dissolve in hot transformer insulating oil.
7.7.3	Finish on outer surface of the transformer-frame parts	Battle ship Grey shade 632 Poly urethane paint two coats, minimum dry film thickness 80 microns
7.8.0	Fittings & accessories	
7.8.1	Rating and Diagram Plate	Required
7.8.1.1	Material	Anodized aluminium 16SWG
7.8.1.2	Background	SATIN SILVER
7.8.1.3	Letters, diagram & border	Black
7.8.1.4	Process	Etching
7.8.1.5	Rating and Diagram Plate details	

		a) Following details shall be provided on rating and diagram plate as a minimum. b) Type/kind of transformer with winding material. c) IS/ IEC **[R3]** standard to which it is manufactured. d) Manufacturer's name. e) Transformer serial number. f) Month and year of manufacture. g) Rated frequency in HZ. h) Rated voltages in KV. i) Number of phases. j) Rated power in KVA. k) Type of cooling (ONAN). l) Rated currents in Amp. m) Vector group connection symbol. n) 1.2/50µs wave impulse voltage withstands level in KV. o) Power frequency withstands voltage in KV. p) Impedance voltage at rated current and frequency in percentage at principal, minimum and maximum tap q) Load loss at rated current. r) No-load loss at rated voltage and frequency s) Continuous ambient temperature at which ratings apply in deg c t) Top oil and winding temperature rise at rated load in deg c; u) Winding connection diagram with taps and table of tapping voltage, current and power v) Transport weight of transformer w) Weight of core and windings x) Total weight y) Volume of oil z) Weight of oil aa) Name of the purchaser bb) PO no and date cc) Guarantee period
7.8.2	Terminal marking Plate for Bushing, anodized aluminium black lettering on satin silver background both inside cable boxes near termination and on cable box cover (all fixed by rivet)	Required
7.8.3	Company Monogram Plate fixed by rivet	Required
7.8.4	Lifting Lug to lift complete transformer with oil	Required
7.8.5	Lifting lug for top cover	Required

7.8.6	Lashing Lug	Required
7.8.7	Jacking Pad with Haulage hole to raise or lower complete transformer with oil	Required
7.8.8	Detachable Bidirectional flat roller Assembly	Required
7.8.9	Pockets for ordinary thermometer on tank cover with metallic identification plate fixed by rivet.	Required
7.8.10	Drain valve (gate valve) for the main tank with cork above ground by 150mm minimum with padlocking and valve guard with metallic identification plate fixed by rivet.	As per manufacturer design
7.8.11	Filter valve (gate valve) at top with padlocking and valve guard with metallic identification plate fixed by rivet.	As per manufacturer design
7.8.12	Air Release Plug on tank cover with metallic identification plate fixed by rivet.	As per manufacturer design
7.8.13	Oil level indicator with low level switch	As per manufacturer design
7.8.14	Earthing pad on tank for transformer earthing complete with non ferrous nut bolt, washers, spring washers etc. with metallic identification plate fixed by rivet	Required
7.8.15	Rain hood for vertical gasket joints	Desirable
7.8.16	Earthing bridge by copper strip jumpers on all gasket joints at at least two points for electrical continuity	Required
7.8.17	Skid base welded type with haulage hole	Required
7.8.18	Core , Frame to tank Earthing	Required

7.8.19	Danger plate made of Anodized aluminum with white letters on red background on Transformer, cable boxes (all fixed by rivet)	Required
7.8.20	Caution plate for Off Circuit tap changer fixed by rivet.	Required
7.8.21	Pressure Relief Device	Required
7.8.22	Gas-inlet valve of non-return type	Required (for transformers with nitrogen blanket above oil)
7.8.23	User manual for Hermetically Sealed Transformers must be provided for review as a part of the technical proposal. The manual must be provided with, but not limited to, maintenance schedule, frequency & method of oil-sampling, procedures for oil-filling & oil-filtration, etc.	Required

8.0 Dry Type Transformer (1000KVA/ 630KVA/ 400KVA/250 KVA)

8.1.0	Major Design criteria	
8.1.1	Voltage variation on supply side	+ / - 10 %
8.1.2	Frequency variation on supply side	+/ - 5 %
8.1.3	Transient condition	- 20 % or + 10 % combined variation of voltage and frequency
8.1.4	Service Condition	Refer Annexure B, the transformer enclosure in PSS is to be designed for outdoor location with service condition as specified, but its full rating shall be available if located indoor in poorly ventilated atmosphere
8.1.5	Insulation Level	
	One minute power frequency withstand voltage	28KV for 11KV system & 3KV for 415 V system
	Lightning impulse withstand voltage	75KV peak for 11KV system

8.1.6	Short Circuit withstand Capacity of the transformer				
8.1.6.1	Three phase dead short circuit at secondary terminal with rated voltage maintained on the other side	For 3 secs.			
8.1.6.2	Single phase short circuit at secondary terminal with rated voltage maintained on other side voltage maintained on other side	For 3 secs.			
8.1.7	Overload capability	As per IEC 60905			
8.1.8	Noise level	Shall not exceed limits as per NEMA TR-1 with all accessories running measured as per IEC 551 / NEMA standard			
8.1.9	Radio Influence Voltage	Maximum 250 Microvolt			
8.1.10	Harmonic currents	Transformer to be designed for suppression of 3rd, 5th, 7th harmonic voltages and high frequency disturbances.			
8.1.11	Partial Discharges	Transformer to be free from partial discharge upto 120 % of rated voltage as the voltage is reduced from 150 % of rated voltage i.e. there shall be no significant rise above background level			
8.1.12	Parallel operation	Shall be designed to operate in parallel with existing transformer. Details of existing transformers shall be forwarded to the bidder on request			
8.1.13	Fire Protection Class	Class F1 shall be required **[R7]**			
8.1.14	Climate Class	Class C2 shall be required**[R7]**			
8.1.15	Environment Class	Class E2 shall be required**[R7]** Transformer shall be E2C2F1 certified **[R7]**			
8.2.0	Major Parameters				
8.2.1	Rating	1000KVA/ 630KVA/ 400KVA/250 KVA[R7]			
8.2.2	Voltage Ratio	11kv / 433 volts			
8.2.3	Vector Group	Dyn11			
8.2.4	Impedance	5%, tolerance as per IS			
8.2.5	Losses at 130 [R7] deg C				
8.2.5.1	No load Loss –Max in KW	1000 KVA	630 KVA	400 KVA	250 KVA[R7]
		1.78	1.2	0.9	0.7
8.2.5.2	Load losses at principal tap- Max in KW	1000 KVA	630 KVA	400 KVA	250 KVA[R7]
		7.5	5.4	3.4	2.2
8.2.6	Temperature rise winding	Outside PSS without		Inside PSS max.	

		enclosure	
		80°C	90°C
8.2.7	Flux density	Maximum flux density at 10 % over excitation /overfluxing-1.73 Tesla [R7] maximum	
8.2.8	Tapping on HV winding	Off Circuit taps on HV winding , + / - 5 % in steps of 2.5 % , change of taps by link	
8.2.9	Design Clearances	Phase – phase	Phase - earth
	11KV system	180mm	120mm
	415V system	25mm	25mm
	415V system	25mm	25mm
8.3	Construction & Design		
8.3.1	Core		
8.3.1.1	Material	High grade , non ageing, low loss, high permeability, grain oriented, cold rolled silicon steel lamination	
8.3.1.2	Grade	Premium grade minimum M3 or better **[R4]**	
8.3.1.3	Lamination thickness	0.23mm (Max) **[R4]**	
8.3.1.4	Design Flux Density at rated conditions at principal tap	1.6 Tesla [R7]	
8.3.1.5	Maximum Flux Density at 10 % over excitation / over fluxing	1.73 Tesla [R7] maximum allowed	
8.3.1.6	Core Design Features	a. All steel sections used for supporting the core shall be thoroughly sand blasted after cutting, drilling, welding. b. Core shall be in the form of step and stack in three limb format [R7]. Note: No wound core shall be acceptable c. Provision of lifting lugs for core coil assembly	
8.3.2	Winding		
8.3.2.1	Material	Electrolytic Aluminum **[R4]**	
8.3.2.2	Maximum Current Density allowed	Maximum allowed 1.5 A per sqmm **[R4]**	
8.3.2.3	Winding Insulating material	Class F minimum, free from compounds liable to ooze out, shrink or collapse. Uniform insulation shall be applied to the windings and overall winding shall be epoxy cast resin	
8.3.2.4	Tapping	Off Circuit taps on HV winding , + / - 5 % in steps of 2.5 % , change of taps by link	
8.3.2.5	Essential provision for tap links	Shall be shrouded with cover made from insulating material. To prevent deposit of dust.	

8.3.2.6	Design features	a) Stacks of winding to receive adequate shrinkage treatment b) Connections braced to withstand shock during transport, switching, short circuit, or other transients. c) Minimum out of balance force in the transformer winding at all voltage ratios. d) Conductor width on edge exceeding six times its thickness e) The termination bus-bar coming out from winding shall be tinned Copper f) Transposed at sufficient intervals. g) Threaded connection with locking facility. h) Winding leads rigidly supported, using guide tubes if practicable i) Provision of taps as indicated in the technical particulars
8.3.2.7	Essential provision of HV and LV winding leads	Phase marking required near termination on both HV and LV side. Phase colour coding required on insulating sleeves on both HV and LV side. Phase sequence 1U, 1V, 1W from left to right looking inside from the HV side door. Phase sequence 2n, 2u, 2v, 2w from right to left looking inside from LV side door Adequate HV termination clearance. Provision of check nut in all HV and LV winding lead connection.
8.3.3	Vibration Isolator	Vibration isolation pads shall be installed between core and coil assembly and enclosure base assembly to prevent the transmission of structure borne vibrations.
8.3.4	Bushings/Support Insulator/ terminations	
8.3.4.1	Type of HV and LV Bushings, support insulators	Epoxy Resin Cast
8.3.4.2	Minimum Creepage of bushings and support Insulators	31 mm / kV
8.3.4.3	Arcing horns	Not required
8.3.4.4	Termination on HV side	By cable within main enclosure by separable connector
8.3.4.5	HV side cable size	11 kV (E) grade , A2XCEWY 3C x 150 sqmm
8.3.4.6	Cable lugs	Long barrel medium duty Aluminium lug with knurling on inside surface. and suitable for cable size for 11 kV (E) grade , A2XCEWY 3C x 150 sqmm
8.3.4.7	HV side bushing	Epoxy cast bushing, 630 Amp, interface type ‘C’ as per EN50180 and EN50181. **[R3]**
8.3.4.7	Termination on LV side	Suitable bus bar as per PSS spec
8.3.5	Current Transformers	

8.3.5.1	Mounting	On LV side terminal busbars on all three phases and neutral with the help of fibre glass mounting plate
8.3.5.2	Maintenance requirements	Replacement should be possible without dismantling LV side support insulators
8.3.5.3	Accuracy Class	0.5s
8.3.5.4	Burden	5VA
8.3.5.5	Type	Resin Cast Ring type suitable for outdoor use
8.3.5.6	CT ratio	a) 250 KVA-400/5 Amps[R7] b) 400/630KVA -1000/5 Amps c) 1000KVA -1500/5 amp
8.3.6	Hardware	
8.3.6.1	External	Stainless Steel only
8.3.6.2	Internal	Cadmium plated except special hardware for frame parts and core assembly as per manufacturer's design
8.4	Gasket	Neoprene rubber based gasket across all doors & covers
8.5	Control cable specification (to be used by the vendor)	PVC insulated, extruded PVC inner sheathed, FRLS **[R3]**, armoured, extruded PVC outer sheathed 1100 V grade control cable as per latest edition of IS 1554 part 1 minimum 2.5 sqmm for signals and 4 sqmm for CT with multistrand copper conductor
8.6	Terminal Blocks to be used by the vendor	Nylon 66 material, minimum 4 sq mm, screw type for control wiring and potential circuit.
8.6.1	Essential provision for CT terminals	Sliding link type disconnecting terminal block screwdriver operated stud type with facility for CT terminal shorting material of housing melamine/ Nylon66
8.7	Painting of WTI box	
8.7.1	Surface preparation	By 7 tank pre-treatment process or shot blasting method
8.7.2	Finish on internal / external surfaces	Polyurethane based painting, min. Dry film thickness 80 microns
8.7.3	Insulating support material for base plate for mounting components	Bakelite shall not be used as a base plate for mounting any components, insulating material non hygroscopic insulating material like FRP shall be used.
8.8	Minimum Protective devices on Transformer	
8.8.1	Surge Arrestor	Required, Connected on Transformer Primary side on all three phases
8.8.1.1	Type	Metal oxide
8.8.1.2	Housing	Polymeric preferable
8.8.1.3	Rating	9 KV.
8.8.1.4	Continuous operating voltage , kV rms	6.35
8.8.1.5	Maximum Continuous operating voltage, kV rms	7.65

8.8.1.6	Nominal Discharge Current, kA peak	5
8.8.1.7	Energy Absorption Capability, kJ/kV	Greater than 2.5
8.8.1.8	Creepage factor	31 mm /kV
8.8.1.9	Reference std	IS 3070 part 3 and IEC 99-4
8.8.2	Winding Temperature scanner	Required
8.8.2.1	No of RTD inputs	Five (Three for windings, one for enclosure & one shall be spare) RTD for enclosure temperature monitoring shall be fixed at enclosure Top from inside to give max enclosure temp reading & shall be wired up to temp. scanner to indicate the reading
8.8.2.1.1	Location of winding RTD	At location of winding where maximum temperature is expected.
8.8.2.2	No of potential free trip contacts	Two
8.8.2.3	No of potential free Alarm contacts	Two
8.8.2.4	Auxiliary supply	240 V AC, 1 phase, 50 Hz. Tapped from LV side busbar through a MCB located inside box
8.8.2.5	Winding Temperature Scanner terminal Box	Required
8.8.2.5.1	Size	As per Manufacturer's Standard
8.8.2.5.2	Fixing of instrument within box	On base plate
8.8.2.5.3	Fixing of terminals within the box	On C channel available with the terminals
8.9	Fitting and accessories	
8.9.1	Rating & Diagram plate	Required
8.9.1.1	Material	Anodized aluminum 16SWG
8.9.1.2	Background	SATIN SILVER
8.9.1.3	Letters, diagram & border	Black
8.9.1.4	Process	Etching
8.9.1.5	Name plate details	Following details shall be provided on rating and diagram plate as a minimum a) Type of transformer i.e cast resin or VPI etc. With winding material b) IS / IEC **[R3]** standard to which it is manufactured c) Manufacturer's name; d) Transformer serial number; e) Month and year of manufacture f) Rated frequency in HZ g) Rated voltages in KV h) Number of phases

		i) Rated power in KVA j) Type of cooling k) Rated currents in a l) Vector group symbol m) 1.2/50µs wave impulse voltage withstand level in KV n) Power frequency withstand voltage in KV o) Impedance voltage at rated current and frequency in percentage at principal, minimum and maximum tap at highest temperature p) Load loss at rated current at highest temperature q) No-load loss at rated voltage and frequency r) Auxiliary loss s) Continuous ambient temperature at which ratings apply in c t) Winding connection diagram with taps and table of tapping voltage, current and power u) Transport weight of transformer v) Weight of core and windings w) Weight of enclosure and fittings x) Total weight y) Tapping details z) Phase ct details aa) Class of insulation bb) IP protection rating of the enclosure cc) Name of the purchaser dd) Po no and date ee) Guarantee period
8.9.2	Detachable Bi-directional flat Roller Assembly	Required
8.9.2.1	Roller center to center distance	Minimum 900 mm on the side of HV and LV termination Maximum 800 mm on the other side (perpendicular to HV, LV termination). and LV termination Maximum 800 mm on the other side (perpendicular to HV, LV termination).
8.9.2.2	Essential provision	Roller dia. 150 mm min., roller to be fixed in such a way so that the lowermost part of the skid is above ground by at least 100 mm when the transformer is installed on roller.
8.9.3	Earthing pad on enclosure for transformer earthing complete with Stainless Steel nut, bolt, washers, spring washers etc.	Required with identification plate on outside of enclosure.
8.9.4	Core, Frame to tank Earthing	Required
8.9.5	Off Circuit tapping link	Required
8.9.6	Tap link position plate	Required inside HV side door

8.9.7	Danger plate made of Anodized aluminium with white letters on red background on HV and LV side	Required
8.9.8	Skid with Haulage lugs	Required
8.9.9	Lifting lugs for complete transformer as well as enclosure	Required
8.9.9.1	Essential provision for lifting lugs	Lifting lugs for core coil assembly shall be provided in such a way that the weight shall not come on canopy while lifting Lifting lugs for canopy/ enclosure shall be provided in such a way that the weight shall not come on canopy while lifting , it shall be borne by supporting members.
8.9.10	Caution Plate for tap links	Required
8.9.11	Ventilation louvers with stainless steel wire mesh and rain water guard	Required as per Manufacturer's design, but it is to be provided minimum required preventing ingress of excessive dust.
8.9.12	Surge Arrestor & its Grounding bushing	Required
8.9.12.1	Essential provision	Surge arrestor shall be erected vertically in such a way that the surge arrestor can be removed at site without removing HV cable lug. Surge arrestor shall not be used for any kind of support. Surge arrestor grounding strip to be routed to the surge arrester grounding bushing near bottom of enclosure with proper support. Surge arrestor grounding bushing shall be identified by identification plate on outside of enclosure. Surge arrestor grounding bushing shall be supplied with all hardware to readily connect purchaser's ground lead.
8.9.13	LV additional neutral earthing bushing	Required
8.9.13.1	Essential provision	Busbar connecting the neutral to additional neutral bushing shall be properly supported and additional neutral bushing shall be identified by identification plate on outside of enclosure. Additional neutral bushing shall be supplied with all hardware to readily connect purchaser's ground lead.
8.9.14	Winding temperature scanner	Required
8.9.15	RTD in Winding and near top of enclosure.	Required
8.9.16	Space heater inside enclosure	Thermostatically controlled space heater inside enclosure required, supply of space heater from feeder pillar through MCB fixed properly inside enclosure.
8.9.1	Mounting of space heater	By suitable spacers so that heater does not come in contact with panel wall directly.

8.9.17	Copper earthing link	Across all gasketted joints in the enclosure body.

9.0 Low Voltage Bus bar system

9.1	LV bus bar	From transformer LV bushing to ACB and from ACB to MCCBs
9.2	Type of connection on transformer	By flexible copper link rated 1600Amp
9.3	Bus bar size for phase & neutral	a) 100x12 mm tinned copper / Eqvt Size Aluminum. b) Connection to each MCCB by 40x6 tinned copper bar.
9.4	Bus bar support insulators	1 KV voltage class, SMC epoxy
9.5	Insulator creepage distance	31mm / KV
9.6	Bus bar sleeve insulation	Color coded, for 1kv
9.7	Bus bar rated current	Type I & II:1600 Amp Type III:1250 Amp Type IV : 500 Amp **[R7]**
9.8	Bus bar short circuit withstand	27.7kA for 1 sec
9.9	Maximum temperature rise	20º C

10.0 Low voltage switchgear, ACB, MCCB & Fuses

10.1.0	Air Circuit Breaker (ACB)	Fixed type 4 pole
10.1.1	ACB - On & OFF operation	Manual as well as electrical by spring charged mechanism
10.1.2	ACB operating mechanism	Trip free, anti pumping type
10.1.3	Spring charging method	Manual as well as electric motor
10.1.4	Spring charging motor supply	1 ph 240V tapped from LV bus bar
10.1.5	Close & trip coil supply	1 ph 240V tapped from LV bus bar
10.1.6	ACB Neutral connection	Fully isolable link sized for 1600 / 1250 / 400 [R7] amp
10.1.7	ACB rated voltage	415v +/- 10% at 50Hz
10.1.8	ACB rated current	1600 / 1250 / 400 amp continuous
10.1.9	ACB rated 3 phase short circuit breaking capacity Ics = Icu	50kA minimum at 415v and 50Hz

10.1.10	ACB rated 3 phase short circuit withstand capacity, Icw	50kA for 1sec
10.1.11	ACB SC making current capacity	100kA peak
10.1.12	ACB rated insulation level	1000volt
10.1.13	ACB mechanical & electrical endurance	As per IS 13947 / IEC
10.1.14	ACB utilization category as per IS	B
10.1.15	ACB indications	ON, OFF & TRIP
10.1.16	ACB operation - manual	ON, OFF by push buttons
10.1.17	ACB operation - electrical	ON, OFF by TNC switch
10.1.18	ACB overload, short circuit & earth fault protection	By micro processor based releases
10.1.19	Operation counter	4 digit minimum , Non reversible **[R7]**
10.1.20	Multifunction meter	Digital CTR & PTR programmable **[R7]**
10.1.21	Display & Event log	Display type LT ACB required with Min. 10 nos previous fault event log **[R7]**
10.2.0	MCCB	For outgoing feeders – 400A 07 no for Type I PSS, 05+02* no's for type II PSS& 03+02* no's for Type III PSS 02 nos for type IV PSS **[R7]** APFC system – 1 no. 630 Amp *Spare Outgoings - Provisions shall also be made in LT panel to increase LT outgoing by 02 no's by adding MCCB's in future.
10.2.1	MCCB type	3 pole, one break per pole, Utilization category B
10.2.2	MCCB - On & OFF operation	Manual by handle
10.2.2(i)[R6]	MCCB design ambient temperature	50deg C
10.2.2(ii)[R6]	MCCB Housing	Thermoplastic material resistant to fire & abnormal heat , non hygroscopic
10.2.2(iii)[R6]	MCCB Terminal	Silver coated copper with phase barriers, spreader terminals & shrouds
10.2.2(iv)[R6]	MCCB Spreader size & material	Minimum-50(W)X50(L)X10(D)mm- Cu suitable for bimetallic joint i.e. for aluminium bus/cable lug
10.2.2(v)[R6]	De-rating at 50Deg ambient temperature	No derarting (0%)

10.2.3	MCCB rated 3 phase short circuit breaking capacity Ics = Icu	36kA minimum at 415v and 50Hz
10.2.4	MCCB rated 3 phase short circuit withstand capacity, Icw	8kA for 1sec
10.2.5	MCCB SC making current capacity	75kA peak
10.2.6	MCCB rated insulation level	1000V
10.2.7	MCCB mechanical & electrical endurance	As per IS 13947 / IEC
10.2.8	MCCB utilization category	B as per IS / IEC 947
10.2.9	MCCB indications	ON, OFF & TRIP
10.2.10	MCCB protection	Microprocessor based release + earth fault
10.2.10(i)[R6]	Tripping characteristic required	
a	Overload setting	Range 60-100%In (Set on 95%)
b	Short Circuit setting	Range 200-1200%In (Set on 300%)
c	Earth fault setting	To be provided
10.2.11[R6]	MCCB Clearances in air	As per table XIII of IS 13947-1
10.2.12[R6]	MCCB temperature rise limits	As per table 2 & 3 of IS 13947-1
10.2.13[R6]	MCCB Ingress Protection	IP2X Minimum (pollution degree minimum 2)
10.2.13(i) [R6]	MCCB additional features	Sealing/padlocking of operating knob in OFF position Sealing/padlocking of operating knob in OFF position isolation suitable with positive contact
10.2.14	Connection to ACB main bus	By Cu bar with double PVC insulation For 400 amp MCCB / fuse – 40x6 mm For 630 amp MCCB – 50x10 mm
10.2.15	Connection to outgoing cables	By terminals suitable for 2X4CX300sqmm , A2XFY 1100 volt grade cable [R7]

11.0 Automatic Power Factor Correction system

The APFC equipment shall be located in LV compartment of package enclosure either as a separate panel or integrated along with LV Switchgear and shall have all the following features –

11.1	APFC Output	a) Type I :300 KVAR @ 400 V b) Type II and III :200 KVAR @ 400 V

		However APFC should be rated at 440 V. Manufcatuerer needs to spcify rated output @ 440V.
11.2	APFC mounting	All components mounted in shelf type arrangement on package substation enclosure LV compartment wall or RMU compartment wall or Part of LT Panel
11.3	APFC relay & data logger	Mounted on base plate supported on compartment wall by three hinges
11.4	APFC system bus bar power connection to transformer LT side	By 4CX300sqmm AYFY 1100v grade cable to or Bus Bars
11.5	APFC system bus bar size	50x10mm tinned copper mounted on SMC insulators 1100V grade
11.6	APFC system CT input signal	From CT on transformer LV side by 7CX2.5sqmm YY 1100V grade cable
11.7	APFC capacitor modules	Type I:12x25KVAR three phase compensation Type II & III:8x25KVAR three phase compensation
11.8	Capacitor duty contactor for each capacitor module	Utilization category 6b as per IS
11.9	MCCB for each capacitor module	100amp, Three Pole, Ics=Icu=35kA
11.10	Connection to each MCCB from APFC system bus	By 35sqmm copper wire double insulated with tinned copper lugs
11.11	APFC control supply	Through 415/240v transformer, 2amp / 6amp SP MCB
11.12	APFC relay	Microprocessor based relay for automatic control of minimum 12 capacitors in sequential or cyclic switching fashion with settable time delay 0 -180 sec
11.13	APFC relay LCD display with self monitoring feature	To show no. of capacitors energized, actual PF & target PF, voltage & current
11.14	Target power factor setting range	0.8 lag to 0.9 lead in steps of 0.1
11.15	APFC relay sensing	3 phase CT input 5 amp to sense max load current
11.16	No volt protection in relay	To switch OFF all capacitors
11.17	Capacitor unit 25KVAR type	Double layer All Poly Propylene (APP) or Mixed Poly Propylene (MPP)
11.18	Capacitor unit construction	1.5mm thick sheet metal welded tank or Al cylindrical construction
11.19	Capacitor unit impregnant	Dry type filler or non PCB liquid
11.20	Capacitor unit conducting layer	Al foil or metalized film
11.21	Capacitor sealing	Hermetic sealing after vacuum process
11.22	Capacitor unit safety	Pressure sensitive dis-connector or internal fuse for each element
11.23	Discharge resistor	Between all three phases of capacitor unit, to reduce the voltage across the capacitor to 50V or less in one minute

11.24	Terminal bushings	For rated voltage class 1 KV Suitable wires / terminals brought out from capacitor unit is also acceptable.
11.25	Earth connection for individual capacitor container	To be done & connected to main earth bus bar of the panel
11.26	APFC Operational features	
11.26.1	Automatic power factor correction	To achieve target lagging power factor without hunting
11.26.2	Operation for rated output	At continuous rated voltage (440 V) & frequency (50 Hz)
11.26.3	Operation with over voltage	115% of rated voltage for 12 hours in a day
11.26.4	Operation with harmonic distortion	THD voltage – 5% & THD current 3%
11.26.5	Maximum permissible over current	1.3 times rated current, continuous
11.26.6	Dielectric loss	0.2 watt per KVAR maximum
11.26.7	Temperature Category & Maximum temperature rise	- 5 / 60 deg C Not exceeding 10 deg C over 60 deg C.
11.26.8	Residual voltage after disconnection from mains	50 volts maximum after 60 seconds
11.26.9	Design life of capacitor unit	Minimum 10 years
11.27.0	Data Logger	(approved by requisite authority / Electrical inspector)
11.27.1	General	Accuracy class 0.5, microprocessor based with LCD display, with 3 CTs for measurement of cumulative KWH, power factor, voltage & current of transformer secondary, THD of voltage.
11.27.2	Data logging and Software	Data logging of KWH value at every 30 minutes to give cumulative reading of KWH for 45 days minimum, data downloadable in ASCII-II or MS Excel format. Software for downloading the data from data logger to be provided by data logger vendor.
11.27.3	Display and communication	Display of DATE, TIME, station ID -Display & log power parameters phase wise & total (load current, kVA, kW & PF). -Display & log kVAr phase wise & total. -Display TDH V or current. -The logger shall be with built in communication facility of RS485 / RS232 to down load all parameters on demand.

12.0 Energy Meter Box

12.1	Energy meter	In the scope of purchaser
12.2	Location	To be provided mounted on enclosure wall in LV compartment.

12.3	Energy meter box Size	650 mm height x 450 mm width x 275 mm depth.
12.4	Box door design	With antitheft hinge, padlock facility, door fixed by stainless steel Allen screw M6 size.
12.5	Fixing of energy meter within box	On slotted horizontal channel 40 x 12 mm size, channel shall be movable on vertical slotted angle 40 x 40 mm size at two ends.
12.6	Meter reading window	Front door shall be with acrylic sheet for viewing the energy meter.
12.7	Sealing arrangement	02 no's sealing arrangement shall be provided on meter box's door.
12.8	Data downloading port	Slot shall be provided on door of meter box for fixing 9 pin DB connector (RS232 serial port).
12.9	Test Terminal Block	No Test terminal block shall be provided.
12.10	Cables and wires	PVC insulated, extruded PVC inner sheathed, armored, extruded PVC outer sheathed 1100 V grade control cable as per latest edition of IS 1554 part 1 minimum 2.5 sq mm for PT and 4 sq mm for CT with multi strand copper conductor.
12.11	Cable Glands	Nickel plated brass double compression weatherproof cable gland.
12.12	Wiring diagram	To be fixed on the back of door along with CT spec. etched on Anodised Aluminium plate fixed by rivet.
12.13	CT / PT Secondary wires	All CT and PT's Secondary wires shall be routed through metallic conduit. All secondary wires shall be bunched and kept for termination without any terminal/ TTB in between.

13.0 Enclosure for packaged substation

13.1	Service conditions	For outdoor use
13.2	Material for enclosure	Galvanised Sheet steel 2mm thick with outer finish painting
13.3	Enclosure construction	Frame supported construction with all doors, covers welded with steel channel ribs at every 1000mm minimum
13.4	Lifting lugs for site handling / lifting by crane	Four numbers on top to enable lifting of total package unit without any problem
13.5	Doors for RMU compartment & LV compartment	With internal anti theft hinge with minimum opening angle of 120º **[R3]**, minimum 3 nos., with lockable handle & with padlocking facility
13.6	Two side covers for transformer compartment	Bolted with Allen head type bolts to main frame
13.7	Top & other side walls of package substation enclosure	Welded sheet metal to main frame

13.8	Removable canopy above top cover	2mm thick sheet metal with 10º slope
13.9	Enclosure integral steel base frame	'I' section of suitable size to support total static and dynamic load
13.10	Base frame bottom support pads for fixing by bolt to foundation	Minimum six numbers to rest on foundation
13.11	Enclosure compartments	Separate compartments for RMU, transformer & LV switchgear/APFC
13.12	Separation between RMU & transformer compartment	By sheet steel 2mm thick
13.13	Separation between transformer compartment & LV compartment	By sheet steel 2mm thick
13.14	Degree of ingress protection against solids & water as per IS12063	IP53 for RMU compartment IP 34 for transformer compartment **[R7]** IP54 for LV compartment
13.15	Louvers on side covers of transformer compartment & side walls of LV compartment	To be provided with steel wire mesh welded from inside so as to meet IP requirement as above
13.16	Louver area on cover / side wall	1500mm height x 1500mm desirable
13.17	Louver position from bottom level	Minimum 200mm above bottom
13.18	Exhaust Fans	Mounted in LV compartment to discharge air in transformer compartment & Controlled by SPMCB & thermostat to operate above 35 deg C, 2x150CFM, 1 ph 230v 50Hz
13.19	Gland plate for RMU compartment	3 mm thick MS plate suitable for 3x3c300/400 sqmm AYFY 11kv cable
13.20	Gland plate for LV compartment	3 mm thick MS plate suitable for 10x 4c400sqmm cable + 10x7c2.5sqmm cable
13.21	Door Opening Provision	Type I, II & III : With 3 side door opening
13.22	Class of enclosure as per IEC 62271-202	10K
13.23	Internal Arc classification	IAC AB 20 KA, 1s **[R3]**
13.24	Limiting dimensions of package enclosure	
13.25 a	Type I (1000KVA Transformer):	3400(L) x 2900(W) x 2800(H)
13.25.b	Type II & III (400KVA /630KVA Transformer)	3400(L) x 2600(W) x 2600(H)
13.26	Type IV (250 kVA	2000(L) x 2000(W) x 2000(H) **[R7]**

	Transformer)	

14.0 Other Provisions: Earthing, Illumination, Hooter & Smoke Detector

14.1.1	Earth bus connection brought out of package substation enclosure to earth pad for connection to earth pit	a) Two earth pads for RMU, transformer & LV compartment each. b) Two earth pads for transformer neutral
14.1.2	Earth bus size	50 x6 GI flat
14.1.3	Earth bus fault current capacity	26.3kA for 1 sec
14.1.4	Earth connection of all covers, doors & structural parts to GI bus	By metallic jumper connection
14.1.5	Earth connection of RMU, ACB & transformer body parts to GI bus	By two numbers of 50x6mm GI flat per equipment
14.1.6	Earth bus identification	Shown by letter 'E'
14.2.1	RMU, transformer & LV compartment illumination	By 36w CFL fixture controlled through SPMCB & door limit switch
14.2.2	RMU, transformer & LV compartment power socket	5/15amp 3 pin socket through 15 amp SPMCB
14.24	Smoke Detector in each compartment	Minimum 02 no's Smoke Detectors in each LT, HT and Transformer compartment with potential free auxiliary contact for tripping the RMU, Alarm and SCADA. All detectors shall be wired upto controller cum alarm unit suitable. **[R3]**
14.25	Hooter	Required with timer reset for operator alarm on opening of PSS door

15.0 Labels & painting

15.1	Name plate on package enclosure	Fixing by rivet only
15.1.1	Material	Anodized aluminum 16SWG / Stainless Steel (SS) **[R3]**
15.1.2	Background	SATIN SILVER
15.1.3	Letters, diagram & border	Black
15.1.4	Process	Etching
15.2	Name plate details	Month & year of manufacture, transformer rating, purchaser name & order number, guarantee period, Ref. IS / IES No. Shall be provided inside enclosure as well as outside enclosure.**[R3]**

15.3	Labels for meters & indications	Anodized aluminium with white character on black background OR 3 ply Lamicoid
15.4	Danger plate on doors of RMU compartment & LV compartment	Etched on 16 swg anodised aluminium / SS plate with white letters on red background
15.5	BSES Insignia	a) 02 no's b) HV and LV side of PSS enclosure. c) Shall be etched on anodized aluminium 16SWG / SS plate. d) Details shall be finalized during drawing approval.
15.6	Enclosure painting surface preparation	Shot blasting or 7 tank chemical process
15.7	Enclosure painting external finish Powder coated epoxy polyester base	Hot dip galvanizing – 80 micron thick grade A, shade - RAL 7032, uniform thickness 60 micron minimum .
15.8	Enclosure painting internal finish	Powder coated epoxy polyester base grade A, shade -white, uniform thickness 80 micron minimum

16.0 Approved makes

16.1.0	RMU	For RMU accessories please refer RMU Specification part
16.4.0	Oil type transformer	Toshiba/Danish/ Schneider// or any other make approved by BRPL.[R7]
16.5.0	Dry type transformer	ABB/ Raychem / TMC/ or any other make approved by BRPL. [R7]
	Transformer core	Nippon/JFE/Posco
16.6.0	Pressure relief valve	Sukrut / VIAL
16.7.0	Bushings make	Baroda bushing / CJI / Jaipur Glass
16.8.0	Winding Temperature Indicator	Precimeasure/ Pecon
16.9.0	ACB	L&T / Schneider-MG / AREVA / GE / Siemens / ABB / C&S **[R7]**
16.10.0	MCCB	GE / Merlin Gerin / ABB / L&T/Siemens **[R7]**
16.11.0	APFC	
16.11.1	Switch	ABB / Siemens / L&T (Salzer)
16.5.2	HRC Fuse Links	Alstom / Siemens / L&T / GE
16.5.3	Load manager	L&T / Enercon / AE / DUCATI / Phasetrac M-40 / TAS POWERTECH
16.5.4	APFC relay	Beluk / ABB / Fraco / Ducati/ TAS / POWERTECH
16.5.5	AC Contactors	ABB / Schneider
16.5.6	Push buttons / Actuator	L&T / Teknic / Siemens

16.5.7	MCB	ABB / L&T / Siemens/Schneider –MG
16.5.8	Capacitors	FRACO / DUCATI/ABB
16.5.9	Fans	EBM Nadi
16.6.0	Terminals	Connectwell / Elmex
16.7.0	Transformer Bushings (HV side)	Euromold (Nexan)/ Elmek/ H.J. International/ Pfisterer any other vendor approved by BSES
16.8.0	Termination kits for RMU	3m/ Raychem/ Denson
16.9.0	Termination kits for Transformer	3M/ Raychem/ Denson / any other make approved by BSES
16.9.1	Cold applied cable boots	3M/ Raychem

17.0 Quality assurance

17.1	Vendor quality plan	To be submitted for purchaser approval for all components listed in clause 4.0 For transformer, RMU & APFC panel sub vendor quality plan to be submitted.
17.2	Inspection points in quality plan	To be mutually identified & agreed
17.3	Quality – Process Audits	BSES shall carryout vendor process audits.
17.4	Field quality plan	Bidder to submit field quality plan along with the bid
17.5	Spare part list	Bidder to submit detailed spare part list along with the bid
17.6	Maintenance manual	Bidder to submit maintenance manual along with the bid

18.0 Inspection & testing

18.1	Type test as per IS / IEC	a) Only type tested quality equipment(s) shall be offered. b) Type test certificates mentioned in this clause shall be submitted along with offer for scrutiny c) The test report should not be more than 5years old. d) Type test and special tests for Transformer (from CPRI/ERDA) shall include the following **[R7]:** i) Impulse withstand test on all three HV limbs of the transformers for chopped wave as per IS 2026 ii) Temperature rise test as per IS 2026 iii) Air pressure test for sealed transformers asper IS 1180 iv) Pressure and Vacuum test on tank v) Dynamic & Thermal (3 sec) Short Circuit Test as per IS. vi) Measure of zero seq. impedance (Cl. 16.10 IS 2026 Part I).

		vii) Measurement of acoustic noise level (Cl. 16.12 of IS 2026 Part I). viii)Measurement of harmonic level on no load current. ix) Partial discharge test x) High voltage withstand test shall be performed on the auxiliary equipment and wiring after complete assembly. e) If identical rating type test reports for transformers are not available vendor to carryout Short circuit withstand test (Dynamic and thermal (for 3 secs)), Lightning impulse test & temperature rise test without any additional cost.
18.1.1	Package substation assembly	As per IEC 62271-202
18.1.2	11kv RMU, transformer, ACB, MCCB, APFC system and capacitor units	As per relevant IS/ IEC, For RMU type test criteria refer RMU specification part
18.2	Routing tests	
18.2.1	Routine tests of PSS	As per IEC 62271-202
18.2.2	Routine tests of transformer, RMU, LT panel & APFC	As per relevant IS/ IEC , For RMU refer RMU specification part
18.3	Inspection and acceptance testing	a) Purchaser reserves the right to inspect /witness all tests on the meters at manufacture's works at any time, prior to dispatch, to verify compliance with the specification/ standards. b) Manufacturer should have all the facilities/ equipments to conduct all the acceptance tests during inspection. All the testing equipment should be calibrated. c) Stage and / or final inspection call intimation shall be given at least 15 days in advance to the purchaser. d) For RMU refer RMU specification part
18.3.1	Stage inspection of transformer	Purchaser shall inspect transformers at the core and coil assembly stage at the manufacturer's premises.
18.3.2	Final inspection of transformers	The sequence of testing shall be as follows a) Visual and dimension check for completely assembled transformer. b) Measurements of voltage ratio. c) Measurements of winding resistance at principal tap and two extreme taps. d) Vector Group and polarity test. e) *Measurements of insulation resistance and polarization index. f) Separate sources voltage withstand test. g) Measurement of iron losses and exciting current at rated frequency and 90%, 100% and 110% rated voltage.

		h) Induced voltage withstand test. i) Load losses measurement. j) Impedance measurement of principal tap (HV and LV) of the transformer. k) Measurement of Iron loss (to be repeated if type test are conducted). l) Measurement of capacitance and Tan Delta for HV and LV bushings and Tan Delta for transformer oil (for all transformers). m) Oil leakage test on assembled transformer n) Magnetic balance test. o) Power frequency voltage withstand test on all auxiliary circuits p) Measure of zero seq. impedance (Cl. 16.10 IS 2026 Part I). q) Measurement of acoustic noise level (Cl. 16.12 of IS 2026 Part I). r) Measurement of harmonic level on no load current. *Insulation resistance measurement shall be carried out at 5kV for HV and 1kV for LV. Value of IR should not be less than 2000 Mohms**[R7].** Polarization Index (PI = IR10min/IR1min) should not be less than 1.5 (If one minute IR value is above 5000 Mohms and it is not be possible to obtain an accurate 10 minutes reading, in such cases polarization index can be disregarded as a measure of winding condition.)
18.3.3	Final Inspection of package substation after complete assembly	As per IEC 62271-202 and relevant IS/ IEC of equipment. a) Visual check b) Dimensional and sheet thickness check c) Verification of Wiring & BOM d) Paint thickness inside and outside of PSS enclosure. e) Functional test i. Operation of switchgear and control gear. ii. Mechanical operation and alignments of PSS doors. iii. Fixing of insulating barriers. iv. Voltage indication check v. Checking of temperature and liquid level of the transformer. vi. Fitting of earthing devices. vii. Cable testing viii. Replacement of LTCT ix. Operation of transformer tap changer x. Operation of illumination system xi. Trip function of HV switchgear. f) IR test

		g) HV test on power circuit h) HV test on auxiliary circuits i) Operational and interlocks check
18.3.4	Acceptance Test of LT Panel / APFC Panel	a) Visual, dimension, wiring & BOM check. b) Operational check. c) IR Test. d) HV Test
18.4	Special acceptance tests	
18.4.1	Transformer	Temperature rise test shall be carried out on 01 no transformer of each rating randomly selected from the offered lot.
18.4.2	PSS	Temperature rise test of PSS along with transformer as per IEC 62271-202.
18.5	Right to waive off tests	Reserved by Purchaser

19.0 Shipping, Handling and Site support

19.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration
19.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
19.3	Packing Identification Label (Anodized Aluminum Plate)	On each packing case, following details are required:
		a) Individual serial number
		b) Purchaser's name
		c) PO number (along with SAP item code, if any) & date
		d) Equipment Tag no. (if any)
		e) Destination
		f) Manufacturer / Supplier's name
		g) Address of Manufacturer / Supplier / it's agent
		h) Description of PSS.
		i) Country of origin
		j) Month & year of Manufacturing
		k) Case measurements
		l) Gross and net weights in kilograms
		m) All necessary slinging and stacking instructions
19.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
19.5	Handling and Storage	a) Manufacturer instruction shall be followed. b) Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.

20.0 Deviations

20.1	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification.

21.0 Drawings Submission

21.1.0	To be submitted along with bid	The seller has to submit following:
21.1.1	GA drawing (Complete assembly, RMU, transformer, LT panel + other items)	
21.1.2	BOM of Packaged substation	
21.1.3	Calculation for sizing of Transformer	
21.1.4	Sizing Calculation of busbar in support of its Guaranteed S.C. rating / Capability	
21.1.5	Guaranteed technical particulars (GTP) of Packaged substation in the format as per annexure 'C'	
21.1.6	Clause wise deviation sheet as per clause no. 20.0	
21.1.7	Catalogues & manuals for Package substation + RMU + Transformer + LT switchgear items + APFC	
21.1.8	User manual for Hermetically Sealed Transformers. The manual must be provided with, but not limited to, maintenance schedule, frequency & method of oil- sampling, procedures for oil-filling & oil-filtration, etc.	
21.1.9	Quality plan for Packaged substation.	
21.1.10	Type test reports as per clause 18.1 of this specification.	
21.1.11	Recommended spare parts and consumable items for five years of operation and spare parts catalogue with price list	
21.2.0	After award of contract, Seller has to submit following drawings for buyer's Approval (A) / Reference (R)	
21.3.1	Program for production and testing (A)	
21.3.2	GTP of Packaged substation as per annexure 'C' of this specification.	
21.3.3	Deviation sheet, in case of any deviations finalized in technical bid evaluation.	
21.3.4	Design calculations for transformer	
21.3.5	Detailed GA drawing(s) (Complete assembly, RMU, transformer, LT panel + meter box + other items)	
21.3.6	Wiring/ schematic drawings (Complete assembly, RMU, transformer, LT panel + APFC + meter box + other items)	
21.3.7	Drawing details of Name plates, danger plates, BSES insignia, instruction sheets etc.	
21.3.8	Drawings of cable cleats/ clamps.	
21.3.9	Foundation drawing(s).	
21.3.10	BOM of Packaged substation	
21.3.11	Quality plan Packaged substation, RMU, Transformer, LT panel, APFC (panel and units etc.	
21.3.12	Installation, commissioning manual for all items in Packaged substation. (for	

	information)	
21.3.13	Operation & maintenance manual for all items in Packaged substation. (for information)	
21.3.14	Transport / Shipping dimensions with weights, wheel base details, un tanking height	
21.4	Submittals required prior to dispatch	
21.4.1	As built Drawings	
21.4.2	Inspection and test reports, carried out in manufacturer's works	
21.4.3	Test certificates of all bought out items	
21.4.4	Operation and maintenance Instruction as well as trouble shooting charts/ manuals	
21.5	Drawing and document sizes	Standard size paper A3, A4
21.6	Number of Documents required at different stages	4 hard copies + 2 soft copies in CD Format at each stage
Note :	Duly signed & stamped copies of the drawings / documentation are required to be submitted to BSES for approval.	

Annexure A Service Conditions

The package substation shall be designed & tested to operate satisfactorily under following conditions -

Sr No	Description	Data by purchaser
1.	Location	Delhi
2.	Reference design ambient temperature	40°C for Delhi
3.	Maximum ambient temperature	50°C for Delhi
4.	Relative humidity	85% for Delhi
5.	Seismic zone	Zone IV for Delhi

Annexure B Technical Specification for transformer oil

Transformer oil shall be new and conform to the following requirements:

1.0 Codes & standards

Latest revision of following codes & standards with all amendments –

	Standard no	Title
1.1	IS 335	New insulating oils
1.2	IS 1783	Drums for oils

1.1 Properties

The insulating oil shall have following features [R7]:

S.No.	Item description	Specification requirement
2.1	Appearance of oil	Clear, free from sediment and suspended matter
2.2	Viscosity Max.	15 mm2 /s at 40°C 1800 mm2 /s at 0°C
2.3	Pour Point, Max	-10°C
2.4	Water content, Max	30 mg/Kg
2.5	Breakdown voltage	
i)	New unfiltered oil. Min.	30 kV
ii)	After filtration Min.	70 kV
2.6	Density Max.	0.895 g/ml at 20°C
2.7	Dielectric dissipation factor Max	0.005 at 90 °C,
2.8	Particle Content	Value to be provided by the vendor
2.9	Acidity Max	0.01 mg KOH/g
2.10	Interfacial tension at 27°C Min	40 mN/m
2.11	Total sulphur content	Value to be provided by the vendor
2.12	Corrosive sulfur	Not-corrosive
2.13	Potentially Corrosive sulfur	Not-corrosive
2.14	DBDS	Not detectable (<5 mg/kg)
2.15	Inhibitor	Not detectable (<0.01%)
2.16	Metal Passivator	Not detectable (<5 mg/kg)
2.17	Other addivites	Type and concentration of additives to

		be provided by the vendor
2.18	2-furfural and related Compounds content	Not detectable (<0.05 mg/kg) for each individual compound
2.19	Oxidation stability	
a)	Total acidity, Max	1.2 mg KOH/g
b)	Sludge Max	0.8%
c)	DDF at 90 °C, Max	0.5
2.20	Gassing Tendency	Value to be provided by the vendor
2.21	ECT	Value to be provided by the vendor
2.22	Flash point Min.	135°C,
2.23	PCA content Max	3%
2.24	PCB content	Not detectable (<2 mg/Kg)
2.25	Test	As per IS 335-2018

Annexure C Guaranteed Technical Particulars (Data by Supplier)

i. Bidder shall furnish the GTP format with all details against each clause.
ii. Bidder shall not change the format of GTP or clause description.
iii. Bidder to submit duly filled GTP in hard copy format with company seal.

Sr. No.	Description	Data to be filled by Manufacturer
1	Manufacturer Name	
2	Manufacturer Address	
2.1	Telephone no	
3	Manufacturer contact person	
4	Manufacturer brand name (Give catalogue reference)	
	Conformance to specification	Yes/No
	If NO for above, Submission of clause wise deviation sheet	Yes/No
5	**11kV RMU**	
1	11kV RMU, 630A	
2	Equipment make	
	Equipment type / brand name	
3	Conformance to design standards as per specification clause no 2.0 –	Yes/No

4	Conformance to specification clause no 3.0 to 17.0 –	Yes/No
5	If NO for pt 3 or pt 4 above, Submission of deviation sheet for each specification clause no –	Yes/No
6	Panel overall dimensions in mm	
	Width (measured from front)	
	Depth	
	Height	
7	Panel weight in kg	
8	Panel extensible on both sides – Yes / No	
9	Panel enclosure protection offered	
10	Panel tested for internal arc (Cable & other compartments) –Yes / No	
11	Heat generated by the panel in Kw	
12	Insulation level for complete panel	
12.1	Impulse withstand (Kv peak) -70kvp min	
12.2	Power frequency withstand (Kv rms) – 28kv min	
13	Bus bar	
13.1	Material & grade	
13.2	Bus bar cross section area in sq mm	
13.3	Bus bar rated current in amp i) at designed 50 deg.C ambient {R9} at 50 deg.C ambient	
13.4	Max temperature rise above reference ambient of 40 deg C	
13.5	Short time current withstand capacity for 3 seconds (in KA)	
13.6	Bus bar clearances in mm P-P / P-E	
13.7	Bus bar with insulation sleeve / barriers	
13.8	Bus bar support insulator type	
13.9	Bus bar support insulator voltage class	
13.10	Bus bar support insulator minimum creepage distance / mm	
13.11	Earth bus bar material	
13.12	Earth bus bar size	
14	**Circuit breaker type – SF6 or VCB**	
14.1	Rated voltage & frequency	
14.2	Rated current in amp	

14.3	Rated breaking current – KA rms symmetrical	
14.4	Short time withstand capacity in KA for 3 sec	
14.5	Rated making current - KA peak	
14.6	Breaker total opening time at rated breaking capacity (in milliseconds)	
14.7	Number of breaks per pole	
14.8	Total length of contact travel in mm	
14.9	No of circuit breaker operation cycles (close & open) guaranteed at rated current, Electrical endurance class	25% rated current -
		50% rated current -
		75% rated current -
		100% rated current -
14.10	No of breaker opening operations guaranteed at rated fault current, Electrical Endurance Class	
14.11	No of breaker mechanical operation cycles (close & open) guaranteed at zero current , Mechanical endurance class	
14.12	Contact material	
14.13	Operating mechanism – trip free	
	Manual Spring charge type	
14.14	Feeder circuit breaker (FCB) –VCB	
14.14.3	Closing coil wattage & rated DC voltage	
14.14.4	Trip coil wattage & rated DC voltage	
14.15	Transformer CT class, ratio & Vk	
15	**Load break switch type – SF6 or VCB**	
15.1	Rated voltage & frequency	
15.2	Rated current in amp	
15.3	Load break switch total opening time at rated current (in milliseconds)	
15.4	Number of breaks per pole	
15.5	Total length of contact travel in mm	
15.7	No of LBS close & open operation cycles guaranteed at	25% rated current -
		50% rated current -

		75% rated current -
		100% rated current -
15.8	No of LBS making operations guaranteed at rated fault current, Electrical endurance class	
15.9	No of LBS close & open operations guaranteed at zero current, Mechanical endurance class	
15.10	Contact material	
15.11	Operating mechanism type	
15.13	Minimum permissible SF6 gas pressure (For SF6 type RMU only)	
15.14	Capacitor type cable voltage indication provided?	Yes / No
15.15	Operation counter provided	Yes/ No
16.1	Disconnect switch continuous rating (Amp)	
16.2	Disconnect switch Short time withstand rating -20kA for 3 sec minimum	Yes / No
16.3	One LBS open operation possible in the event of loss of SF6 gas	Yes/No
17.1	Cable termination – Height of power terminal from gland plate	Mm
17.2	Torque required for tightening terminal lug	
18	Mimic diagram, labels & finish as per cl no 12	Yes / No
19	Submission of RMU / component catalogue	Yes/No
20	Unit price for Conversion kit offered separately for converting the RMU from single cable termination design to double cable termination design	Yes / No
21	Earth Switch	
21.1	Minimum number of operations at no load- Mechanical Endurance class	
21.2	Making capacity endurance of earth switch – Electrical endurance class	
22	Self Powered Relay – Make / Model	As per make list (Relay shall be communicable with SCADA)
22.1	CT Input	
22.2	IDMT Setting Range 4 element – Over Current & Earth fault & steps	Overcurrent- Earth Fault-

		Instantaneous O/C- Instantaneous E/F-
22.3	Operating Time	Over Current – Curves Instantaneous
22.4	Pick up Current	
22.5	Resetting Current	
22.6	Relay Burden	
22.7	Time Accuracy	
22.8	Tripping Coil O/P – type & duration	
22.9	Fault Current Display	
22.10	No of Fault Current Latching with time stamping	
22.11	Display Facility / Type	
22.12	Operational Indicators	
22.13	Potential Free Output Contacts	
22.14	Thermal Withstand Capacity of Relay	
23	Fault Passage Indicator	Over Current and Earth Fault
23.1	CBCT	
a	Type	
b	Mounting Arrangement	
c	CT to indicator connection	
d	ID of sensor	
23.2	Earth Fault Indicator	
a	Sensing Current	
b	Sensing Time	
c	Indication	
d	Reset Time	
e	Resetting Facility	
f	Output Contact	
g	Contact Rating	
h	Aux Power Supply	
i	Degree of Protection	
j	Mounting Arrangement	
k	Ambient Temperature	
24	Current Transformer- Make	
24.1	Ratio	
24.2	Burden	

24.3	Accuracy Class		
25	Voltage Presence Indicator		
	Make		
	Rating		
	Model No		
26.8	Terminal Blocks, Disconnecting type fuses make		
6.0.0	**11kv cable**	from RMU to transformer	
6.1.0	Cable size 3CX150 sqmm AYFY	Yes/No	
6.2.0	Cable rated voltage - 11000v	Yes/No	
6.3.0	Cable short circuit current capacity for 1 sec	kA	
6.4.0	Type of insulation - XLPE	Yes/No	
6.5.0	Outer insulation sheath – PVC with armor	Yes/No	
6.6.0	Cable termination type & make		
7.0.0	**250 KVA/400KVA /630KVA/1000KVA hermetically sealed type transformer**		
7.1.0	Make		
7.2.0	Type - Oil immersed, core type, step down	Yes/No	
7.3.0	Transformer continuous rating when placed in package substation enclosure	HV winding	LV winding
		KVA	KVA
7.4.0	Rated voltage (kV)	HV winding	LV winding
		11 KV	0.433 KV
7.5.0	Rated current	HV winding	LV winding
		Amps	Amps
7.6.0	Transformer vector group – Dyn11	Yes / No	
7.7.0	Impedance at principal tap rated current and frequency, ohm @75 °C	250KVA/400KVA & 630KVA - 4.5.0 % & 1000KVA-5% with IS tolerance **[R4]**	
7.7.1	Impedance at lowest tap	Ω	
7.7.2	Impedance at highest tap	Ω	
7.8.0	Resistance of the winding at 75°C in ohm	HV winding	LV winding
		Ω	Ω
7.9.0	Zero sequence impedance in ohm	HV winding	LV winding
		Ω	Ω
7.10.0	Guaranteed maximum losses at principal tap full load and 75°C without any positive tolerance, kW		
7.10.1	No load losses (max.)	KW	

7.10.2	Load losses (max.)	KW
7.10.3	Total losses (max.) at 50% and 100% load **[R4]**	KW
7.10.4	No load loss at maximum permissible voltage and frequency (approx.),	KW
7.11.0	Temperature rise over reference ambient	
7.11.1	Top oil by thermometer °C	35 0C
7.11.2	Winding by resistance °C	40 0C
7.12.0	Efficiency	at 75°C and unity power factor
7.12.1	at 100% load	
7.12.2	at 50% load	
7.12.3	at 25% load	
7.13.0	Efficiency	at 75°C and 0.8 power factor lag
7.13.1	at 100% load	
7.13.2	at 50% load	
7.13.3	at 25% load	
7.14.0	Load and power factor at which Maximum efficiency occurs	
7.15.0	Regulation at full load at 75°C	
7.15.1	at unity power factor	
7.15.2	at 0.8 power factor lagging	
7.16.0	Regulation at 110% load at 75°C	
7.16.1	at unity power factor	
7.16.2	at 0.8 power factor lagging	
7.17.0	Tapping	Off circuit
7.17.1	Capacity	Full capacity
7.17.2	Range-steps x % variation	
7.17.3	Taps provided on HV winding	Yes / No
7.17.4	Rated current of rotary switch 100Amp	Yes / No
7.18.0	Transformer Tank	Corrugated plate tank
7.18.1	Cooling	ONAN
7.18.2	Tank material	Robust mild steel plate without pitting and low carbon content
7.18.3	Thickness of sides mm	
7.18.4	Thickness of bottom mm	
7.18.5	Thickness of cover mm	
7.18.6	Tank designed and tested for Vacuum, Pressure (Ref: CBIP Manual)	Yes/ No
7.18.7	Vacuum mm of Hg. / (KN/m^2)	
7.18.8	Pressure mm of Hg.	Twice the normal head of oil / normal pressure + $35kN/m^2$ whichever is lower, As per CBIP

7.18.9	Is the tank lid sloped?	Yes / No
7.18.10	Inspection cover provided	Yes / No
7.18.11	Location of inspection cover	Yes / No
7.19.0	Core	
7.19.1	Core material grade	Premium grade minimum M3 or better **[R4]**
7.19.2	Core lamination thickness	mm
7.19.3	Insulation of lamination	With insulation coating on both sides
7.19.4	Design flux density at rated condition at principal tap, Tesla	
7.19.5	Maximum flux density at 12.5 %**[R4]** over excitation / over fluxing,	1.9 Tesla
7.19.6	Equivalent cross section area	mm^2
7.20.0	Guaranteed No Load current at 100% rated voltage.	
7.20.1	HV	Amps
7.20.2	LV	Amps
7.21.0	Guaranteed No Load current At 110% rated voltage.	
7.21.1	HV	Amps
7.21.2	LV	Amps
7.22.0	Winding	
7.22.1	Type of Winding	
7.22.1	HV	
7.22.2	LV	
7.22.2	Conductor material	Electrolytic Copper
7.22.3	Current density (HV/LV)	Maximum allowed 3.0 A per mm^2.
7.22.4	Gauge/area of cross section of conductor	
	HV	mm^2
	LV	mm^2
7.22.5	Insulating material	type & thickness in mm
	HV Turn	mm
	LV Turn	mm
	LV Core	mm
	HV - LV	mm
7.23.0	Transformer insulation Polarization Index value (Min 1.5	
7.24.0	Transformer insulation IR value for HV winding (Min 2000Mega Ohm)	
7.25.0	Minimum design clearance, mm	

7.25.1	HV to earth in Air	
7.25.2	HV to earth in oil	
7.25.3	LV to earth in Air	
7.25.4	LV to earth in oil	
7.25.5	Between HV & LV in Air	
7.25.6	Between HV & LV in oil	
7.25.7	Top winding and yoke	
7.25.8	Bottom winding and yoke	
7.26.0	Transformer Insulating oil	
7.26.1	Quantity of oil	Ltrs
7.26.2	In the Transformer tank	
7.26.3	In each radiator	
7.26.4	Total quantity	
7.26.5	10% excess oil furnished?	Yes / No
7.26.6	Type of Oil	
7.27.0	Bushing / Support Insulator	
7.27.1	Make	
7.27.2	Type	
7.27.3	HV side	
7.27.4	LV side	
7.27.5	Reference Standard	
7.27.6	Voltage class, kV	
	HV side Bushing/ Support Insulator	12 kV
	LV side line and neutral bushing/ Support insulator	1.1 kV
7.27.7	Creepage factor for all bushing / Support Insulator mm/KV	31 mm / kV
7.27.8	Rated thermal short time current	
	HV bushing	KA
	LV line and neutral bushing	KA
7.27.9	Weight, Kg	
	HV bushing	KG
	LV line and neutral bushing	KG
7.27.10	Free space required for bushing removal	Mm
	HV bushing	
	LV line and neutral bushing	
7.28.0	HV Termination arrangement	To 3CX150 mm^2 AYFY 11KV By screened separable connector kit
7.28.1	Phase to phase clearance ,	mm
7.28.2	Phase to earth ,	mm
7.29.0	L.V termination arrangement	To 100x12 mm for phase &

		neutral	
7.29.1	Phase to phase clearance,	25 mm minimum	
7.29.2	Phase to earth clearance ,	25 mm minimum	
7.30.0	Current Transformer on LV phases		
7.30.1	Type		
7.30.2	Make		
7.30.3	Reference Standard		
7.30.4	CT Ratio		
7.30.5	Burden, VA		
7.30.6	Class of Accuracy / ISF		
7.30.7	CT terminal box size		
7.31.0	Pressure release device on tank - make		
7.31.2	Minimum pressure the device is set to rupture		
7.32.0	Fittings Accessories Each Transformer furnished as per Clause 7.3.0	Yes/No	
7.33.0	Painting: as per clause for the transformer, cable boxes, Marshalling box	Yes/No	
7.34.0	Over all transformer dimensions		
7.34.1	Length	mm	
7.34.2	Breadth	mm	
7.34.2	Height	Mm	
7.35.0	Weight data		
7.35.1	Core	KG	
7.35.2	Winding	KG	
7.35.3	Frame	KG	
7.35.4	Tank	KG	
7.35.5	Weight of oil in Tank	KG	
7.35.6	Total Transport weight of the transformer	KG	
7.36.0	Transformer total oil volume	liters	
8.0.0	**250/400/630/1000KVA Cast Resin Transformer**		
8.1.0	Make		
8.2.0	Type- Cast Resin Dry Type	Yes / No	
8.3.0	Transformer continuous rating when placed in package substation enclosure	HV winding	LV winding
		KVA	KVA
8.4.0	Rated voltage (kV)	HV winding	LV winding
		11 KV	0.433 KV
8.5.0	Rated current	HV winding	LV winding

		Amps	Amps
8.6.0	Transformer vector group – Dyn11		Yes / No
8.7.0	Impedance at principal tap rated current and frequency, ohm @130°C		5.0 % with IS tolerance
8.7.1	Impedance at lowest tap		Ω
8.7.2	Impedance at highest tap		Ω
8.8.0	Resistance of the winding at 130°C in ohm	HV winding	LV winding
		Ω	Ω
8.9.0	Zero sequence impedance in ohm	HV winding	LV winding
		Ω	Ω
8.10.0	Guaranteed maximum losses at principal tap full load and 130°C without any positive tolerance, kW		
8.10.1	No load losses (max.)		KW
8.10.2	Load losses (max.)		KW
8.10.2	Total losses (max.),		KW
8.10.4	No load loss at maximum permissible voltage and frequency (approx.),		KW
8.10.5	Total stray loses @ 130° C		
8.11.0	Temperature rise over reference ambient		
8.11.1	Winding by resistance: Outside the PSS enclosure / inside the PSS enclosure $_0$ C		80°C/ 90°C
8.11.2	Maximum hot spot temperature, Deg. C		°C
8.12.0	Efficiency		at 130°C and unity power factor
8.12.1	at 110% load		%
8.12.2	at 100% load		%
8.12.2	at 80% load		%
8.12.3	at 60% load		%
8.12.4	at 40% load		%
8.12.5	at 20% load		
8.13.0	Maximum hot spot temperature, Deg. C		at 130°C and 0.8 power factor lag
8.13.1	Efficiency		%
8.13.2	at 110% load		%
8.13.3	at 100% load		%
8.13.4	at 80% load		%

8.13.5	at 60% load	%
8.13.6	at 40% load	%
8.14.0	Maximum efficiency at 130°C	%
8.14.1	% Load and power factor at which it occurs	
8.15.0	Regulation at full load at 130°C	
8.15.1	at unity power factor	
8.15.2	at 0.8 power factor lagging	
8.16.0	Regulation at 110% load at 1300 C	
8.16.1	at unity power factor	
8.16.2	at 0.8 power factor lagging	
8.17.0	Core	
8.17.1	Core material grade	Premium grade minimum M3 or better **[R4]**
8.17.2	Thickness of lamination mm	mm
8.17.3	Insulation of lamination	
8.17.4	Design Flux Density at rated condition at principal tap, Tesla- 1.6 Tesla (Max)	
8.17.5	Maximum flux density at 10 % over excitation /overfluxing, Tesla -1.73Tesla (Max)	
8.17.6	Equivalent cross section area	
8.18.0	Guaranteed No Load current At 100% rated voltage , Amps	
8.18.1	HV	
8.18.2	LV	
8.19.0	Guaranteed No Load current At 110% rated voltage, Amps	
8.19.1	HV	
8.19.2	LV	
8.20.0	Type of Winding	
8.20.1	HV	
8.20.2	LV	
8.20.3	Conductor material	
8.20.4	Current density Amps/sqmm	
	HV winding	
	LV winding	
8.20.5	Gauge/area of cross section of conductor, sqmm	
	HV	
	LV	
8.21.0	Tapping - Off Ckt	Yes / No
8.21.1	Capacity	Full Capacity

8.21.2	Range- steps X % variation		
8.21.3	Taps provided on HV winding		Yes / No
8.21.4	Tap link Current rating , A		
8.22.0	Insulating material and thickness	Material	Thickness
8.22.1	HV Turn		mm
8.22.2	LV Turn		mm
8.22.3	LV to Core		mm
8.22.4	HV to LV		mm
8.23.0	Minimum design clearance, mm		
8.23.1	HV to earth in Air		mm
8.23.2	LV to earth in Air		mm
8.23.3	Between HV & LV in Air		mm
8.23.4	Top winding and yoke		mm
8.23.5	Bottom winding and yoke		mm
8.24.0	Bushing / Support Insulator		
8.24.1	Make		
8.24.2	Type		
8.24.3	Reference Standard		
8.24.4	Voltage class, kV		
8.24.5	HV side Bushing / Support insulator		
8.24.6	LV side line and neutral bushing / Support insulator		
8.24.7	Creepage factor for all bushing		mm / KV
8.24.8	Weight		KG
8.24.9	HV bushing / Support insulator		
8.24.10	LV line and neutral bushing / Support insulator		
8.24.11	Free space required for bushing / Support insulator removal, mm		
8.24.12	HV bushing / Support insulator		
8.24.13	LV line and neutral bushing / Support insulator		
8.25.0	HV Termination arrangement		Suitable for 3CX150 mm^2 AYFY 11KV
8.25.1	Phase to phase clearance		mm
8.25.2	Phase to earth clearance		mm
8.25.3	HV side bus bar size		
8.25.4	HV Termination height		Mm
8.26.0	L.V termination arrangement		Suitable to 100x12 mm for phase & neutral
8.26.1	Phase to phase clearance,		25 mm minimum
8.26.2	Phase to earth clearance ,		25 mm minimum

8.26.3	LV side bus bar size	
8.26.4	LV Termination Height	Mm
8.27.0	Current Transformer on LV phases	
8.27.1	Type	
8.27.2	Make	
8.27.3	Reference Standard	
8.27.4	CT Ratio	
8.27.5	Burden, VA	
8.27.6	Class of Accuracy	
8.28.0	WT scanner terminal box size	
8.29.0	Alarm and Trip contact ratings of protective devices	
8.29.1	Rated / making/ breaking currents , Amp @ Voltage for	
8.29.2	Winding temperature scanner	
8.30.0	Fittings and Accessories as per Cl. 7.19 provided	(YES / NO)
8.31.0	Over all transformer dimensions	
8.31.1	Length	mm
8.31.2	Width	mm
8.31.3	Height	mm
8.32.0	Weight data	
8.32.1	Core	KG
8.32.2	Frame parts, kG	KG
8.32.3	Core and frame, kG	KG
8.32.4	Total Winding, kG	KG
8.32.5	Core , Frame, Winding, kG	KG
8.32.6	Enclosure, kG	KG
8.32.7	Total Transport weight of the transformer, kG	KG
8.32.8	Total weight of the transformer with all accessories	KG
8.33.0	Shipping Data	
8.33.0	Weight of heaviest package, kG	KG
8.33.0	Dimensions of the largest package (L x B x H)	mm
8.34.0	Surge Arrestor requirement	
8.34.1	Type	
8.34.2	System Voltage , kV rms	
8.34.3	Rated Voltage of Arrestor, kV rms	
8.34.4	Continuous operating voltage , kV rms	
8.34.5	Maximum Continuous operating voltage, kV	

	rms	
8.34.6	Nominal Discharge Current, kA peak	
8.34.7	Energy Absorption Capability, kJ/kV	
8.34.8	Creepage factor	
8.34.9	Reference std	
8.35.0	WTI Scanner Details	
8.35.1	Make	
8.35.2	Model no.	
8.35.3	No of Channel / Input	
8.35.4	Manual submitted	
9.0.0	Low voltage bus bar system	To connect transformer LV side to ACB & to MCCB
9.1.0	Bus bar material tinned copper	Yes / No
9.2.0	Bus bar size	sqmm
9.3.0	Bus bar continuous current rating	Amp
9.4.0	Bus bar insulator voltage class	kV
9.5.0	Bus bar droppers size from ACB to MCCB (40x6 tinned copper)	
9.6.0	Maximum bus bar temperature rise	
10.0.0	ACB, MCCB	As per IS 13947
10.1.0	ACB make	
10.1.1	ACB rated voltage 415v +/- 10%	
10.1.2[R7]	ACB 4 pole	Yes / No
10.1.3	ACB continuous current capacity at 415v 50Hz, at 50 deg C	amp
10.1.4	ACB short circuit breaking capacity Ics =Icu = 50kA minimum	kA
10.1.5	ACB SC making current capacity 100kAp	kA peak
10.1.6	ACB short time current withstand capacity for 1 sec (Icw= 50kA)	kA
10.1.7	ACB rated impulse withstand voltage for main & aux circuit in kv	
10.1.8	ACB closing time in ms	
10.1.9	ACB opening time in ms	
10.1.10	Guaranteed number of close & open operations at no load	
10.1.11	Guaranteed number of close & open operations at rated load	
10.1.12	ACB dimensions	
10.1.13	ACB operating mechanism -Trip free, anti pumping type, manual as well as motor	Yes / No

10.1.14	Spring charging motor supply	volt
10.1.15	Close & trip coil supply	volt
10.1.16	ACB utilization category -B as per IS	
10.1.17	ACB indications - ON, OFF & TRIP	
10.1.18	ACB operation - manual - ON, OFF by push buttons	
10.1.19	ACB operation – electrical - ON, OFF by TNC switch	
10.1.20	ACB overload, short circuit & earth fault protection - By static or micro processor based releases	
10.1.21	Inbuilt CT burden, ration & class	
10.1.22	Overload release setting range	
10.1.23	Short circuit release setting range	
10.1.24	Earth fault release setting range	
10.1.25 **[R7]**	Display & Event Log	Display Require , Min last 10 nos fault event log req
10.2.0	MCCB make	
10.2.1 **[R7]**	MCCB type -3 pole, one break / pole	Yes / No
10.2.2	MCCB - On & OFF by Manual handle	Yes / No
10.2.3	MCCB Neutral connection - Fully isolable link sized for rated current	
10.2.4	MCCB rated voltage 415v +/- 10% at 50Hz	
10.2.5	MCCB rated continuous current at 50deg C(after derating)(400 amp & 630A MCCB as per enquiry)	400/630 amp
10.2.5(i){R6]	De rating of MCCB(0% at 50 deg C)	Yes / No
10.2.6	MCCB 3 ph short circuit breaking capacity Ics = Icu =36kA	
10.2.7	MCCB 3 ph short circuit withstand capacity, Icw =8kA for 1 sec	
10.2.8	MCCB SC making current capacity	
10.2.9	MCCB rated insulation level	
10.2.10	MCCB mechanical & electrical endurance as per IS 13947 / IEC	
10.2.11	MCCB category of duty - B as per IS / IEC 947	Yes / No
10.2.12	MCCB indications -ON, OFF & TR	
10.2.13	MCCB protection – Microprocessor release + earth fault	
10.2.14[R6]	Tripping characteristic required	

a	Overload setting- Range 60-100%In (Set on 95%)	
b	Short Circuit setting- Range 200-1200%In (Set on 300%)	
c	Earth fault setting To be provided	
10.2.15R6]	MCCB Housing- Thermoplastic material resistant to fire & abnormal heat , non hygroscopic	
10.2.16R6]	MCCB Terminal- Silver coated copper with phase barriers, spreader terminals & shrouds	
10.2.16 R6]	MCCB Spreader size & material-	
	Minimum-50(W)X50(L)X10(D)mm- Cu suitable for bimetallic joint i.e. for aluminium bus/cable lug	
10.2.17[R6]	MCCB Clearances in air- As per table XIII of IS 13947-1	
10.2.18[R6]	MCCB temperature rise limits - As per table 2 & 3 of IS 13947-1	
10.2.19[R6]	MCCB Ingress Protection- IP2X Minimum (pollution degree minimum 2)	
10.2.20 [R6]	MCCB additional features	Sealing/padlocking of operating knob in OFF position Sealing/padlocking of operating knob in OFF position isolation suitable with positive contact
10.3.0	Connection to ACB main bus by Cu bar with double PVC insulation	Yes / No
10.3.1	For 400 amp MCCB	
10.3.2	For 630 amp MCCB	
10.4.0	Connection to outgoing cables by bus bar terminals suitable for 2x4CX300sqmm AYFY 1100 volt grade cable	
10.4.1	MCCB– 7 nos. for Type–I , 5 nos. for Type–II & 3 for Type-III & 630 Amp three phase + neutral link	(YES/ NO)
10.4.2	Only for Type II & III- Provisions in LT panel to increase LT outgoing by 02 no's by adding MCCB's in future.	(YES/ NO)
11.0.0	APFC system	
11.1.0	Rating of APFC system	KVAR
11.2.0	Rated voltage & frequency	Volts at 50Hz

11.3.0	Rated line current of APFC system	Amp
11.4.0	Rated capacitance	micro Farad
11.5.0	Capacitor steps – Type I: 12x25KVAR? Type II: 8 X 25 KVAR?	Yes / No
11.6.0	Rated current of each 25KVAR unit	Yes / No
11.7.0	Rated capacitance – 25KVAR unit	micro Farad
11.8.0	Three phase connection – star / delta	
11.9.0	Capacitor dielectric type –	APP / MPP
11.10.0	No of series group / capacitor unit	
11.11.0	No. of parallel elements / series group	
11.12.0	Thickness of PP film in micron	
11.13.0	Thickness of Al foil in micron	
11.14.0	No. of PP film layers	
11.15.0	Maximum voltage stress per each PP film layer	
11.16.0	Discharge device material	
11.17.0	Capacitor tank steel thickness	mm
11.18.0	Capacitor unit dimension (L x D x H)	
11.19.0	APFC dimensions in mm (L x D x H)	
11.20.0	APFC system weight in kg	
11.21.0	Heat generated by APFC in Kw with all capacitor steps ON	
11.22.0	Operation with over voltage 115% of rated voltage for 12 hours in a day	
11.23.0	Operation with harmonic distortion THD 5% voltage & current	
11.24.0	Maximum permissible over current of	
11.25.0	1.3 times rated current continuous	
11.26.0	Dielectric loss less than 0.2w / KVAR	
11.27.0	Guaranteed minimum capacitor switching operations (ON/OFF) per year	
11.28.0	Maximum temperature rise above ambient of 45 Deg C	Deg C
11.29.0	Residual voltage after de-energiszation & at 60 seconds	
11.30.0	Design life of capacitor unit	
11.31.0	APFC panel insulation level	
11.32.0	1 minute power frequency withstand	KV
11.33.0	Impulse withstand voltage	KVp
11.34.0	Main bus bar material / size (sqmm)	
11.35.0	Main bus bar rated current	

11.36.0	Main bus bar short time withstand	
11.37.0	CT make & accuracy class	
11.38.0	CT ratio & burden (VA)	
11.39.0	APFC relay make / type	
11.40.0	APFC relay catalogue enclosed?	Yes / No
11.41.0	Data logger make / type	
11.42.0	Data logger catalogue enclosed?	Yes / No
11.43.0	AC contactor make	
11.44.0	AC contactor rating	Amp
11.45.0	AC contactor utilization category as per IS	
11.46.0	100amp MCCB make	
11.47.0	100amp MCCB current breaking capacity Ics=Icu=35kA	
11.48.0	Copper wire size from MCCB to contactor & capacitor – 35sqmm Cu	
12.0.0	Energy meter box as per specification provided?	Yes / No
13.0	Enclosure for package substation	
13.1	Service conditions for outdoor use	Yes / No
13.2	Material for enclosure – Galvanised Sheet steel 2.5mm thick CRCA for all side doors, covers with painting	Yes / No
13.3	Enclosure construction -Frame supported construction with all doors, covers welded with steel channel ribs at every 1000mm minimum	Yes / No
13.4	Lifting lugs for site handling / lifting by crane - qnty	
13.5	Doors for RMU compartment & LV compartment with anti theft hinge minimum 3 nos., with lockable handle & with padlocking facility	Yes / No
13.6	Two side covers for transformer	Yes / No
	compartment bolted with Allen head type bolts to main frame	
13.7	Top & other side walls of enclosure welded sheet metal	
13.8	Removable canopy above top cover -2.5mm thick sheet metal with 10º slope	Yes / No
13.9	Enclosure integral steel base frame ‘I’ section size	
13.10	Base frame bottom support pads for fixing by bolt to foundation - minimum six numbers to rest on foundation	Yes / No

13.11	Enclosure compartments -separate compartments for RMU, transformer & LV switchgear/APFC	Yes / No
13.12	Separation between RMU & transformer compartment by sheet steel 2.5mm thick	Yes / No
13.13	Separation between transformer compartment & LV compartment by sheet steel 2.5mm thick	Yes / No
13.14	Degree of ingress protection against solids & water as per IS12063	
a	IP53 for RMU compartment	
b	IP34 for transformer compartment [R7]	
c	IP33 for LV compartment	
13.15	Louvers on side covers of transformer compartment & side walls of LV compartment with steel wire mesh welded from inside so as to meet IP requirement as above	Yes / No
13.16	Louver area on cover / side wall -1500mm height x 1500mm minimum	
13.17	Exhaust fans mounted for APFC system to discharge air in transformer compartment - Controlled by SPMCB & thermostat to operate above 35 deg C, 2x150CFM, 1 ph 230v 50Hz	
13.18	Gland plate for RMU compartment - 2.5mm thick MS plate suitable for 3x3c300sqmm AYFY 11kv cable	
13.19	Gland plate for LV compartment -2.5mm thick MS plate suitable for 10x4c400sqmm cable + 10x7c2.5sqmm cable	
13.20	Class of enclosure as per IEC 62271-202 = 10K	Yes / No
13.21	Overall dimensions of package substation (LxWxH)	In mm
13.22	Overall weight of package substation	Kg
14.0	Enclosure earthing & illumination	
14.1	Two earth bus connection brought out of package substation enclosure to earth pad for connection to earth pit -Two earth pads for RMU, transformer & LV compartment each -One earth pads for transformer neutral	
14.2	Earth bus size 50X 6 mm GI flat	
14.3	Earth bus fault current capacity 26.3kA for 1 sec	

14.4	Earth connection of all covers, doors & structural parts to GI bus by metallic jumper connection	Yes / No
14.5	Earth connection of RMU, ACB & transformer body parts to GI bus by two numbers of 50x6mm GI flat per equipment	
14.6	Earth bus identification shown by letter 'E'	Yes / No
14.7	RMU, transformer & LV Compartment illumination by 36w CFL fixture controlled through SPMCB & door limit switch	
14.8	RMU, transformer & LV compartment power socket - 5/15amp 3 pin socket controlled through 15 amp SPMCB	
14.9	Paint shade external for enclosure	
14.10	Paint shade internal for enclosure	
14.11	Paint material & thickness	
14.12	Name plate & labels as per specification provided?	Yes / No
14.13	Smoke Detector	Yes / No
14.13.1	Make	
14.13.2	No Of Aux Contacts	
14.14	Hooter	Yes / No
15.0	Type test report submitted with GTP for RMU, transformer, ACB, MCCB, APFC system?	Yes / No
15.1	GA drawing of package substation submitted with GTP?	Yes / No
15.2	Bill of material submitted with GTP?	Yes / No
15.3	Clause wise deviation to technical specification submitted?	Yes / No

Bidder / Vendor seal / signature ----------

Name of the bidder	
Address of bidder	
Name of contact person	
Telephone no & email id	

Annexure D - CRGO & Testing Points [R7]

In addition to the BSES specification following points to be verified during manufacturing/inspection.	
1	Transformer core shall be low loss, non-ageing, high permeability PRIME GRADE

	CRGO with M3 Grade or better with max thickness of 0.23mm and with max core loss of 1 W/Kg, perfectly insulated and clamped to minimize noise and vibrations.
2	Following stage inspections will be carried out by purchaser or by third party engineers appointed by BSES :
2.1	Verification & inspection of the mother coil at port & putting stamp & seal may be inspected by BSES.
2.2	Reconciliation of mother coil by checking stamp & seal at factory before slitting. One sample of CRGO to be sealed for testing at ERDA/CPRI. Following Tests shall be conducted on the sample: 1) Specific core loss measurement 2) Magnetic polarization 3) Magnetic permeability 4) Specific core loss measurement after accelerated ageing test 5) Surface insulation resistivity 6) Electrical resistivity measurement 7) Stacking factor 8) Ductility(Bend test) 9) Lamination thickness 10) Magnetization characteristics (B-H curve)
2.3	Bidder should have in house core cutting facility for proper monitoring & control on quality. In case it is done outside cutting shall be done in presence of BSES.
2.4	Following documents to be submitted during the stage inspection :
2.4.1	Invoice of supplier
2.4.2	Mills test certificates
2.4.3	Packing list
2.4.4	Bill of lading
2.4.5	Bill of entry certificates by customs
2.4.6	Core material shall be directly procured either from the BSES approved manufacturer or through their authorized service centre/distributor and not through any contractor.
2.5	Bidder should have hydraulic core lifting facility to avoid any jerk at the time of core building.
2.6	BSES may appoint recognized testing authority like CPRI /ERDA with their instruments & engineer's team and measure no load loss, load loss and percentage impedance of the transformer at supplier's works at our own cost. Bidder shall agree and give them full cooperation during their stay & testing at shop floor. The losses & impedance values so obtained will be considered as final.
2.7	Bidder should have in-house NABL accredited testing facility.

Annexure E Recommended spares (Data by supplier)

List of recommended spares as following

Sr No	Description of spare part	Unit	Quantity
1		No	
2		No	
3			

4			
5			
6			
7			

Annexure F: BOM for 250 kVA PSS [R7]

Bill of Material for 11kV, 250 kVA PSS with (2 X 2 X 2 mtr)		
A	3 Way RMU (2 LBS + 1 VCB)	1 No.
B	250 kVA Dry/Oil DT	1 No.
C	LT Switchgear	
	Incomer 400 A 4P LT ACB	1 No.
	Outgoing 250A 3P MCCB	2 No.
D	Outdoor Enclosure	
	Outdoor type enclosure having modular construction of CRCA sheet metal in corrugated type wall design for better heat dissipation and providing robust construction. The enclosure shall have IP54 degree of protection for HT & LT switchgear compartment & IP34 degree of protection for Transformer compartment. The enclosure exterior shall be painted with epoxy based powder paint (colour RAL 7032). Each compartment will be provided with the door and pad locking arrangement. Doors of transformer compartment are fitted with Arc reflectors from the inside for providing better safety. The Compartment illumination lamp with door operated switch shall be provided for each compartment.	1 Set
E	Height of all equipment (RMU,LT panel & DT) from FGL	300 mm above from FGL
F	No foundation requirement , base frame / Pad mounted	Req.
G	Smoke detector with flag type auxiliary relay	Req.
H	Other material like (MFM, Fire Ball, Cable sealing compound, Space for DT meter Installation, etc.)	As per Spec

Technical Specification

for

11 kV Ring Main Unit

Specification no – SP-ERMUX-15-R9

Prepared by		Reviewed by		Approved by		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
Gautam Deka/Pronab Bairagi	27/02/20 27/02/2020	Amit Tomar	27.02.2020	K. Sheshadri	27/02/2020	R9	27/02/2020

Index

Record of Revision

Revision No	Item / clause no.	Nature of Change	Approved By
R5	1, Annex. 1.9	Service performance requirements during guarantee period specified.	DS
R5	1, Annex. 1.11	Training requirements for RMU & Self powered relay specified.	DS
R5	2	IEC 62271 specified	DS
R5	4.4.1	Solid Shielded Insulation Added	DS
R5	5.6	Added – Operating Handle support	DS
R5	5.13.3	Cable termination height is increased to 900 mm.	DS
R5	5.14.2	Bus bar short time withstand capacity changed to 20kA for 3 sec	DS
R5	5.24	Added – Avoid any type of Gaps or holes on the cable termination chamber wall.	DS
R5	6.5.4	Included provision of 2nos AC incoming supply MCB	DS
R5	6.6.2	LBS short time withstand capacity revised to 20kA for 3 sec	DS
R5	6.7	LBS fault making capacity revised to 50kA peak	DS
R5	6.8	Mechanism endurance class M1 and Electrical Endurance class E3 specified	DS
R5	6.9	Minimum no. of operations at rated fault current specified – Electrical endurance class E3	DS
R5	6.10	Fault Passage Indicator specifications included	DS
R5	7.2	CB arc interruption medium only in Vacuum bottle	DS
R5	7.4	Added – Protective flap on Emergency PB	DS
R5	7.5.2	20kA short time withstand capacity specified	DS
R5	7.6	Mechanical – M1 & Electrical-E2 endurance class specified for circuit breaker module	DS
R5	7.7	CB fault making capacity revised to 50kAspecified	DS
R5	7.8	CB fault breaking capacity revised to 20kA	DS
R5	8.7	No load mechanical endurance class M0 specified for earth switch	DS

R6	8.8	Making capacity endurance class E2 specified	DS
R5	10.6	Added – Prevent electrical operation if handle is inserted for manual operation	DS
R5	12.1	Sticker type mimic diagram non acceptance specified	DS
R5	13.3	Process audit included in the Quality systems for RMU, self powered relay	DS
R5	13.4	Approved sub vendor list specified for FPI self powered relay	DS
R5	Annexure A – 1.5	2 nos. is changed to 2 sets of Operating handle	DS
R5	Annexure C – 21 to 26	Earth Switch , Self powered relay, FPI, CT, VPI details included in GTP particulars, to be provided by supplier	DS
R5	Annexure F	BSES 11kV terminal connection lug dwg. – Bimetallic Ring type, provided for supplier to provide suitable terminal fixing arrangement at 11Kv bushing.	DS
R6	Annexure I	Requirement of 11 kV "Metering Cubicle" requirement added	DS/GS
R7	4.2	Added Both side extensible (L.H.S. and R.H.S.) requirement	VP
R7	18.0	Added Equipment ID requirement	VP
R7	1.10	Added Equipment ID requirement	VP
R7	7.11	Circuit breaker (TCB / FCB): Added all the CTS shall be bushing mounted requirement	VP
R7	Annexure G(1)	Added Servicing and Warranty requirement-Equipment supply (11kV Ring Main Unit) requirement	VP
R8	6.10	FPI (for both Earth Fault and Over Current Protection)	VP
R8	Annexure-I	Make List	VP
R8	16	Deviation Clause	VP
R8	1.0A	Motorized Compatibility	VP
R8	7.13	Self Powered –shall be communicable	VP
R8	9.4	Digital Manometer for SF6 gas pressure measurement	VP
R8	Annexure-E (f)	4 Way Outdoor RMU (2VCB+2LBS)	VP
R9	5.1, 5.7	Panel Construction –CRCA/GI with 2 to 2.5 mm thick sheet	KS
R9	5.8	Base frame shall be constructed with 75mm ISMC/ISA channel and HDPE cleat shall be adjustable to hold the cable	KS
R9	5.12	11kV, 3CX400 sqmm cable added provision of termination facility.	KS

R9	5.15	Earth Bus bar-Tinned Copper flat sized for rated fault duty for 3 sec	KS
R9	5.20	TBs shall be push on type in the place of screw type.	KS
R9	6.10.2	Connection of CBCT with FPI shall be with only PVC wire	KS
R9	7.11	Position of CTs inside compartment shall be adjustable in vertical and horizontal direction	KS
R9	7.12	CT accuracy class shall be 5P10	KS
R9	7.16	VCB breaking timing shall be 40 to 60ms	KS
R9	8.8	Making capacity endurance of earth switch- E2 Class with 5 operation as per IEC 62271-102	KS
R9	9.1	Stainless steel Tank enclosure suitable for IP67. Metal thickness shall be 3mm	KS
R9	Annexure-H-8.14 and 9.10	Make and grade of Epoxy Resin shall be Cycloaliphatic	KS
R9	12.8	Printed copy of termination and wiring diagram shall be fixed/mounted inside each and every compartment	KS
R9	Annexure-I	Make list	KS
R9	Annexure-K	Special Technical Requirement	KS

Proposed by	Reviewed By	Approved by
27/02/20 27/02/2020	27/02/2020	
Gautam deka/ Pronab Bairagi	Amit Tomar	K. Sheshadri

1.0 Scope of work

A. 11kV Manual RMU shall be supplied as per the specification. All the manual RMU shall be compatible for retrofit solution of motorized RMU in future

B. Metering Cubicle (Only with Outdoor RMU, if specified with purchase requisite) **[R6]**

C. For scope of supply, refer annexure – A

2.0 Codes & standards

Materials, equipment and methods used in the manufacture of switchboards shall conform to the latest edition of following –

S No.	Title
Indian Electricity Rules	With latest amendments
Indian electricity act	IE act 2003
IS 3427	A.C. Metal Enclosed Switchgear and Control gear for Rated Voltages Above 1 Kv
IS 9920 part 1,3 & 4	High voltage switches above rated voltage 1kv
IS 13118	General requirements of circuit breakers above rated voltage 1kv
IS 3231	Electric Relays for Power System Protection
IEC 60265 part 1	High voltage switches
IEC 60056	High voltage alternating current circuit breakers
IEC 60059	Preferred current ratings of high voltage switchgear
IEC 60185	Current transformers
IEC 60694	Specification for high voltage switchgear
IEC 60298	AC metal enclosed switchgear
IEC 60129	Ac disconnector and earth switches
IEC 60529	Classification of degrees of protection provided by enclosures
IEC 60255	Electrical relays

In the event of direct conflict between various order documents, the precedence of authority of documents shall be as follows -

i. Guaranteed Technical Particulars (GTP)

ii. Specification including applicable codes & standards

iii. Approved Vendor Drawings

iv. Other documents

3.0 Electrical Distribution System Data

3.1	Supply	3 phase AC, 3 wire
3.2	Voltage	11000 volt ±10%

3.3	Frequency	50 Hz ± 5%
3.4	System neutral	Earthed at upstream 11kv source

4.0 11kv RMU System layout

4.1	RMU Configuration	As per scheme given in Annexure E & type as per Purchase requisition
4.2	Extensibility	Both side extensible (L.H.S. and R.H.S.) **[R7]**
4.3	Load break switch, Circuit breaker & earth switch in RMU panel	All shall be non draw out type, fixed position
4.4.1	Insulation medium for panel	SF6 gas or Dry air in sealed metallic tank
4.4.2	Breakers	SF6 gas or Vacuum type (with disconnector & earth switch)
4.4.3	Load break switches	SF6 gas or Vacuum type (With Earth Switch)
4.5	Arc interruption chamber for breaker	i) Separate for each breaker ii) Arc interruption chamber of breakers shall be separate from the main insulated tank. (Desirable feature)
4.6	Maximum dimensions for a 3 way panel (1 CB + 2 LBS)	
4.6.1	Width (measured from front)	1250 mm
4.6.2	Depth	800 mm
4.6.3	height	2000 mm

5.0 RMU panel construction

5.1	Panel type	CRCA/GI Metal enclosed, framed, Compartmentalized panel construction {R9}
5.2	Service Location	Indoor, non air conditioned environment / Outdoor with continuous ambient temperature of 50 deg C and shall be suitable for external climatic condition Resistant to water ultraviolet radiation (Canopy for outdoor application)
5.3	Mounting	Free Standing
5.4	Overall Enclosure Protection	IP4X minimum, vermin proof IP 54 (For outdoor duty)

5.5	Doors	Front access with anti theft hinge arrangement, Minimum three hinges. Hinges arrangement shall ensure that door cannot be removed.
5.6	Covers	Bolted for rear access, with handles. Support for handle shall be provided at suitable place on RMU body. **[R5]** All the accessible bolts / screws shall be vandal proof. One set of required Special tools per RMU (if any) shall be in the scope of supply.
5.7	Construction	CRCA/GI Metal enclosed, framed, Compartmentalized panel construction. CRCA thickness shall be 2 to 2.5 mm subject to type test report from CPRI/ERDA**. Sheet thickness below 2 mm in any part of RMU shall not be accepted {R9}**
5.8	Base frame	Base frame shall be made with 75mm ISMC/ISA channel for both Indoor and Outdoor type RMU. Proper Bolted fixing arrangement shall be provided for erection on RCC foundation. Also, base frame shall be painted with 2 coats of anti rust red oxide and 2 coats of bitumen paint shall be provided. {R9}Adjustable HDPE clits as cable supporting clamps for each power cable (to suit the cable size from 150 to 400 sq mm PILC / XLPE cable. Exact size shall be provided during drawing approval stage.), also cleat shall be adjustable vertically. {R9}
5.9	Lifting lugs	Four numbers
5.10	Cable Entry	Bottom 3mm metallic, removable type & split type in two parts, with 1no. 90 mm diameter knocks out punch/hole in the centre (For double cable boxes, Un-drilled gland plate to be supplied. Approval should be taken for the same during drawing submission)
5.12	Cable type & size	3c x 150 / 240 / 300/400 sq mm Aluminum conductor XLPE/ PILC with armor & PVC outer sheath {R9}
5.13	Terminals for 11kv cable termination	Suitable for Ring Type Bimetallic lug as per annexure F **[R5]**
5.13.1	Right angled boots	Single piece cold shrink type per bushing
5.13.2	Brass Nut bolt	M16 size
5.13.3	Bimetallic washers	Required
5.13.4	Termination type	suitable for heat shrinkable type
5.13.5	Termination height	For Indoor / Outdoor : Min. height from gland plate shall be 900mm **[R5]**

5.14	Bus bar	Copper with sleeve (Sizing Calculation to be submitted in support of its Guaranteed S.C. rating / Capability) {R9}
5.14.1	Bus bar continuous rated current	630amp (at designed 40 deg.C ambient) {R9}
5.14.2	Bus bar short time withstand capacity	20 KA for 3 sec **(R5)**
5.14.3	Bus bar support insulator material	SMC / DMC resin
5.14.4	Maximum temperature rise above reference ambient 40 deg C	In line with Table 3 of IEC60694
5.15	Earth bus bar	Tinned Copper flat sized for rated fault duty for 3 sec {R9}
5.16	Earth bus internal connection to all non current carrying metal parts	By 2.5 sq mm copper flexible wire, Earth connection point maximum 1 meter away from cable test facility
5.17	Earth bus external connection to owners earth	Studs on both sides with holes for M10 bolt + hardware to readily receive purchaser earth connection
5.18	Cooling arrangement	By natural air without fan
5.19	Panel internal wiring	Multi strand flexible color coded PVC insulated Cu wire 1 sq mm (SCADA) / 2.5 sq mm (for CT's) 1100 volt grade (AC-black, DC – grey, Earth – green) with ferrules at both ends.
5.20	Hardware (Nut, bolts & handle)	Stainless steel (Except termination nut-bolts which are Brass / Tinned Copper)
5.21	Gasket	Neoprene rubber
5.22	Marshalling terminal blocks	1 Sq mm, Nylon 66 material, push on type + 20% spare in each row of TB. {R9}
5.23	Panel cover fixing bolts	Allen head 6mm with hexagonal slot
5.24	Padlock facility	Required for all earth switches & all handles
5.25	Bushings for future extensions of RMU	Should be duly insulated & covered with metallic covers in unused condition
5.26	Explosion vents	To ensure operator's safety, design should ensure that gases / flames generated during flash over / blast in any of the compartment, must not come out from the front of RMU as well shall not go to adjacent cable compartment. Internal

		arc test report (for Cable compartment & other compartments) must be submitted to support above, along with RMU GA drawing indicating these vents. There shall not be any type of holes, gaps etc on the walls of cable termination compartment. **[R5]**
5.27	SF6 gas annual Loss	< 0.1% of total mass. Pressure of SF6 gas shall be above the operating limit throughout the life of the equipment.

6.0 Load break switch (LBS) / Isolator

6.1	Type	Three poles operated simultaneously by a common shaft
6.2	Arc interruption in dielectric medium	SF6 or Vacuum
6.4.2		Clause deleted. **[R5]**
6.6.1	Continuous rating of LBS	630 Amp at design 40 deg C ambient
6.6.2	Short time withstand capacity	20 KA for 3 sec **[R5]**
6.7	Fault making capacity	50 kA peak **[R5]**
6.8	Minimum number of operations at rated current (as per IEC 62271-102)	Mechanical Endurance – Class M1(1000 operations) Electrical Endurance – Class E3 (100 operations) **[R5]**
6.9	Minimum number of operations at rated fault current (as per IEC IEC 62271-102)	Class E3 (Min 10 operations) **[R5]**
6.10	Fault passage indicator (FPI) (For both Earth fault and Over Current Protection) **[R8]**	To be provided on right hand side of one LBS for panel type 1CB + 2 LBS. For all other configuration of RMU, FPI to be provided on all LBS. Wherever, there are two cables per LBS, two FPI needs to be considered for that particular LBS
6.10. 1	Earth Fault Indicator	CBCT – Split open type suitable for mounting without disconnection of cable.
6.10.2	Connection of CBCT with FPI	Cable connection of FPI with CBCT shall be of pre moulded type on the CBCT side. Cable shall be 2.5 sq.mm cu cable or {R9}

6.10.3	Fault Passage Indicator (For both Earth Fault and Over Current Protection) **[R8]**	Digital type and shall operate as the current exceeds the set value. Flash indication for identifying faults with red LED with one flash for every one sec. Test & rest button 1 NO + 1 NC potential free contact for remote indication FPI power supply unit shall use lithium battery with minimum life of 1000 blinking hours , so that FPI shall continue to function even after main feeder has tripped.
6.10.4	Data by Purchaser	
6.10.4.1	System Fault Level	2kA – 8.75kA
6.10.4.2	Type of Grounding	Solidly Grounded
6.10.4.3	Fault clearing time	100ms
6.10.4.4	Cable Type	PILC / XLPE , 70 sq.mm to 400 sq.mm {R9}
6.10.4.5	Earth Fault Indicator	
6.10.4.5.1	Sensing Current	100 to 400A {R9}
6.10.4.5.2	Sensing Time	30 to 100 ms in steps of 10ms.
6.10.4.5.3	Reset Time	0.5 -1-2-3-4 hr
6.10.4.5.4	Resetting Facility	a) Self rest after reset time b) Self rest after restoration of voltage c) Manual d) Remote resetting
6.10.4.5.5	Contact Rating	1A at 230 V
6.10.4.5.6	Degree of Protection	IP 54
6.10.4.5.7	Mounting Arrangement	Surface or Flush Mounting
6.10.4.5.8	Ambient Temperature	-20 to 50 Deg C {R9}

7.0 Circuit breaker (TCB / FCB)

7.1.1	Type	Three pole, operated simultaneously by a common shaft
7.1.2	Transformer circuit breaker -TCB	For controlling transformer, manual operation only
7.1.3	Feeder circuit breaker - FCB	For controlling cable feeder, manual operation. Remote trip operation by SCADA
7.2	Arc interruption in dielectric medium	Vacuum Bottle **(R5)**
7.3.1	Operating mechanism - TCB	Manual spring charged stored energy type
7.3.2	Operating mechanism - FCB	Manual spring charged stored energy type, remote electrical close / open operation possible.
7.4	Emergency trip / open push button	On panel front with Protective flap to prevent any accidental tripping of breaker. **[R5]**
7.5.1	Continuous rating at design 40 deg C	630amp

	ambient {R9}	
7.5.2	Short time withstand capacity	20 KA for 3 sec **(R5)**
7.6	Minimum number of operations at rated current (as per IEC 62271-100)	Mechanical Endurance – Class M1(2000 operations) Electrical Endurance – Class E2 **(R5)**
7.7	Fault making capacity	50 KA peak **(R5)**
7.8	Fault breaking capacity	20 KA Minimum **(R5)**
7.9	Maximum number of operations at rated Fault current *(as per IEC 62271-100*)	Electrical Endurance – Class E2 . To be guaranteed by manufacturer with authorized lab test reports **(R5)**
7.10	Breaker status auxiliary contact	2NO + 2NC wired to terminal block
7.11	Current transformer	1. 75-400 / 1 amp for TCB/ FCB. {R9} 2. Considering three core cable terminations, mounting flexibility shall be provided for CT's (in horizontal & vertical direction both). Additionally, CAUTION marking (by sticker/ paint) shall be provided to avoid CT's installation above the screen of cable. (I.e. earth potential point.) 3. Position of CTs inside compartment shall be adjustable in vertical and horizontal direction {R9}
7.12	CT accuracy class	5P10 minimum {R9}
7.13	Protection relay	Self powered, Microprocessor based Numerical relay (with LCD display), IDMT over current / earth fault protection with high set element, manual reset type Relay mounting flush to panel front. Relay shall be communicable for automation purposes
7.14	Relay auxiliary contacts for remote indication	Potential free contact 1NO + 1NC wired to terminal block
7.15	Shunt trip 230v AC (for WTI trip & door limit switch of Dry type transformer) & for remote trip from SCADA.	To be wired to terminal blocks (If the functional requirement is achieved by the Protection relay, then shunt trip is not required.
7.16	Breaking Timing	40 to 60 ms {R9}

8.0 Earth switch (ES)

8.1	Type	Three Pole (ON, OFF and Earth), operated simultaneously by a common shaft, for each Circuit breaker & Load break switch.
8.2	Switching in dielectric medium	Dry Air in sealed medium or SF6 gas
8.3	Operating mechanism for close & open	Manual
8.4	Fault making capacity	50 kA (Desirable)
8.5	Auxiliary contacts	1NO+1NC wired to terminal block
8.6	Disconnect switch (if provided in series with vacuum bottle)	Desirable to be located on purchaser cable connection side of vacuum bottle
8.7	Minimum number of operations at no load (as per IEC 62271-102)	Mechanical Endurance – Class M0(1000 operations) **[R5]**
8.8	Making capacity endurance of earth switch (as per IEC 62271-102)	Class E2 (Min 5 operations) **[R5]** {R9}

9.0 Requirements of sealed housing live parts

9.1	Enclosure	Stainless steel enclosure suitable for IP67. Metal thickness shall be 3mm. {R9}
9.2	SF6 gas pressure low alarm	To be given
9.3	Provision for SF6 gas filling	To be given (For 'sealed for life' design of RMU, this is not applicable)
9.4	Provision for SF6 gas pressure indication	Digital Manometer with non return valve
9.5	Arc interruption method for SF6 breaker / Load break switch	Puffer type / rotating arc type
9.6	Potential free contacts for SF6 gas pressure low	1NO +1NC (Desirable)

10.0 Operational interlocks

10.1.1	Interlock type	Mechanical
10.1.2	Load break switch & respective earth switch	Only one in 'close' condition at a time
10.1.3	Circuit breaker & respective earth switch	Only one in 'close' condition at a time

10.2	Prevent the removal of respective cable covers if load break switch or circuit breaker is 'ON'	Electrical / Mechanical
10.3	Prevent the closure of load break switch or circuit breaker if respective cable cover is open	Electrical / Mechanical
10.4		® clause deleted
10.5	Cable test plug for LBS/CB accessible only if Earth switch connected to earth	Mechanical

11.0 Indication & signals (for Local)

11.1	Operation counter on front / Inside the RMU LT chamber	To be provided for each LBS & Circuit breaker, with minimum four digits & non resettable type
11.2	Cable charge status indication for all LBS & CB	Capacitor type voltage indicators with LED on all the phases (Shall be clearly visible in day light)
11.3	Spring charge status indication	On front for breaker
11.4	Earth switch closed indication (For Each LBS)	On front
11.5	Load break switch ON/OFF indication	Green for OFF / Red for ON
11.6	Circuit breaker On/OFF indication	Green for OFF / Red for ON
11.7	Circuit breaker protection relay operated on fault	Flag
11.8	Fault passage indication on LBS	Flag
11.9	Status signals to SCADA-to be wired to marshalling terminal block	2NO + 2NC
11.9.1	LBS close / open	potential free contacts
11.9.2	LBS & CB Earth Switch close /open	potential free contacts
11.9.4	CB close / open	potential free contacts
11.9.5	Protection relay operated	potential free contacts

11.9.6	FPI operated	potential free contacts
11.9.7	SF6 gas pressure low	potential free contacts (Desirable)
11.10.1	Commands from SCADA- to be wired to marshalling terminal block	LBS close / open
11.10.2		FCB close / open
11.10.3		FPI Reset

12.0 Mimic diagram, labels & finish

12.1	Mimic	1. Mimic diagram (Shall not be accepted with Stickers) **[R5]** 2. On panel front with description of function & direction of operation of handles/buttons
	Operating Instructions	Operating instruction chart and Do's & Don'ts in Hindi / local language to be displayed on left / front side of panel enclosure on anodized Al Sheet 16SWG, duly affixed on panel.
12.2	Name plate on panel front	Fixing by rivet only
12.2..1	Material	Anodized aluminum 16SWG / SS
12.2.2	Background	SATIN SILVER
12.2.3	Letters, diagram & border	Black
12.2.4	Process	Etching
12.2.5	Name plate details	Month & year of manufacture, equipment type, input & output rating, purchaser name & order number, guarantee period
12.3	Labels for meters & indications	The label shall be riveted and not pasted on the panel compartment door. Preferable the labels shall be engraved on the plate.
12.4	Danger plate on front & rear side	Anodized aluminum 16 SWG with white letters on red background
12.5	Painting surface preparation	Shot blasting or chemical 7 tank process
12.6	Painting external finish	Powder coated epoxy polyester base grade A, shade -RAL 7032, uniform thickness 60 micron minimum
12.7	Painting internal finish	Powder coated epoxy polyester base grade A, shade -white, uniform thickness 60 micron minimum
12.8	Termination Drawing and Wiring Drawing	Printed copy shall be fixed/mounted inside each and every compartment. {R9}

13.0 Quality assurance

13.1	Vendor quality plan	To be submitted for purchaser approval
13.2	Inspection points in quality plan	To be mutually identified & agreed
13.3	Quality – Process Audits	BSES shall carryout vendor process audits.
13.4	Field quality plan	Bidder to submit field quality plan along with the bid
13.5	Spare part list	Bidder to submit detailed spare part list along with the bid
13.6	Maintenance manual	Bidder to submit maintenance manual along with the bid
13.7	Approved sub vendor List	**[R5]**
13.7.2	Fault Passage Indicator	pls refer make list
13.7.4	Self Powered O/C & E/F Relay	Ashida ADR241S-761 {R9}
13.7.5	Boots	3M / Raychem/K.D.Joshi

14.0 Inspection & testing

14.1	Type test	1. Equipment of type tested quality only, including internal arc test on various compartments like cable chamber, SF6 gas tank etc. 2. Type test certificate to be submitted along with offer for scrutiny. Type test more than 5 years old will not be acceptable. 3. a) temperature rise test b) voltage regulation test
14.2	Routine test	As per relevant Indian standard
14.3	Acceptance test	To be performed in presence of purchaser at manufacturer works
		1. Physical inspection & BOM, wiring check
		2. Insulation resistance test (Before & after HV test)
		3. HV test for one minute,
		4. Operation & interlock check
		5. Measurement of resistance of main circuit
		6. Voltage Indication check
		7. Functional testing of Fault passage Indicator for Alarm
		8. Primary current injection test for each circuit breaker feeder with relay
		9. Breaker closing & opening time measurement

15.0 Shipping, Handling and Site support

15.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration
15.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
15.3	Packing Identification Label (Anodized Aluminum Plate)	On each packing case, following details are required:
		i. Individual serial number
		ii. Purchaser's name
		iii. PO number (along with SAP item code, if any) & date
		iv. Equipment Tag no. (if any)
		v. Destination
		vi. Manufacturer / Supplier's name
		vii. Address of Manufacturer / Supplier / it's agent
		viii. Description (Configuration of RMU; e.g. 1CB + 2 ISO, Manual, Extensible and Quantity must be prominently displayed at least 3 sides of packing box & on top.
		ix. Country of origin
		x. Month & year of Manufacturing
		xi. Case measurements
		xii. Gross and net weights in kilograms
		xiii. All necessary slinging and stacking instructions
15.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
15.5	Handling and Storage	1. Manufacturer instruction shall be followed. 2. Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.

16.0 Deviations

16.1	a) Deviations from this specification shall be listed separately by bidder clause wise (format given below) along with optional offer and has to submit the list along with bid/quotation. BRPL will review the deviations and if BRPL is agreed with the deviation, seller has to take written confirmation from BRPL on deviation during tender evaluation. b) In the absence of any separate list of deviations from the bidders with bid as well as written confirmation from BRPL on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully. c) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BRPL old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.

Deviation sheet format.

Sl. No.	Document Name	Clause No.	Deviation	Reason	Merit to BRPL

17.0 Drawings Submission

17.1	To be submitted along with bid	The seller has to submit following:
17.1.1	GA / cross sectional drawing of product showing all the views / sections	
17.1.2	Detailed reference list of customers using the offered product during the last 5 years with similar design and rating	
17.1.3	Completely filled GTP	
17.1.4	Manufacturer's quality assurance plan and certification for quality standards	
17.1.5	Type test reports for the type, size & rating of product / equipment offered	
17.1.6	Complete product catalogue and Manual.	
17.1	Recommended spare parts and consumable items for five years of operation and spare parts catalogue with price list	
17.2	All documents as per clause 13 of this specification	
17.3	After award of contract, Seller has to submit following drawings for buyer’s Approval (A) / Reference (R)	
17.3.1	Program for production and testing (A)	
17.3.2	Guaranteed Technical Particulars (A)	
17.3.3	GA drawing	
17.3.4	Schematic and wiring drawings for all components	
17.3.5	Terminal arrangement & cable box details including gland plate arrangement etc	
17.3.6	Bill of material	
17.3.7	Detailed loading drawing to enable the buyer to design and construct foundations	
17.3.8	Transport / Shipping dimensions with weights, wheel base details, un tanking height	
17.3.9	detailed installation and commissioning instructions	
17.3.10	quality plan	
17.4	Submittals required prior to dispatch	
	-Inspection and test reports, carried out in manufacturer’s works	
	-Test certificates of all bought out items	
	-Operation and maintenance Instruction as well as trouble shooting charts/ manuals	

17.5	Drawing and document sizes	Standard size paper A3, A4
17.6	Number of Documents required at different stages shall be per Annexure-A	
Note :	Duly signed & stamped copies of the drawings / documentation are required to be submitted to BRPL for approval.	

18.0 Equipment ID [R7]

I. Equipment ID shall be painted on any appropriate face of the equipment at a clearly readable height from the base level of the equipment.

II. Font: Recommended type face for the signage is True type or Post script

III. Font Size: All painting should be in UPPERCASE. Recommended height of 50 mm with spacing between alphabets of 3 mm.

IV. Total No's of Character: 18

V. Height of Font: 50 mm

VI. Height of Base: 100 mm

VII. Spacing between alphabets: : 3 mm

VIII. Paint: Base coat – Dense Yellow. Letters – Black Quick Drying paint 2 coats.

IX. Equipment ID shall be separately provided by BRPL

Annexure A Scope of supply

1.0 The scope of supply shall include following

1.1 Design, manufacture, testing at manufacturer works before dispatch, packing, delivery and submission of all documentation the 11kv Ring Main Unit (RMU). All the manual RMU shall be compatible for retrofit solution of motorized RMU in future 11kV RMU shall be as per scheme enclosed as Annexure E.

1.2 Configuration of 11kV RMU shall be as per Purchase Requisition.

1.3 Control Center has to be carried out at all sites by vendor engineer. [R5]

1.4 Guarantee Period for RMU shall be 66 months from the date of supply or 60months from date of commissioning, whichever is earlier. [R5]

1.5 Service Performance Requirements During Guarantee Period: [R5].

1.6 Each RMU shall be supplied with 2 sets of Operating Handle. [R5]

1.7 Supplier scope includes training of BRPL team – Minimum 4 batches (each batch with 4-5 engineers) for minimum 3 days at factory for erection, commissioning,

maintenance trouble shooting of mechanism, FPI and all other components. This shall be carried out within 1 week from date of 1st shipment/ dispatch. Supplier shall also provide training for Self Powered relay at respective manufacturer' factory for 12 engineers/ technicians in 2 batches. [R5].All the trainings shall be applicable for each P.O.

1.8 Unit price for Conversion kit should be offered separately for converting the RMU from single cable termination design to double cable termination design, at site.

1.9 BOQ as following –

Sr No	Purchaser Equipment Tag No / SAP code	RMU standard configuration Type	Unit	Quantity
1		*Example – Type A2*	No	*e.g. 1*
2		*Example – Type R5*		
3				
4				

2.0 Submission of documents

	Along with offer	For Approval after award of contract	Final after approval
Documents as given in clause no 17 of specification	3 copies + 1 soft copy on CD	4 copies + 1soft copy on CD	6 copies + 1 soft copy on CD for all type of documents

3.0 Delivery schedule

3.1	Delivery period start date	-	from date of purchase order
3.2	Delivery period end date	-	as agreed with supplier
3.3	Material dispatch clearance	-	after inspection by purchaser

Annexure B Technical particulars (Data by purchaser)

Sr No	Description	Data by purchaser
1.	Reference design ambient temperature	*40 deg C*
2.	Maximum ambient temperature	50 deg c for Delhi
3.	Relative humidity	e.g. 85% for Delhi
4.	Seismic zone	e.g. 4 for Delhi
5.	Extensibility of RMU on one side is required -	Yes / No

Annexure C Guaranteed Technical Particulars (Data by Supplier)

Bidder shall furnish the GTP format with all details against each clause.
Bidder shall not change the format of GTP or clause description.
Bidder to submit duly filled GTP in hard copy format with company seal.

Sr. No.	Description	Data to be filled by Manufacturer
1	11kv RMU (as per scope of supply annexure A)	Separate GTP to be filled for each type of RMU
2	Equipment make	
	Equipment type / brand name	
3	Conformance to design standards as per specification clause no 2.0 –	Yes/No
4	Conformance to specification clause no 3.0 to 17.0 –	Yes/No
5	If NO for pt 3 or pt 4 above, Submission of deviation sheet for each specification clause no –	Yes/No
6	Panel overall dimensions in mm	
	Width (measured from front)	
	Depth	
	height	
7	Panel weight in kg	
8	Panel extensible on both sides – Yes / No	
9	Panel enclosure protection offered	
10	Panel tested for internal arc (Cable & other compartments) –Yes / No	
11	Heat generated by the panel in Kw	
12	Insulation level for complete panel	
12.1	Impulse withstand (Kv peak) -70kvp min	
12.2	Power frequency withstand (Kv rms) –	

	28kv min	
13	Bus bar	
13.1	Material & grade	
13.2	Bus bar cross section area in sq mm	
13.3	Bus bar rated current in amp i) at designed 50 deg.C ambient {R9} ii) at 50 deg.C ambient	
13.4	Max temperature rise above reference ambient of 40 deg C	
13.5	Short time current withstand capacity for 3 seconds (in KA)	
13.6	Bus bar clearances in mm P-P / P-E	
13.7	Bus bar with insulation sleeve / barriers	
13.8	Bus bar support insulator type	
13.9	Bus bar support insulator voltage class	
13.10	Bus bar support insulator minimum creepage distance / mm	
13.11	Earth bus bar material	
13.12	Earth bus bar size	
14	**Circuit breaker type – SF6 or VCB**	
14.1	Rated voltage & frequency	
14.2	Rated current in amp	
14.3	Rated breaking current – KA rms symmetrical	
14.4	Short time withstand capacity in KA for 3 sec	
14.5	Rated making current - KA peak	
14.6	Breaker total opening time at rated breaking capacity (in milliseconds)	
14.7	Number of breaks per pole	

14.8	Total length of contact travel in mm	
14.9	No of circuit breaker operation cycles (close & open) guaranteed at rated current, Electrical endurance class	25% rated current -
		50% rated current -
		75% rated current -
		100% rated current -
14.10	No of breaker opening operations guaranteed at rated fault current, Electrical Endurance Class	
14.11	No of breaker mechanical operation cycles (close & open) guaranteed at zero current , Mechanical endurance class	
14.12	Contact material	
14.13	Operating mechanism – trip free	
	Manual Spring charge type	
14.14	Feeder circuit breaker (FCB) –VCB	
14.14.3	Closing coil wattage & rated DC voltage	
14.14.4	Trip coil wattage & rated DC voltage	
14.15	Transformer CT class, ratio & Vk	
15	**Load break switch type – SF6 or VCB**	
15.1	Rated voltage & frequency	
15.2	Rated current in amp	
15.3	Load break switch total opening time at rated current (in milliseconds)	
15.4	Number of breaks per pole	
15.5	Total length of contact travel in mm	
15.7	No of LBS close & open operation cycles guaranteed at	25% rated current -
		50% rated current -
		75% rated current -
		100% rated current -
15.8	No of LBS making operations guaranteed	

	at rated fault current, Electrical endurance class	
15.9	No of LBS close & open operations guaranteed at zero current, Mechanical endurance class	
15.10	Contact material	
15.11	Operating mechanism type	
15.13	Minimum permissible SF6 gas pressure (For SF6 type RMU only)	
15.14	Capacitor type cable voltage indication provided?	Yes / No
15.15	Operation counter provided	Yes/ No
16.1	Disconnect switch continuous rating (Amp)	
16.2	Disconnect switch Short time withstand rating -20kA for 3 sec minimum	Yes / No
16.3	One LBS open operation possible in the event of loss of SF6 gas	Yes/No
17.1	Cable termination – Height of power terminal from gland plate	mm
17.2	Torque required for tightening terminal lug	
18	Mimic diagram, labels & finish as per cl no 12	Yes / No
19	Submission of RMU / component catalogue	Yes/No
20	Unit price for Conversion kit offered separately for converting the RMU from single cable termination design to double cable termination design	Yes / No
21	Earth Switch	
21.1	Minimum number of operations at no load- Mechanical Endurance class	

21.2	Making capacity endurance of earth switch – Electrical endurance class	
22	Self Powered Relay – Make / Model	As per make list (refer annexure I (Relay shall be communicable with SCADA)
22.1	CT Input	
22.2	IDMT Setting Range 4 element – Over Current & Earth fault & steps	Overcurrent- Earth Fault- Instantaneous O/C- Instantaneous E/F-
22.3	Operating Time	Over Current – Curves Instantaneous
22.4	Pick up Current	
22.5	Resetting Current	
22.6	Relay Burden	
22.7	Time Accuracy	
22.8	Tripping Coil O/P – type & duration	
22.9	Fault Current Display	
22.10	No of Fault Current Latching with time stamping	
22.11	Display Facility / Type	
22.12	Operational Indicators	
22.13	Potential Free Output Contacts	
22.14	Thermal Withstand Capacity of Relay	
23	Fault Passage Indicator	Over Current and Earth Fault
23.1	CBCT	
a	Type	
b	Mounting Arrangement	
c	CT to indicator connection	

d	ID of sensor	
23.2	Earth Fault Indicator	Make / Model as per Annexure-I
a	Sensing Current	
b	Sensing Time	
c	Indication	
d	Reset Time	
e	Resetting Facility	
f	Output Contact	
g	Contact Rating	
h	Aux Power Supply	
i	Degree of Protection	
j	Mounting Arrangement	
k	Ambient Temperature	
24	Current Transformer- Make	As per Annexure-I
24.1	Ratio	
24.2	Burden	
24.3	Accuracy Class	
25	Voltage Presence Indicator	
	Make	As per Annexure-I
	Rating	
	Model No	
26.8	Terminal Blocks, Disconnecting type fuses make	

Bidder / Vendor seal / signature ----------

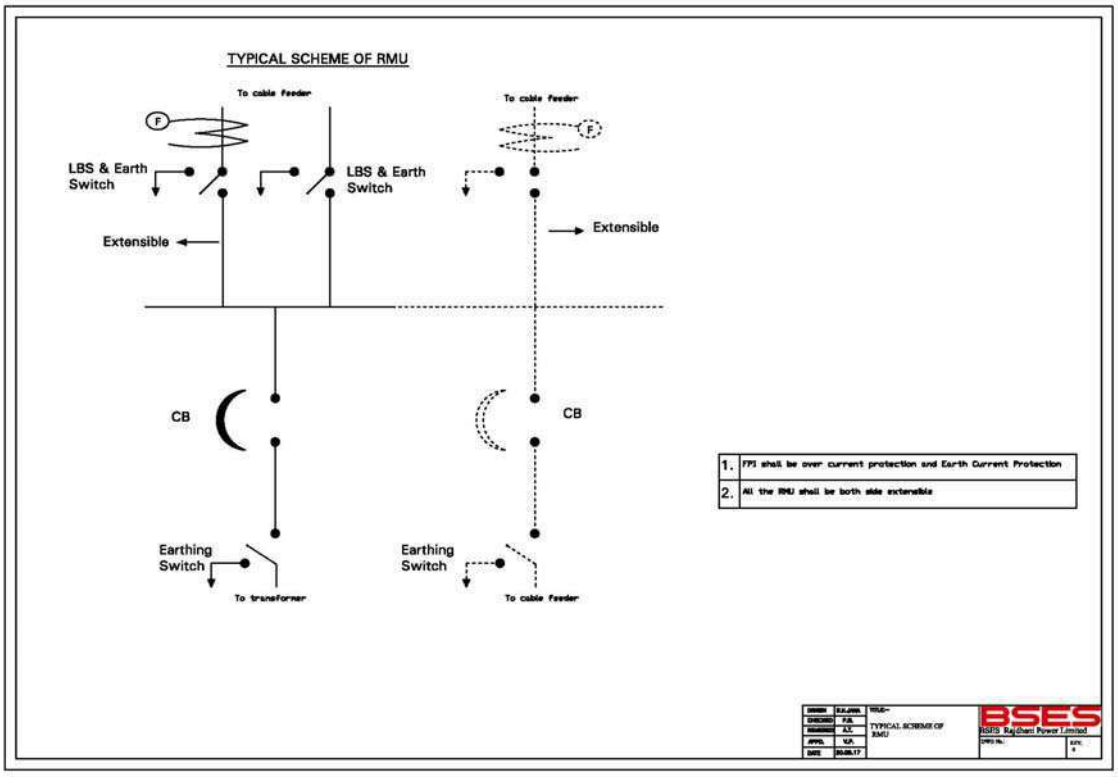
Name of the bidder	
Address of bidder	
Name of contact person	
Telephone no & email id	

Annexure D Recommended spares (Data by supplier)

List of recommended spares as following

Sr No	Description of spare part	Unit	Quantity
1		No	
2		No	
3			
4			
5			
6			

Annexure E Typical scheme of RMU



a) 11kv RMU shall have Transformer circuit breakers (TCB) with Load break switches (LBS) or Feeder circuit breakers (FCB) as per configuration defined in Purchase Requisition.c) TCB shall be operated manually only with facility for remote shunt trip.

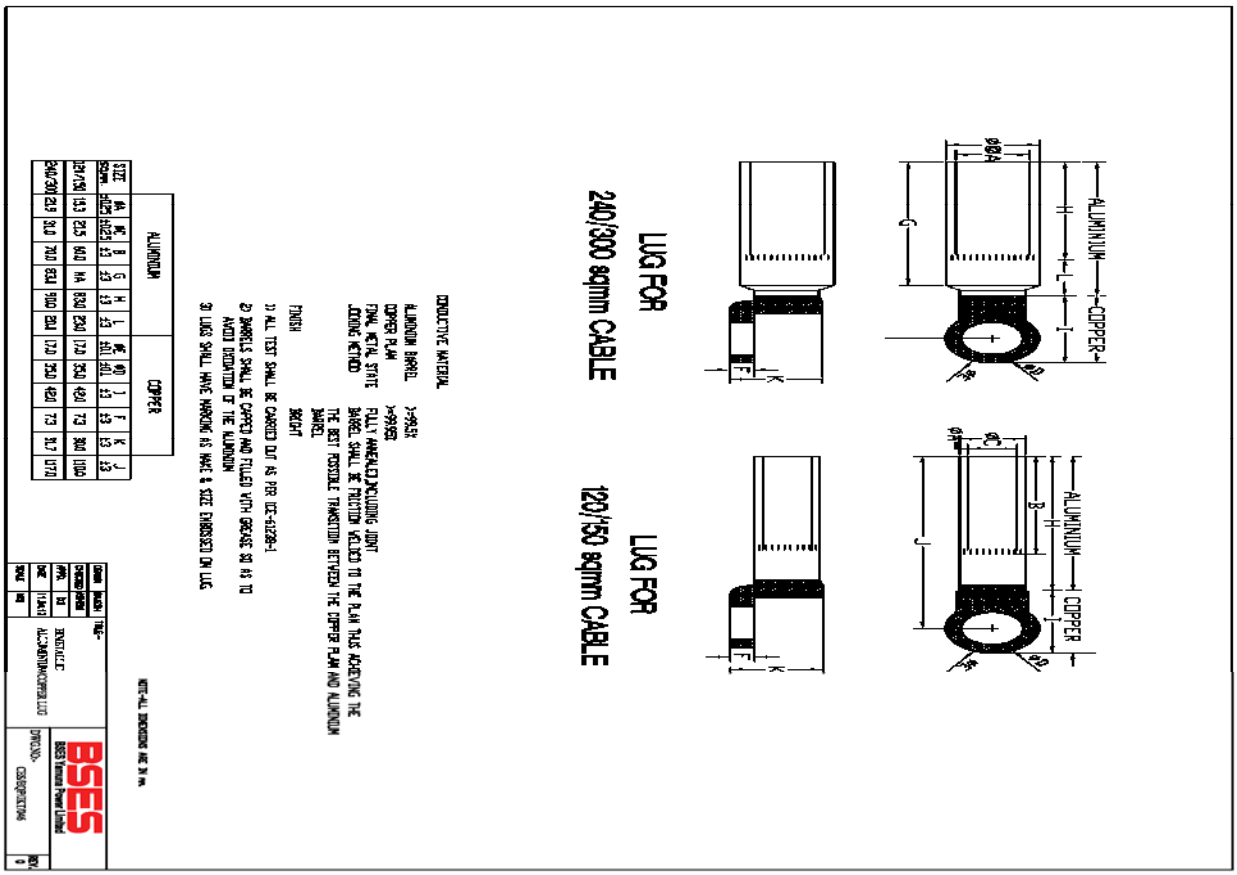
d) 11kv RMU shall be suitable for extension on sides for addition of LBS, TCB or FCB.

e) Fault passage indicator (For Both Earth Fault and Over Current Protection) including associated CT & connecting cable is shown by letter 'F'.

f) RMU Configuration-

S.no.	Item description	Type	Combination
1	3 Way	Indoor	2LBS+1VCB
2	4 Way	Indoor	2LBS+2VCB
3	3 Way	Outdoor	2LBS+1VCB
4	4 Way	Outdoor	2LBS+2VCB
5.	1 way	Outdoor	1VCB

Annexure F Drawing of Bimetallic Ring Type Lug



Annexure G(1) [R7] SERVICING AND WARRANTY REQUIREMENT-EQUIPMENT SUPPLY (11KV RING MAIN UNIT)

INDEX

1. Purpose

This document is prepared to specify the servicing requirement and Warranty / Guarantee handling procedure in case of difficulty that arises in the supplied equipment within the useful service life of the equipment being procured by BSES Rajdhani Power Limited.

2. Applicability

It is applicable to any equipment supplied directly or indirectly for installation / use in BSES Rajdhani Power Limited.

3. Priority

This document which include service, warranty / guarantees management / handling procedures shall be considered a final in case of any contradiction with other contractual document.

4. Liability

i) Supplier shall be liable to arrange OEM qualified service engineers as and when required by BSES Rajdhani Power Limited to attend defects, trouble shooting to restore equipment health to ensure 100 % capacity availability.

ii) OEM shall be liable to provide essential spares at reasonable price for entire lifespan of the equipment.

iii) Service call shall be attended within reasonable time frame as mentioned in this document.

iv) Service cannot be denied by supplier/OEM till completion of useful life of the equipment.

v) The commercial liability shall be restricted to supply/service contract provision.

It will be liability of manufacturer /vendor tie up with accessories / component manufacturer to full fill requirement stipulated this document.

5. Warranty Requirements

i) The equipment failed / malfunctioned within stipulated warranty period shall be attended free of cost for the reasons not attributed to BSES Rajdhani Power Limited.

ii) The cost incurred for service, spares, transportation, consumable and manpower / labour shall be borne by supplier.

iii) OEM is bound to send service engineer to site on request for troubleshooting promptly.

iv) There is no cap on number of visit or spare replacement required to repair / trouble soot the problem in the equipment during warranty period.

v) Each break down / problem reported shall be analysed scientifically to establish the root cause of breakdown.

vi) In case it is established that any component or accessories is not performing satisfactorily or causing repeated failure due to poor performance, manufacturing mistakes, design mistakes or not suitable to our environment condition applicable to NCR region, the OEM shall be liable to rectify or replace the same in all equipment supplied to BRPL irrespective of warranty period.

vii) In case if RMU supplier is not OEM of the equipment / accessories, the supplier will be liable to tie up with OEM to provide service / spares to meet warranty / servicing requirement stipulated in this documents.

viii) Irrespective of onsite or workshop repairing, it will be responsibility of OEM to maintain work quality to ensure no compromise on performance and useful life of the equipment.

6. Process requirements

6.1 Complain Registration.

i) Supplier to provide communication details for complaint registration in O&M Manual, on website as well as shall be printed on the equipment. In case of changes, same shall be communicated to BRPL.

ii) BRPL will register complain through a e-mail / telephonic call to the call centre / service centre

6.2 Confirmation and Service time Schedule.

i) All timing will be counted from date of call registration by BRPL till restoration of equipment health at respective site in operation condition satisfactory of BRPL engineer.

ii) Service call confirmation & service engineer visit schedule shall be provided within two hour for working hour call (09:00AM to 06:00PM, Monday to Saturday) and before 10 AM next working day for off working hour calls.

iii) Emergency trouble shooting calls - within 12 Hrs including spare arrangements.

iv) Normal trouble shooting call - within 48 Hrs.

v) On site repairing / component replacement - within 7 days.

vi) OEM workshop repairing - within 30 days including returning to BRPL stores.

vii) Replacement of complete RMU - within 45 days.

viii) The service engineer shall intimate necessary requirement to attend call along with confirmations

6.3 Site visit & Investigation.

i) The OEM shall depute qualified and experienced engineer to carryout trouble shoot as well as testing and collecting necessary data / details essential for root cause analysis.

ii) The service engineer shall collect preliminary details to understand and estimate the spare requirement, shutdown time requirement from our respective area engineer whose details will be provided along with service call.

iii) The necessary tools shall be carried by service engineer attending calls.

iv) Service engineer to get call attendance certificate from respective area BRPL engineers.

v) Service engineer to intimate necessary precaution required to prevent repetition of problem to respective area BRPL engineer as well as CES Team.

vi) Detailed technical report (root cause analysis) to be submitted to CES Team for records and analysis against each call.

6.4 Recommendation.

i) Shall be based on scientific study / test results only.

ii) Shall cover root cause analysis for failure.

iii) Shall cover spares / component list for repairing.

iv) Shall cover time requirement.

v) Shall cover site preparation / condition requirement.

vi) Other critical measures essential for quality work.

6.5 On Site Repairing.

i) All site repairing shall be under supervision of OEM engineer and shall meet all OEM recommendation to ensure quality of work.

ii) All spares arrangement shall be carried out well in advance to minimize outage time. The list must be shared with CES team

iii) Necessary repairing process to be intimated to CES team in advance. It shall include in process & final quality and performance checks / test.

iv) The repairing process shall be certified by OEM design / quality expert.

v) Detailed time schedule and spares arrangement details shall be submitted to CES team for necessary planning.

vi) The repairing work shall be witness by BRPL CES engineer, who may insist in process / performance checks / test in addition to above if felt essential.

vii) If BRPL engineer observed any quality problem / skill problem, may insist for repairing at OEM facility.

6.6 Repairing at OEM facility.

Following requirement shall be fulfilled during OEM workshop repairing work: -

i) During site inspection, if service engineer felt necessary to send equipment to OEM facility, the same shall be organized by OEM.

ii) In case if BRPL felt that site repairing is not up to the required quality or felt necessary to analyze cause of failure, the same shall be organized by OEM.

iii) Equipment unpacking, testing and opening for analysis inspection shall be carried out in presence of BRPL engineer. It shall be intimated to BRPL at least 3 days in advance for necessary travel arrangement.

iv) If cause of failure observed due to design mistake / manufacturing mistakes, the same shall be rectified in all other similar design equipments without any cost to BRPL.

v) OEM to intimate the final testing for inspection. BRPL may depute engineer or third party representative to carryout inspection / testing before dispatch.

vi) Dispatch shall be carried out only after BRPL clearance.

vii) Necessary lifting, shifting, loading / unloading & transportation arrangement shall be in the scope of OEM / supplier.

viii) A document required essential for lifting and shifting of equipment will be intimated at least two days in advance.

6.6 Witness / Inspection stages.

Even though OEM is liable for overall quality of work, BRPL may witness / Inspection following activity:-

i) On site inspection, repairing/replacement work.

ii) Testing / inspection equipments / any accessories / component to establish the cause of failure.

iii) Opening of equipment for internal part inspection.

iv) Final testing/inspection before despatch.

v) Testing / checking of the evidence causing failure / problem.

Note: It will be responsibility of OEM / Supplier to establish with facts, figure, photographs, and evidence to prove that cause of failure not attributed to design.

7 .0 Documents / records / report submission

The following be recorded and provided to BRPL by OEM against each call / repairing / rectification works for BRPL clearance and future reference:-

i) Root cause analysis report.

ii) All test report.

iii) Minutes of meeting.

iv) Spares / accessories test report / calibration certificates.

v) Proof of expenditure for cost incurred to BRPL.

vi) Copy of transportation documents.

vii) All technical details of parts / accessories being replaced.

8.0 Qualification requirements for service engineers

i) All work must be carried out by only qualified, experience engineer certified by OEM. BRPL may request qualification and experience details if felt necessary.

9.0 Safety.

i) All necessary personal protective equipments requirement for the personal and labour will be in the scope of OEM / supplier.

ii) It will be liability of OEM / Supplier to meet the necessary safety norms , standards, rules & regulation .

iii) BRPL may audit the same during on site work.

10.0 Communications.

For better coordination, single channel communication must be followed. BRPL and OEM / Supplied to communicate to each other their team for communication time to time in case of any changes.

At present, all warranty related communication is to be done with CES team.

11.0 Changes / revision management.

Necessary approval of O&M analytic cell is essential for changes in this document.
In case if any stack holders do not agree or wish to amend its content may send request to BRPL O&M analytic cell for approval.
The request will be in effect only on consideration and authorized release of revision in document by O&M analytic cell.

Annexure 'H' 11 Kv Metering Cubicle

1.0 General Requirement

1	Panel Type	Outdoor, Metal enclosed, framed, Compartmentalized panel construction
2	Service Location	Outdoor
3	Mounting	Free Standing
4	Overall Enclosure Protection	IP 54 Minimum (Complete unit i.e. RMU coupled to Metering unit shall be IP54)
5	Panel Fabrication	The metering cubicle shall be fabricated with 2.0mm CRC sheet. Load bearing members and high voltage compartments shall be 3.0 mm. The panel shall be vermin proof and totally enclosed. CT/PT compartment shall be fabricated after bending the M.S. Sheets on three sides and fourth side shall be welded to make the complete assembly tamper proof. Pressure release device/ explosion vent should be provided on the CT PT compartment at the rear side.
6	Compartmentalized panel construction	The panel shall have four separate compartments. All the compartments shall be completely segregated from each other. 1. Meter Compartment 2. CT- PT compartment 3. Incoming 4. Outgoing

7	Meter Compartment	The Upper compartment i.e. the “meter compartment” shall be suitable for housing 3 phase 4 wire Energy Meter (energy meter not in bidder’s scope of supply) and associated wiring.
7.1	Double door	1. Double door arrangement as front and back door to meet IP54 requirement. Both the doors should have 02 no’s concealed type (Anti Theft) hinges. 2. Front door should have at least 01 no's padlocking and 02 no's sealing arrangements.
7.2	Meter reading Window	Provided on front and back door to enable the meter reader to perform inspection of meter compartment and note down the reading of meter. 1. Front Door: window of size 350 (W) X 300 (H) mm approximately with colour-less transparent acrylic sheet and wire mesh welded from inside. 2. Back door: window of size 350 (W) X 300 (H) mm approximately with colour-less transparent acrylic sheet.
7.3	Data Downloading slot	Slot to facilitate installation of data downloading cable with DB9 serial connector. 1. Front door: Slot of size 25mm X10 mm (+/- 2 mm) should be provided on front door with sealable cover. 2. Back door: Slot of size 30 mm X 50 mm shall be provided to facilitate installation of data downloading cable.
7.4	Meter hanging arrangement	The meter compartment shall contain hanger arrangement of slotted angle for mounting meter so that meter can be adjusted vertically and horizontally. Two horizontal and two vertical slotted channels should be provided for the same.
8	CT PT Compartment	The CT/PT compartment shall be completed welded type and house the 11 KV dry type current transformers (3 no’s) and 3 phase dry type potential transformer.
8.1	Current Transformers	The metering current transformers shall be suitable for 11 KV; 50Hz effectively earthed neutral system. The CT shall be single core, epoxy resin cast, copper wound primary type with rated burden 5VA and accuracy class 0.5s or better conforming to IS:2705 (Part-I&II). Instrument security factor shall be less than or equal to 10. CTs should have solid copper bus bar type primary terminals for connection with main busbar/bushing terminal. Secondary terminals of CTs should be made of copper or brass.

<table>
<tr><td rowspan="7">8.2</td><td rowspan="7">STC of CT</td><td>SL</td><td>CT ratio</td><td>Short time rating</td><td>Size of main Bus bar</td></tr>
<tr><td>1</td><td>15 / 5 A</td><td>6 KA for 1 sec.</td><td>30 x 4 sqmm</td></tr>
<tr><td>2</td><td>30 / 5 A</td><td>6 KA for 1 sec.</td><td>30 x 4 sqmm</td></tr>
<tr><td>3</td><td>60 / 5 A</td><td>18KA for 1 seconds</td><td>30 x 4 sqmm</td></tr>
<tr><td>4</td><td>100 / 5A</td><td>18KA for 1 seconds</td><td>30 x 4 sqmm</td></tr>
<tr><td>5</td><td>150 / 5 A</td><td>18KA for 1 seconds</td><td>30 x 4 sqmm</td></tr>
<tr><td>6</td><td>300 / 5 A</td><td>18KA for 1 seconds</td><td>40 x 6 sqmm</td></tr>
<tr><td>8.3</td><td>Potential Transformer</td><td colspan="4">The Potential Transformer shall be dry type Epoxy resin cast, Copper wound suitable for 3 phase 11KV, 50Hz effectively earthed neutral system. The PT shall be connected in star to have ratio 11KV/√3 / 110/√3 V with rated burden of 10VA per phase and accuracy class 0.5 or better conforming to IS:3156 (Part I & II). Primary terminal of PT should be of copper. Secondary terminals of PT should be made of copper or brass.</td></tr>
<tr><td>8.4</td><td>Pressure release device</td><td colspan="4">Pressure release device/ explosion vent should be provided on the CT PT compartment at the rear side.</td></tr>
<tr><td>9</td><td>Incoming</td><td colspan="4">1. Coupled to the breaker module of RMU.
2. Coupling arrangement should meet the IP54 requirement.</td></tr>
<tr><td>10</td><td>Outgoing</td><td colspan="4">Cable compartment with cover/ door.</td></tr>
<tr><td>10.1</td><td>Cable type & size</td><td colspan="4">3C x 300 to 400 sq mm Aluminum conductor XLPE with armor & PVC outer sheath {R9}</td></tr>
<tr><td>10.1</td><td>Cable Entry</td><td colspan="4">1. Bottom
2. Gland plate - 3mm metallic, removable & split type in two parts, with 1no. 90 mm diameter knocks out punch/hole in the centre. Approval should be taken for the same during drawing submission</td></tr>
<tr><td>10.2</td><td>Cable support</td><td colspan="4">‘HDPE’ cleat(s) shall be provided.</td></tr>
<tr><td>10.3</td><td>Termination Type</td><td colspan="4">Suitable for heat shrinkable type</td></tr>
<tr><td>10.4</td><td>Terminals for 11kV cable termination</td><td colspan="4">1. Suitable for Ring Type Bimetallic lug.
2. Material of Nut, bolts and spring washer- Brass
3. Size of Nut bolt- M16</td></tr>
</table>

10.5	Termination height	From gland plate 900 mm minimum
10.6	Right angled boots	Single piece cold shrink type (make – 3M/K.D.Joshi Raychem) {R9}
11	Panel Wiring	1. Secondary wiring of CTs and PTs shall be done with 2.5 sq. mm PVC insulated cables with stranded copper conductor. 2. CT and PT wiring should run in independent rigid steel conduit pipes of appropriate size from CT/PT compartment to meter compartment. 3. Conduit pipes shall be clamped with the inner wall of the panel and shall be so laid that none of the wires can be tampered from outside. 4. Current transformer and Potential transformer secondary wiring shall be colour coded as per IS and shall be suitably ferruled for identification. 5. No link or test terminals shall be provided in wire from CT/PT to meter terminals.
12	Earthing	1. The assembly comprising of the chassis, framework and the fixed parts of the metal casing shall be provided with two separate earthing terminals of M10 or above. 2. These terminals shall be provided over and above all other means provided for securing and earthing metallic enclosures (armour or other metallic coverage) or current-carrying cables. 3. The earthing terminals shall be readily accessible and so placed that the earth connection of the CT/ PT chamber is maintained when the cover or any other movable part is removed. 4. The earthing terminals shall be protected against corrosion and shall be metallically clean. 5. Earth continuitity shall be provided to all Gesketted joints by copper braid suitable for rated fault current. 6. Under no circumstances shall a movable metal part of the enclosure be insulated from the part carrying the earthing terminals when the movable part is in place. 7. The earthing terminals shall be identified by means of the symbol marked in a legible and indelible manner on or adjacent to the terminals.

13	Bushing	Bushing should be made of homogeneous epoxy / polymeric material free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality. Bushings shall be designed to have ample insulation level, mechanical strength and rigidity for the conditions under which they will be used. The hollow porcelain bushings shall conform to IS-5621. Bushing clamping accessories, bolts, studs etc shall be hot dip galvanized. All the nuts and washer shall be SS-304. All iron parts shall be hot tin galvanized and all points shall be airtight. All current carrying contact surfaces shall be silver plated. The creepage distance of the bushing shall not be less than 31 mm/KV. Bushing shall be tested in accordance with IS-2099. Routine as well as type tests reports in conformity with IS-2099 shall be furnished to the purchaser.
14	Connections	1. No joint in the primary winding of CT shall be acceptable. 2. Connection between CT terminal and bushing terminals shall be done with solid copper busbar of adequate size. 3. Flexible copper strip / rope are not acceptable for primary connection. 4. PT should be connected to primary busbar through bus bar of appropriate size (connections using flexible conductor are not acceptable). 5. All bus bars/ connections in the CT/PT compartment shall be encapsulated in epoxy.
15	Lifting Lug	1. 04 No's lifting lugs shall be provided at the top of the metering cubicle for transportation. 2. All nuts, bolts, flat and spring washers shall be SS only.
16	Height of the Base frame	The total height including base channel shall not be more than 2000 mm. Width and depth should be minimum possible and may be increased suitably to accommodate CT's/PT's.
17	Provision for Sealing	Welded Stud with nut must be provided for the purpose of sealing on the following compartments/ locations. 1. Meter compartment 2. Coupling arrangement of RMU and metering cubicle. 3. Outgoing cable compartment

2.0 Labels & painting

1	Name plate	The metering cubicles shall be provided with a non detachable type nameplate with legible and indelible marking fixed on the enclosure sheet with welded arrangement so that in case name plate is removed no passage holes are left. (separate name plate should be provided for RMU & metering cubicle)
2.1	Location	Name plate having complete data shall be provided outside as well as inside the metering cubicle at a suitable place where it can be easily read.
2.2	Material	Anodized aluminum 16SWG / SS
2.3	Background	SATIN SILVER
2.4	Letters, diagram & border	Black
2.5	Process	Etching
2.6	Name plate details	1. BRPL Property 2. Supplier's name 3. P.O. No. & Year of manufacturing 4. Sr. No. of metering cubicle 5. Particulars of CT's such as ratio, VA burden, accuracy class, SC rating, BIL. 6. Particulars of PT's such as ratio, accuracy class, VA burden, BIL. 7. Standard connection diagram 8. Consumer account no 9. Sanctioned load. 10. Date of release of connection.
2.7	Labels for CT Ratio	On CT PT compartment by anodized aluminum with white character on black background OR 3 ply lamicoid
2.8	Danger plates	1. On CT PT compartment and each cable compartment 2. Anodized aluminum 16 SWG with white letters on red background
2.9	BSES Insignia	a) 01 no's b) Shall be etched on anodized aluminium 16SWG / SS

		plate. c) Details shall be finalized during drawing approval.
2.10	Enclosure painting surface preparation	7 tank chemical process
2.11	Enclosure painting internal/ external finish Powder coated epoxy polyester base	Hot dip galvanizing – 80 micron thick grade A, shade - RAL 7032, uniform thickness 60 micron minimum.

3.0 Technical requirement of CT and PT

SL	Description	Requirement for CT	Requirement for PT
1	Nominal System Voltage (KV rms)	11KV	11KV
2	Highest System Voltage (KV rms)	12KV	12KV
3	Type	Single phase Indoor CT's	Three phase Star/Star PT.
4	Accuracy Class	0.5s	0.5
5	Rated frequency	50Hz	50Hz
6	Rated Secondary Current Amp.	5 Amp	N / A
7	Rated continuous thermal current	1.2 times of rated primary current,	NA
8	Max Ratio error	As per IS 2705	As per IS 3156
9	Max Phase angle error	As per IS 2705	As per IS 3156
10	Rated burden	5VA at 0.8 pf (Lag)	10VA/ phase at 0.8 pf (Lag)
11	Rated voltage factor	N / A	1.2 times continuous and 1.5 times for 30 seconds
12	Short time current rating		
12.1	Thermal rating	As provided in section 3.2	N / A
12.2	Dynamic rating	2.55 times of short time thermal current rating	N / A

13	One minute high voltage power frequency withstand voltage		
13.1	On primary winding KV rms On secondary winding KV rms	28KV (rms) for 1 minute for 11 KV class 3KV (rms) for 1 minute	28KV (rms) for 1 minute for 11 KV class 3KV (rms) for 1 minute
13.2	1.2 / 50 impulse withstand voltage	75 KV (peak) for 11 KV class	75 KV (peak) for 11 KV class
14	Winding materials	Copper	Copper
15	Insulation security factor	< 10	N / A

4.0 Inspection & testing

1	Type test	1. Metering cubicle shall be type tested as per IS 3427 2. CT and PTs shall be type tested as per IS2705 and IS3156 respectively. 3. Bushings shall be type tested in accordance with IS2099. 4. Type tests should not pertain to period earlier than five Years.
2	Routine test	1. Metering cubicle shall be tested as per IS 3427 2. CT and PTs will be tested in accordance with IS2705 and IS3156 respectively. 3. Temperature rise test will have to be carried out during Inspection. 4. During inspection, all routine and acceptance tests shall be carried out in presence of purchaser's representative.
3	Physical Inspection	1. Checks of all mounting plates / fasteners. 2. Checking of components as per drawing. 3. Electrical circuit's fasteners tightness / surface area contacts. 4. Labels / identification / nameplates. 5. All doors checks – safety and accessibility. 6. Panel surface finish / smoothness.

4	Right to waive off tests	Reserved by Purchaser

5.0 Guaranteed Technical Particulars (Data by Supplier)

SL	Description	Requirement	Data By Supplier
1	Name of Manufacturer		
2	Type and Designation	Outdoor type with resin cast CT and PT	
3	Normal system voltage	11KV	
4	Highest system voltage	12KV	
5	Frequency	50Hz	
6	Insulation Class		
7	Impulse Withstand Voltage (On assembled CT-PT set)	75 KV peak	
7.1	One minute power frequency dry withstand voltage (On assembled CT-PT set Primary)	28KV rms	
7.2	Secondary	3KV rms	
8	Current Transformers:	(3 nos. total, 01 no. per phase)	
8.1	Type	Resin cast wound type	
8.2	Transformation ratio (CT Ratio)	As per requirement	
8.3	Rated Output (VA Burden)	5VA	
8.4	Class of accuracy	0.5s	
8.5	Rated continuous thermal current	1.2 times of rated primary current	
8.6	Short time thermal current rating for one second	As per CT ratio and specification	
8.7	Rated Dynamic current	2.55 times of short time thermal current rating	
8.8	Security factor	Less than 10	

SL	Description	Requirement	Data By Supplier
8.9	Insulation level	28KV for 1 min	
8.10	No. of cores	One	
8.11	Max Ratio error	As per IS:2705/1992	
8.12	Max phase angle error	As per IS:2705/1992	
8.13	Max. temp rise over max ambient temp of 50 deg C at rated continuous thermal current at rated frequency & withstand burden	As per IS:2705/1992	
8.14	Make and Grade of epoxy resin	Cycloaliphatic {R9}	
9	Potential Transformers	(3 Phase 4 wire unit)	
9.1	Burden in VA/Phase	10 VA/phase	
9.2	Transformation ratio	11KV/110V (L-L)	
9.3	Class of accuracy	0.5	
9.4	Winding connection	Star/Star	
9.5	Insulation level	28KV for 1 min	
9.6	Rated voltage factor and time	1.2 continuous and 1.5 for 30 seconds	
9.7	Temp rise over max ambient temp	Within limits of IS-3156/1992	
9.8	Max phase angle error	Within limits of IS-3156/1992	
9.9	Max Ratio error	Within limits of IS-3156/1992	
9.10	Make and Grade of epoxy resin	Cycloaliphatic {R9}	
10	Size of main bus bar		
10.1	For CT ratio less than and equal to 150/5	30 x 4mm (minimum)	
10.2	For CT ratio of 400/5 {R9}	40 x 6mm (minimum)	

SL	Description	Requirement	Data By Supplier
11	Core material	CRGO (Virgin grade)	
12	Minimum creepage for HT Bushing	341mm	
13	Clearances a. Phase to phase clearance b. Phase to earth clearance		
14	No. of Paint coats a. Primer b. Enameled RAL 7032	2 coats 2 coats	
15	Weight of complete unit		
16	Gauge of a. Meter box b. HT compartments	2mm (min) 3 mm (min)	
17	Dimensions of complete Metering cubicle a. Height (mm) b. Breadth (mm) c. Length (mm)		
18	Meter compartment		
18.1	Dimensions of meter compartment with double door (minimum sheet thickness 2mm) a. Height (mm) b. Breadth (mm) c. Length (mm)		
18.2	Protection class	IP 5X	
18.3	Provision of Acrylic window		
18.4	Provision of slotted channel (40*12mm) suitable for 6mm bolts (4 Nos)	Required	
18.5	Provision of Pad locking & sealing arrangement of door		
18.6	Provision of mounting metering reading port on door.		
19	Metering cubicle mounting	Floor mounting	

Annexure 'I' Make list

Make List of RMU's Accessories {R9}		
Sl. No.	Descriptions	Make
1	Relay (Self Power+ AUX DC/ACSupply+ Communicable)	Ashida 241S-761
2	CT	Narayan Power Tech (NPT)/Gilbert Maxwell, 400/75-1/1, 5P10, 2.5 VA, Pragati, Nortex
3	FPI (Both for Earth Fault and Over Current Protection)	EMG/C&S/Schneider/SIEMENS
4	CBCT (Both for Earth fault and Over current protection)	EMG/C&S/Schneider/SIEMENS
5	Boot	3M/Raychem/K.D.Joshi
6	Wire	Polycab/Havells/Finolex/KEI
7	AC & DC MCB	SIEMENS/Havells/C&S/ Schneider
8	Disconnecting type fuses	Connectwell/Wago/Phoenix/Elmex
9	TB (disconnecting type)	Connectwell/Wago/Phoenix/Elmex
10	Vacuum Interrupter	CG/ ABB/Schneider/SIEMENS/other type tested

Annexure 'J' Type test

The entire product shall be type tested from CPRI / ERDA. In case of new offer or type test report is older than 5 years, bidders shall carry out type tests from CPRI / ERDA without any cost implication to BRPL

Annexure-K -Special Technical Requirement: {R9}

Sl. No	Descriptions
1	Animated video for ETC guide of RMU shall be submitted to BRPL before delivery of first lot
2	Relay Protection setting (min 10%)
3	All the communicable accessories shall have Latch contact
4	NO/NC contact for manometer shall be provided

Sl. No	Descriptions
5	--Bidders shall have additional RMU readily available of each type to replace under warranty faulty RMU in case it is repairable at OEM factory --In case of under warranty failure and if the faulty RMU is repairable only at OEM factory, bidder has to replace the faulty RMU during lifting with new/ operatable same type of RMU within the time period mentioned in the tech spec warranty clauses. --BRPL shall not issue any RMU from their assets for replacement activity. In case of delay, penalty shall be imposed as per this corrigendum sl no 9 --After Warranty period completion (5 years), these clause shall not be applicable to OEM
6	Sample RMU
6.1	1 sample RMU of each type shall be manufactured as per BRPL specification after award of PO. BRPL will do the routine testing and inspection of the sample RMU and if found satisfactory as per BRPL specification, BRPL will give clearance/ approval for bulk manufacturing
6.2	During inspection of the sample RMU, BRPL may ask the vendor to modify/ change the design as per BRPL requirement including the make of accessories mentioned in the specification. OEM is liable to modify the design irrespective of the offer submitted during tender stage. However, BRPL will not ask for the requirement beyond the technical specification.
6.3	The lead time required to arrange the accessories/ to modify the design required as per BRPL requirement shall be in the account of bidder.
6.4	BRPL is not liable to bear any extra cost, out of the PO for the approval of sample RMU and the bulk quantity afterwards.
6.5	The sample may be used in BRPL network based on fulfilment of technical requirement and BRPL approval. Else fesh RMUs as per the approved sample shall be supplied in line with PO quantity.
6.6	During bulk manufacturing and PO execution, BRPL may ask necessary changes to be done (if required). Bidder is liable to provide the required changes as per the BRPL requirement irrespective of the offer / design given during tendering stage without any cost implication to BRPL. However, BRPL will not ask any changes out of BRPL Technical specification
7	Warranty clause's terms & conditions mentioned in the technical specification Annexure- G(1), Clause no-6.2 shall be strictly followed by the OEM, in the event of violation of warranty clauses, BRPL is liable to impose penalty with1% of RMU unit rate per day basis (Unit rate shall be considered as per the PO)
8	Submission of Type test report (not more than 5 years from the date of tender opening) of internal arc for 1 sec (AFLR 20kA for 1 sec) from CPRI/ERDA is mandatory with minimum 3 way RMU configurations.
9	Complete Civil foundation Drawing along with sectional view (RCC casting shall be followed) and Bar Bending Scheduled (BBS) shall be submitted by bidders

Sl. No	Descriptions
	along with drawing
10	Submission of 3nos as built drawing to BRPL before dispatch of first lot of material is mandatory. Also one set of as built drawing shall send with each unit of supplied RMU. Proper holding arrangement to be provided to place as built drawing inside the RMU.
11	Test bushing feature-The bushing of RMU must have the feature of “Test Bushing”.
12	Broken conductor feature in relay-The relay must have the feature of detecting change in impedance (negative phase sequence over current)
13	BRPL may conduct stage wise inspection of RMU manufacturing at vendor works. OEM is liable to intimate the manufacturing scheduled along with related dates before commencement of manufacturing.

BSES

TECHNICAL SPECIFICATION

FOR

LAYING OF 66 kV / 33 kV / 11 kV / 1.1 KV GRADE PVC / XLPE CABLES

Specification no: GN101-03-SP-06-03

BSES RAJDHANI POWER LTD			
Prepared by	Pronab Bairagi		Rev : 03
Reviewed by	Amit Tomar	31.10.17	Date : 31.10.2017
Approved by	Vijay Panpalia		Pages : 44
Registered Office: BSES Bhavan, Nehru Place, Delhi - 110019			

Index

General Specification

1.0 Codes & standards

Materials, equipment and methods used in the Laying of 11/33/66KV Cable shall conform to the latest edition of following –

S. No.	Reference No.	Name of Standard
1		Indian Electricity Rules, 1956
2		Indian Electricity Act, 1910
3		Indian Electricity Supply Act, 1948
4		Electricity Laws Act, 1991
5		National Electrical Code (Indian standards Institution)
6	IS 1255	Code of practice for installation and maintenance of Power Cable upto and Including 33KV rating.
7	IS 1554	PVC Insulated Electrical Cables upto 11KV
8	IS 2274	Code of Practice for electrical wiring installation – system voltage exceeding 650V
9	IS 7098 Part II	Crosslinked Polyethylene Insulated PVC sheathed cables for working voltages from 3.3KV upto and including 33KV
10	IS 7098 Part III	Crosslinked Polyethylene Insulated PVC sheathed cables for working voltages from 66KV upto and including 220KV
11	IS 5820	Specification of precast concrete Cable cover.

2.0 Design guidelines and Parameter for cable laying-

S. No.	Parameter	Details
2.1	Selection of Cable Route	The cable route selection shall be done by the concerned supervising engineer by first conducting route survey and selecting a route along with contractor keeping followings in mind: -The side of road which presents the least obstacles and the fewest roadways crossings. -The future consumers and existing cables in the route may influence the cable route. -Railway, road crossings, MCD and other government agencies may also influence in selection of cable route. -Plans for future building projects should be considered. -The route shall be as far as possible away from parallel running gas, water pipes and telephone/telecommunication cables.
2.2	Site Preparation	a) Barricading: • The identified cable route shall be barricaded continually before excavation. • Barricading shall be as drawing laid • Open Trench method shall be adopted as far as possible for trench preparation. b) Excavated Earth:

		• The excavated earth shall be so stored at site, that it shall not cause trouble to running traffic • All excavated earth shall be stored within the barricaded area. • c) Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the working area from the risk of accidents due to speedy vehicular movement. Same the way barricades protect the road users from the danger due to construction equipment and temporary structures. d) The structure dimensions of the barricades , material and composition, its colour scheme, BSES logo and details shall be in accordance with specification and drawing laid down in the tender documents. e) All the barricades shall be erected as per the design requirements of employer, numbered painted and maintained in good condition and also barricade in charge maintain a barricade register at site. f) All barricades shall be conspicuously seen in the dark/night time by the road users so that no vehicle hits the barricades. Conspicuity shall be ensured by affixing retro reflective strips of required size and shape at appropriate angle at bottom and middle portion of the barricades at a minimum gap of 1000 mm. In addition minimum one red light /red blinker and red beacon light should be placed at the top of each barricade. g) PPP to be provided by vendor to all workers and engineers. **h) Also refer Annexure- 7: Barricading and Safety**
2.3	Clearance	The desired minimum clearances are as follows – - Power cable to power cable – A minimum clearance equal to diameter shall be maintained. Trench drawings shall be referred to for guidance. - Power Cable to control cables – 0.2 M - Power cable to communication cable – 0.3M - Power cable to gas/water main – 0.3 M
2.4	Depth of Cable Laying	The desired minimum depth of laying from ground surface to the top of cable shall be: 650 / 1100V grade XLPE Cables – 75 cm 6.35 / 11KV grade XLPE Cables – 90 cm Low voltage and Control cable - 75 cm 19 / 33KV grade XLPE Cables - 1.2 M 38 / 66KV grade XLPE Cables - 1.5 M Cables at Road crossing - 1.0 M (min.) Cables at railways level crossings (measured from bottom of sleepers to the top of Pipe) - 1.0 M (min.) Whenever there is any obstacle at the laying depth, the cable should be lowered/ raised to cross the obstacle. However variation in the depth is to be approved by BSES. The Contractor shall provide the same in deviation report.
2.5	Width of Cable	The width and depth of Cable Trenches shall depend upon number of

	trenches	circuits and Voltage Grade. Annexure # 3 and drawings of this specification shall be followed.
2.6	Bending Radius of Cables	While pulling of the Cable from the drum or during laying following minimum bending radius shall be maintained so that the cable, in particular the insulation does not get damaged – A) Single Core Cables (PVC & XLPE) Upto 1.1KV grade – 15 X D Above 11KV grade - 20 X D B) Multi Core Cables (PVC & XLPE) Upto 1.1KV grade - 12 X D Above 1.1KV grade – 15 X D Where 'D' is overall diameter of the cable.
2.7	Maximum permissible Tensile Strength for Cables	For cables pulled with Stocking PVC and XLPE SWA Armoured cables P = 30 X D PVC and XLPE AWA Armoured cables P = 20 X D Where P= pulling force in Kgrm, D= Diameter of Cable in mm For Cables pulled by Cable eyes Aluminium conductor – 30 N/mm2 = 3 Kg/sq. mm Copper conductors - 50N/mm2 = 5 Kg/sq. mm Permissible force is calculated by multiplying the above values by cross sectional area (CSA) of conductor of each core and then number of cores.
2.8	Methods of Laying	a) Cables shall be laid in direct in ground, in trenches excavated therein and shall be protected with covers as given in the drawing. Cables shall also be drawn into pipes of ducts or laid in the formed trenches or troughs or on racks or supported in trays or cleats as required by the site exigencies. Where the cables are laid in the formed trenches, the installation shall include removal and replacement of the trench covers and the provision of temporary protective covers on the trenches where they cross the access ways. b) HDPE (PN6,PE80) or RCC ducts shall be used where cable cross roads and railways tracks. Spare ducts for future extensions should be provided. Spare duct should be sealed off. Buried ducts or ducting blocks shall project into footpath or upto the edge of road, where there is no footpath, to permit smooth entry of cable without undue bending. The diameter of the cable conduit or pipe or duct should be at least 1.5 times the outer diameter of the cable. Angular alignment of the duct across road crossings shall be predetermined to maintain safe bending radius when direction of cable trench changes before or after the road. c) The contractor shall lay cable by Horizontal direct drilling (HDD) in main roads and highway with heavy traffic, passage to public property where excavation is not possible. Contractor shall take approval for laying of cable by means of HDD wherever required from the supervising engineer. The cable laid by HDD shall be

		minimized so that it doesn't exceed by 12% of total route length. This is to avoid De-rating of Cables. d) Unless approved by BSES, the contractor shall lay the cables, direct in ground, in single layer. The cables shall be laid with the pre-determined and approved cable route. e) Spacing shall be maintained uniformly between the cables all along the length including the bends, as approved by BSES. To maintain the spacing, suitable non-metallic formers shall be placed uniformly with spacing not exceeding 5 meters. Every bend shall have at least one spacer. f) 75 mm of the sand bed shall be placed at the bottom of cable trench. g) After the cables have been laid the trench shall be filled with the sand and shall be well rammed to a level not less than 75 mm above the top of the cables all throughout the route. h) To protect the cables against external mechanical damage, which may be caused by other agencies, the cable shall be protected by suitable cover. (for drawing of RCC cable cover refer annexure VI). i) The type of the covers shall be as under - 1.1KV Cables – Single layer of brick thickness not less than 75 mm (3 inch) - 11KV Cables – sand stone of thickness not less than 75mm (3 inch). - 33KV Cables shall be protected by reinforced concrete cover of width 300 mm as per attached drawing with thickness not less than 50mm. - 66KV Cables shall be protected by reinforced concrete cover as per attached drawing with thickness not less than 50mm. The RCC cable cover shall be embossed as "BSES EHV CABLE". j) Back fill to be filled up to 75mm and the warning tape shall be installed continuously. The tape shall be yellow in colour with Black / Red lettering of minimum 20mm height. The approved warning message shall be written in English and Hindi/ local language. The minimum thickness and width of the tape should be 300 microns and 150 mm respectively. k) The trench shall be filled-up by loose soft soil (300mm) and Excavated soil as indicated in drawings.
2.9	Cable over	On Bridges the cables are generally supported on wooden cleats and

	Bridges	clamped on steel supports at regular intervals. The cables laid on bridges shall be provided with Sun shield. Approval from appropriate authorities (PWD/railways) as applicable shall be taken by contractor.
2.10	Laying of Single Core Cables	a) The single core cables shall be laid in trefoil formation. Single core cables can be laid individually in HDPE pipe in case of HDD only. (Details of HDPE Pipe as per Annexure-9) b) For single core cables laid in trefoil formation, plastic cable ties shall be used at interval of 1.0 (one) meter throughout the cable length to maintain the trefoil arrangement. c) To balance the inductance, the phase sequence in trefoil format shall be maintained by vendor (for double circuit) d) To prevent magnetic losses (eddy current and hysteresis losses), the base plate of the panels or the terminal box of the equipments, shall have aluminium plate. In case the entry into the building is through GI pipe, a "slit" in the GI pipe shall be necessary. Alternatively GI pipes may altogether be avoided and non-metallic pipes such as PVC or HDPE pipe shall be used. Concrete pipes having steel reinforcement (RCC pipe) are not to be used.
2.11	Earthing of Single Core Cables	a) Single point bonded earthing shall be employed to prevent flow of induced circulating current in the armour and screen and consequential de-rating of cables for feeder less than 2.0 KM. b) For feeder length more than 2 KM, mid point earthing shall be provided.
2.12	Violation of barricading guideline and safety norms	On violation of barricading guideline and safety norms, a fine of Rs.5000 /day shall be imposed. BRPL inspector/engineer in-charge shall be empowered to impose the above penalty.

3.0 General guidelines for Laying Cables

S. No.	Parameter	Details
3.1	General	a) Laying of the cables and handling of the same shall be undertaken, at all times, by adequate staff suitably trained and supplied with all the necessary plant, equipment and tools. b) The contractor shall be responsible for all the route survey, establishment of the position of the joints as per the site exigencies and the drum lengths of cables to be laid. While carrying out the route survey the contractor shall take into account the obstacles on the route whether above or below ground. The cable shall be planned to be laid in an orderly formation, free from unnecessary bends and crossings c) The contractor shall submit a drawing for the complete scheme

		showing the entire route, road crossings, location of joints and also the arrangement of cables to be laid. In case due to site exigencies, cables have to cross over within the trench, the same shall be shown in the drawing. For each and every job, these drawings shall be approved by BSES, prior to commencement of work. d) BSES shall arrange for all the material and manpower required for jointing and end termination. The Contractor shall provide pit, carry out excavation for creation of working space required for jointing by the jointer. All civil works, structural work, clamping and earthing shall be carried out by the contractor, so that the cables and accessories perform satisfactorily during the entire life time. e) The entry and exit of the cables into the building shall be through RCC or GI pipe except for single core cables, which shall be properly sealed and shall be duly supported as per the method and technique approved by BSES, so that the outer sheath of the cable does not get damaged at the entry and exit points. The sealing should be of adequate length so that it minimizes the risk of spreading of fire or ingress of water.
3.2	Handling and Storage of Cable drums (All empty drums are returnable)	a) The cable drums shall be transported upright, so that the weight is distributed on both the flanges. Under no circumstances the cable drum may be laid on its side. During transportation the drums must be properly secured. The cable drums should never be dropped from Lorry or a trailer, so as to prevent damage to the cable drum and also to the cable. Ramp may be used for unloading. The drums may be rolled over short distance, provided the correct direction of rolling as provided on the drum is observed. Alternatively, a mobile crane should be used for lifting and lowering the drum. A chain-pulley arrangement may also be used to lift the drums and deposit the same on ground if required. b) In case the drums are to be stored prior to cable laying, they should be arranged in such a way to leave some space between them for air circulation. It is desirable that the drums stand on battens placed directly under the flanges. Overhead covering is not essential except in heavy rainfall areas or during monsoon. Cable should however be protected from direct rays of sun by leaving the battens on or by providing some form of sunshade. In no case the drums shall be stored in a flat position with flanges horizontal. c) For transportation of the cable drums from storage site to work site, the drum should be mounted on a trailer or an open lorry and unloaded by mobile cranes. d) After cable laying, empty cable drums shall be taken return back by vendor from site at their own risk and cost. Cost of empty drums shall be deducted from vendor account during final settlement.
3.3	Cable Laying	a) The ground over which the drum is positioned at site should be

		properly consolidated and jacks placed on both sizes of the drum to make the pay-off arrangement stable. Suitable arrangement be made to stop the drum rotation, during cable laying preferably by square wooden poles kept temporarily pivoted over cable roller under the flanges which when required can be applied on the flange as a brake by personnel manning the drum. b) The cable should always be paved off from the top of the drum. The drum must be positioned in such a way that the arrow on the drum points opposite to the direction of rotation marked on the drum. c) It must be ensured that the cable is not dragged over sharp object or on the road surface, so as to avoid damage to the outer sheath of the cable. d) The pulling method to be used shall be approved by BSES. Cable supplier's recommended maximum pulling tension shall not be exceeded. e) Rollers shall be placed at intervals and the cable shall be pulled over the rollers. The rollers shall be kept lubricated so that they rotate freely, minimize friction to the cable in motion. Rollers shall be positioned at the bends to minimize side wall friction. The contractor shall ensure that PVC/HDPE sheath of cable is free from damage due to abrasion. f) The cable should not be pulled out from the drum by lifting of the coil while the drum is lying flat on the flange. This leads to twisting of the armour and cores resulting in permanent damage to the cable. g) To avoid ingress of moisture, it must be observed that the end capping of the cables is not damaged. Cut pieces of the cables must be capped immediately, before laying of the same is taken-up.
3.4	Excavation of the Trenches	a) The excavation of the trenches shall be commenced, with proper co-ordination with BSES, so that all the necessary clearances for the route are already obtained from the competent authorities, well in time. b) Before opening of the section of the trench, the contractor shall satisfy himself that the line of the trench is clear of underground obstructions, by taking out trial pits on the line of the trench. c) The exact location of each trench shall be approved on site by BSES. The trenches shall be kept as straight as possible and each trench shall be excavated to approved formation and dimensions. If necessary, the trenches shall be adequate shored by wooden planks and bracing to avoid trench cave-ins which would cause injury to the persons and also damage the cables laid. d) The bottom of each trench shall be firm and of smooth contour. The contractor shall take reasonable precautions to prevent damage to the highway or ground surface from a slip or breaking away of the sides of the trench. e) The trench excavation and filling in shall be so executed that all

		walls, roads, sewers, drains, pipes, cables, structures, places and things shall be reasonably secured against risk of subsidence or injury and shall be carried out to the satisfaction of the authorities concerned. Should, however, a damage to an existing or other services be made, the Contractor will arrange and pay for any necessary repair, to make good the damages. f) Where trenches pass from a footway to a roadway or at other positions where a change of level is necessary, the bottom of the trench shall rise or fall gradually. The rate of rise or fall shall be approved by BSES. g) Contractor shall ensure that during excavation and until restoration has been completed, for reasonable access of persons and vehicles to property or places adjacent to the route. h) When the excavation of the trenches has been accurately executed, the contractor shall inform BSES for approval. Laying of cables or building of structure shall not be started until the contractor has been advised by BSES to proceed with the work.
3.5	Excavated material	a) The materials excavated from each trench shall be placed so as to prevent nuisance or damage to adjacent ditches, drains fences, gateways and other property or things. Excavated material shall be stacked so as to avoid undue interference with traffic. b) Where, owing to traffic or for reasons of safety or other considerations, this is not permissible, the excavated material shall be removed from the site and returned for refilling the trench on completion of laying; surplus material shall be disposed off by the contractor at his own cost.
3.6	Pipes and Ducts	a) Care shall be taken to make the bend of the pipes or duct lines as easy as practicable and in no case of radius less than 3 meters. Where approved, split pipes may be used on bends, the pipes being fitted round the cable after laying. b) All road crossings shall be ducted. This applies to present and future roads as indicated on the route plans. The pipes and the ducts shall be laid in an approved manner and shall be surrounded by 150 mm of PCC (1:2:4) c) Ducts under the road shall be provided by the contractor, by non-disruptive method, if road cutting is not permitted by the concerned authorities Cable laying shall be done by Horizontal Direct drilling method (HDD). d) The cables shall be suitably protected at entry and exit from the pipes, so that the outer sheath does not come in contact with the edges of the pipes / ducts. The pipes and ducts shall have slope so that the seepage water can drain through the small opening provided on the lower side of the pipe sealing. e) The pipes and ducts shall be secured to the base at both ends and at regular interval, throughout the length, so that at no point the ducts or pipes get suspended over the threaded cable, and damage the same, thus defeating the very purpose of providing the pipe / duct.

		f) At all road crossings at least one spare duct / pipe shall be provided for future use. The pipe shall be thoroughly cleaned of obstructions. A draw wire or rope shall be left in each pipe to facilitate the drawing in of the cables. The duct end shall be sealed temporarily to prevent the entry of foreign matter. End caps and permanent markers shall be placed flush with footpath / roadways at both the ends. The pipes and ducts shall be cleaned again immediately before the cables are drawn in. g) The internal diameter of the pipe / duct should be such that the cables occupy only 40% of the area of the pipe / duct to avoid de-rating.
3.7	Joint Bays	The contractor shall provide all help so as to enable jointers to carry out their work efficiently and expeditiously. The method of securing and supporting cable joints and cables also the bonding and earthing thereof, shall be detailed on the drawing. The details shall be approved by BSES prior to commencement or work. The joint position should be staggered.
3.8	Back filling of trenches	a) Filling in of trenches shall not be commenced until BSES has inspected and approved the cables and accessories at site. The inspection should be got done on daily basis so that the trenches do not remain open unnecessarily, to avoid inconvenience to public. b) The trench shall be backfilled after putting all protections for cables. c) Soft soil shall be backfilled for 300 mm above the cable protection cover. d) Caution Tape shall be laid all along the cable route above the soft soil filling. e) Complete backfilling shall be done above the caution tape.
3.9	temporary Reinstatement	a) Where cables routes are in public highways, footpaths, gardens etc., the method of reinstatement will be subject to approval by MCD. All costs incurred will be at the contractor's expenses. b) The contractor shall be responsible for proper permanent reinstatement of the upper levels, which shall be carried out to the satisfaction of BSES and the MCD authorities concerned. c) Before finally leaving site, permanent reinstatement shall be executed by the contractor to the approval of MCD and the property owners and all costs incurred shall be to the contractor's account.
3.10	Permanent Reinstatement of Public Road,	a) In public roads and footways the surfaces and foundations shall be temporarily reinstated by the contractor. After settlement, temporary reinstatement material shall be removed as necessary and the permanent reinstatement shall be carried out to the approval of the appropriate highway authority / MCD. Stone and pre-cast concrete paving kerbs and channels shall also be finally reinstated by the contractor. b) Temporary reinstatement shall be maintained by the contractor until commencement of final reinstatement to ensure that the surface is always safe for the passage of pedestrians and vehicular traffic.

3.11	Identification	All cables shall be identified below the gland at each end, at joint position and at approved positions by means of bands engraved or punched with cable no. feeder name, size of cable, number of cores, phase colour etc. The bands shall be secured fastened in a permanent manner, and shall be made of material able to resist corrosion, dampness and mechanical damage.
3.12	Cable Route Markers	All cables routes shall have markers at suitable location with a gap not exceeding 30 meters. The route markers shall be approved design. Additional markers shall be provided at joint locations with approved markings.
3.13	Cable supports / Clamps	a) The contractor shall supply and install all the supports, racks, trays, cleats, saddles, clips and other parts required to carry and secure the cables, without risk so that there is no undue mechanical load or stress due to weight of the cable at each end. Cleats, saddles and clips shall be of the design as approved by BSES. No cable shall be laid on the trench floor. They shall be run in a neat and orderly manner and the crossing of cables within the trench shall be avoided as far as possible. Where cable runs unavoidably cross, a suitable supporting arrangement shall be provided to maintain an adequate gap between the cables b) Every cable shall be supported at a point not more than 500 mm from its termination.
3.14	Installation of Cables in tunnels / basement / below the panels etc	a) The design of cable support for cables installed in air in cable tunnels, basements etc. shall consist of vertical steel members spaced at approved interval and secured to the walls, floors and ceilings as necessary by means of bolts either cemented in position or expanded into cored holes. Each vertical support shall have bolted to it a number of steel brackets spaced at the intervals and designed to support and retain trays constructed of galvanized sheet steel of adequate section to carry the weight of the cables, plus space for an additional quantity of future cables at least 25% by weight and dimensions in excess of the cables installed under the contract and an additional load of 100 kg at the extremity without distortion. The trays shall be designed with raised edges to retain the cables and shall incorporate an interlocking feature so as to prevent movement between supports. b) The design and construction of all cable cleating and supporting arrangements shall suit the cable system design. The spacing of cable supports shall be approved by BSES. c) Cable run on trays shall be neatly dressed and where not provided with cleats shall be secured by heavy gauge, type approved metal reinforced, clips or saddles. Not more than six cables shall be embraced by one clip. d) Mild steel of appropriate sections, duly painted in an approved manner, shall be used for fabrication of cable supports. The steel shall be free from blisters, scales, laminations or other defects. Before final painting, the steel sections shall be provided with double coat of red primer.

3.15	Cable Protection at overhead Towers or Poles	Where the cables terminate on overhead line poles or towers located outside substation compounds the contractor shall provide suitable cable supporting galvanized steel work attached to the pole or tower and comprising backboard, runners, sheet, steel cover of not less than 3.0mm thickness, stays, cable cleats, anti climbing guard and all incidental items to provide secure protection for the cables. Isolators and Lightning arrestor if required to be installed shall be provided as free issue item to the contractor, however the erection and steel structure required shall be in scope of the contractor.
3.16	Sun Shades	All cables shall be protected from direct solar radiation by ventilated sun shields as approved by BSES.
3.17	Route Plan	a) BSES intents to show all the cable routes, location of joints and other underground obstructions on a GPS map. b) During the progress of the contract works the contractor shall record on a set of route plans and cross section drawings of an approved form, these details so that the same can be transferred on the GPS maps. Such particulars will allow an accurate reference to be made in the case of any fault or projected modification. These records shall show, amongst other data, both indoors and outdoors the exact position of every joint, cable end termination and also the particulars of the depth of the trench, the arrangement of the cables, with cable numbers and the position of all obstructions revealed during the course of excavations. These completed records shall be submitted to BSES within 15 days of completion of any particular route/feeder. The final bill shall not be processed by BSES unless this activity has been completed to the entire satisfaction of BSES
3.18	Site Facilities to be maintained by the Contractor	a) The contractor shall arrange for all the tools and tackles required for cable laying as per this specification. BSES shall arrange for all the material and manpower required for jointing and end termination. b) Illumination and Power supply shall be arranged by the contractor so that the work can be carried out round the clock. c) The contractor shall maintain functional dewatering pumping facility with suitable power supply so as to protect the cables and the joints from ingress of water due to rain or otherwise d) The contractor shall make arrangement to provide suitable scaffolding arrangement to carry out the termination work e) The contractor shall carry out proper barricading of the dug cable route and the joint bays and shall take all necessary precautions to avoid any public hazard f) Also refer Annexure-7: Barricading and Safety.
3.19	Type of Roads and guidelines for road restoration	The typical section of type of Roads (based on width) under PWD and MCD are :- - 20 Feet Wide road - 30 Feet wide road - 40 to 60 Feet Road - Other (which include Kota stone, Agra stone, Cement concrete, interlocking paving tiles, brick road, chequered tiles

		and asphalted road) The drawing are shown in annexure IV The guidelines for road restoration for various type of roads and surfaces are indicated in annexure V as :- - Bituminous road Type I (category I & II) - Bituminous road Type II (category III) - Cement concrete road - Kota/Rajasthan stone Road - Brick Road - Interlocking paving tiles. - Agra stone road - Chequered tiles road - Asphalted road

4.0 Testing

S. No.	Parameter	Details
4.1	Tests to be carried out during and after completion of Cable Laying	Testing of cable before jointing – - Cable shall be tested for Insulation Resistance prior to laying by opening the end and resealing end properly. Testing on complete Cable Installation – a) Insulation resistance of each core shall be measured against all the other cores and the metal screen connected to earth. b) The resistance of the conductor shall be measured. c) DC High voltage. For old cables test voltage shall be 1.5 times rated voltage or less depending on age of cable.(refer annexure # 2 for values) d) Charging of Cable at No-Load at Nominal working voltage for 24 Hours. e) After laying and before termination of cable a sheath test shall be conducted for 66KV Single core Cable as under :- At both ends the cable shall be raised from ground. From the end graphite coat applied over the outer PVC jacket shall be removed with a piece of glass for a length of 300mm. A spiked steel rod with an eye for attaching a wire shall be driven into the ground and connected to a nearby water or hydrant pipe. Insulation resistance of PVC jacket shall be measured between the aluminium wire armour and the spike with a 500/1000V insulation tester. Measured resistance shall not be less than 2.5M OHM per KM. Thereafter 10KV DC shall be applied for one minute in the same way. After the test the armour shall be kept earthed to the steel spike for 15 minutes for discharging residual charge.
4.2	**Statutory**	a) Road cutting permission

	clearance	Road cutting permission shall be taken from competent authority by vendor. How ever official fees shall be paid by BRPL. b) Electrical inspector clearance Electrical Inspector clearance shall be in vendor scope. How ever official fees shall be paid by BRPL.

5.0 Progress Reporting:

S. No.	Parameter	Details
5.1	Detailed Progress report	Progress report to be submitted by Contractor to BSES once in a Week containing i) Excavation status ii) Cable laying status iii) Status of preparedness for Jointing iv) Reason for any delay in total programme v) Details of damage to cable during laying. vi) Progress on final completion / Constraints / Forward path

6.0 Drawing, Data & Manuals:

S. No.	Parameter	Details
6.1	To be submitted After Completion of the Job	As the works is completed the following reports in quadruplicate shall be submitted to BSES for record purpose and shall be incorporated in the 'As constructed Records'. a) Feeder details (sending end, receiving end, SAP number of project etc) - Type of cables, cross section area, rated voltage. Details of construction, cable number & drum number. - Year and month of laying. - Actual total route length, cable length, length between joint to joints or end. - Location of cables and joints in relation to certain fixed reference points, for example buildings, hydrant, boundary stones etc. - Jointing reports detailing the date, weather conditions, jointers and supervising Engineers names, details of type of cable and type of joint or termination, location and joint bay number, ambient temperature. - Results of original electrical measurements and testing on cable installation. - Full written reports will be required of any damage occurring to cable or equipment together with remedial action proposed which will be subject to the approval of BSES.
6.2	Drawing and document sizes	Standard size paper A0, A1, A2, A3, A4

7.0.0 Deviations

Deviations from this Specification shall be stated in writing by the contractor. Written approval shall be obtained from BSES by the contractor. In absence of such a statement, it will be assumed by BSES that the Contractor complies fully with this specification during execution of the job.

Deviation mentioned in any other submitted tender docs like in GTP, QAP, Old PO, old WO, BRPL Standard, vendor standards etc. shall not be considered as a deviation at any stage of contract.

The format for approval of deviation attached in annexure # 1

Annexure # 1 – DEVIATION REPORT FORMAT

S. NO.	Clause No. of Specification	Details about deviation	Reason for deviation	Approved by (Sign & Name)

Annexure # 2 – DC HIGH VOLTAGE TEST

Rated Voltage of cable in KV	Test Voltage Between		Duration in Min.
	Any conductor and metallic sheath / Screen / armour	Conductor to conductor (for unscreened Cables)	
0.65 / 1.1	**3**	**3**	**15 Min**
6.35 / 11	**18**	**30**	
19 / 33	**60**	**----**	
38 / 66	**90**	**----**	

Reference value for DC High voltage Test.

Annexure # 3 – CABLE TRENCH DETAILS

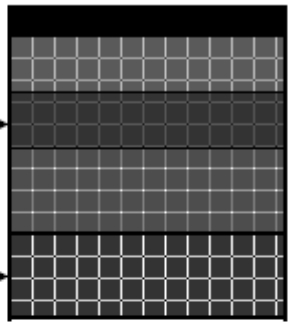
S. No.	Cable Size	Trench		Cable Trench drawing reference
		Width (mm)	**Depth (mm)**	
1	**1.1 kV LT Cables**			
a	3.5Cx150 mm^2 - Single Circuit	**400**	**875**	A – 1 (Drg. # 9)
b	3.5Cx150 mm^2 - Double Circuit	**400**	**875**	A – 1 (Drg. # 9)
c	3.5Cx150 mm^2 - Triple Circuit	**400**	**875**	A – 1 (Drg. # 9)
d	3.5Cx300 mm^2 - Single Circuit	**400**	**875**	A – 1 (Drg. # 8)
e	3.5Cx300 mm^2 - Double Circuit	**400**	**875**	A – 1 (Drg. # 8)
f	3.5Cx300 mm^2 - Triple Circuit	**400**	**875**	A – 1 (Drg. # 8)
2	**11 KV Cables**			
a	3Cx150 / 300 mm^2 - Single Circuit	400	**1055**	A – 2 (Drg. # 6)
b	3Cx150 / 300 mm^2 -Double Circuit	650	**1055**	B – 1 (Drg. # 7)
3	**33 kV Cables**			
a	3Cx400 mm^2 - Single Circuit	**400**	**1235**	A – 3 (Drg. # 3)
b	3Cx400 mm^2 - Double Circuit	**650**	**1235**	B – 2 (Drg. # 4)
c	3Cx400 mm^2 - Quadruple Circuit	**650**	**1235**	B – 2 (Drg. # 5A)
d	3Cx400 mm^2 - Quadruple Circuit	**650**	**1545**	B – 3 (Drg. # 5B)
e	3Cx400 mm^2 - Quadruple Circuit	**1200**	**1235**	C – 1 (Drg. # 5C)
4	**66 kV Cables**			
a	1Cx630/1000 mm^2 - Single Circuit	**650**	**1445**	B – 4 (Drg. # 1)
b	1Cx630/1000 mm^2 - Double circuit	**1200**	**1445**	C – 2 (Drg. # 2)
c	3Cx300 mm^2 - Double circuit	**1200**	**1445**	C – 2 (Drg. # 2A)

Annexure # 4 – Standard Road Profile

STANDARD ROAD PROFILE
20' - 00 " FEET WIDE ROAD (Road type 1)

Sketch 1 of 4

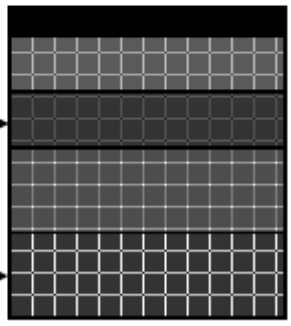
1 **20 mm thick** Pre-Mix Carpet
2 **75 mm thick** WBM 53mm to 22.5 mm stone aggregate
3 **75 mm thick** WBM 63mm to 45 mm stone aggregate
4 **100 mm thick** WBM 90mm to 65 mm stone aggregate
5 Compacted Earth



Sketch 2 of 4

30' - 00 " FEET WIDE ROAD (ROAD TYPE II)

1 **20 mm thick** Pre-Mix Carpet
2 **75 mm thick** WBM 53mm to 22.5 mm stone aggregate
3 **75 mm thick** WBM 63mm to 45 mm stone aggregate
4 **100 mm thick** WBM 90mm to 65 mm stone aggregate
5 Compacted Earth

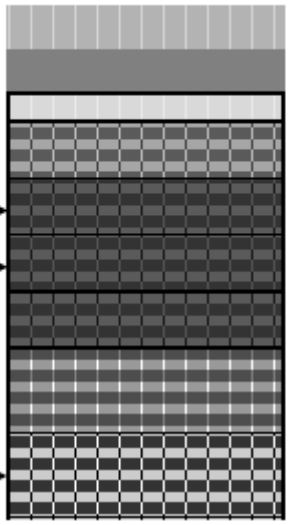


Section X-X '

Sketch 3 of 4

40'-00 " TO 60'-00" FEET WIDE ROAD

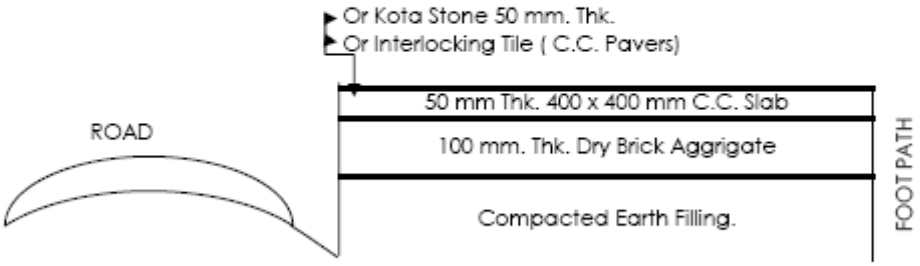
1 **50 mm thk.**(Dense Asphaltic coat) (DAC)
2 **50 mm thk.**(Dense Bituminous)
3 **20 mm thick** Pre-Mix Carpet
4 **75 mm thick** WBM 53mm to 22.5 mm stone aggregate
5 **75 mm thick** WBM 63mm to 45 mm stone aggregate
6 **75 mm thick** WBM 63mm to 45 mm stone aggregate
7 **75 mm thick** WBM 63mm to 45 mm stone aggregate
8 **100 mm thick** WBM 90mm to 65 mm stone aggregate
9 Compacted Earth



Section A-A '

Sketch 4 of 4

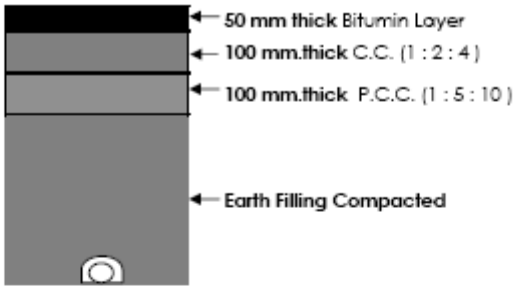
General drawing for cases other than roads.



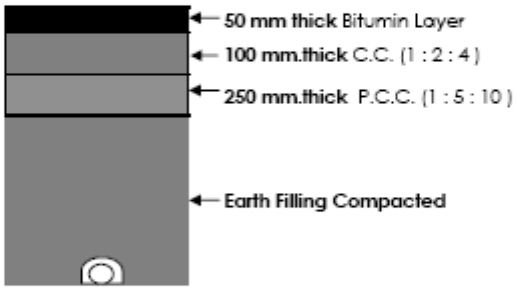
Details of Foot Path Along roads under PWD & MCD.

Annexure # 5 – Road Restoration Sectional Drawing

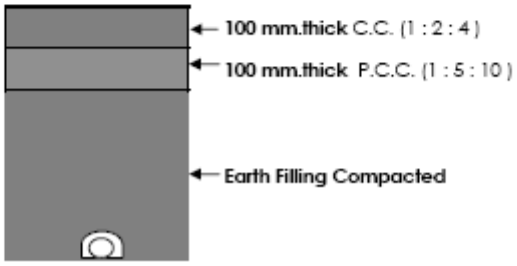
ROAD RESTORATION SECTIONAL DRAWINGS



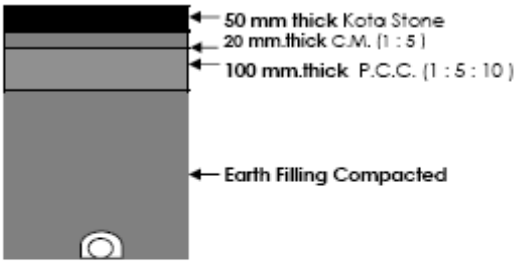
Bituminious Road Type - I (Category 1 & 2) Road width 20 to 30 feet and 30 to 40 feet.



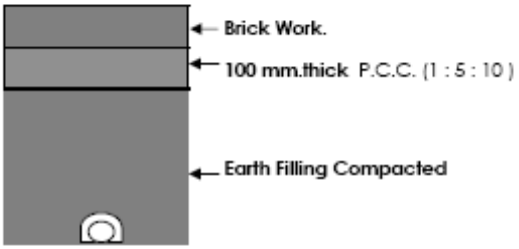
Bituminious Road Type - II (Category 3)



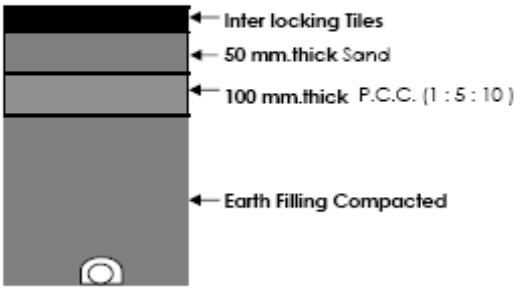
Cement Concrete Road



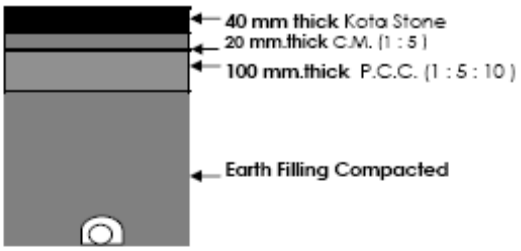
Kota / Rajasthan stone Road



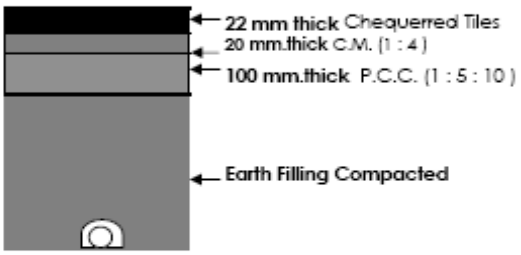
Brick Road



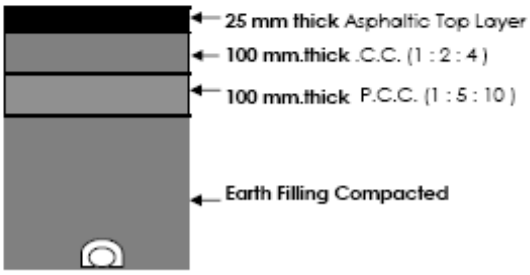
Interlocking Paving Tiles



Agra stone Road .



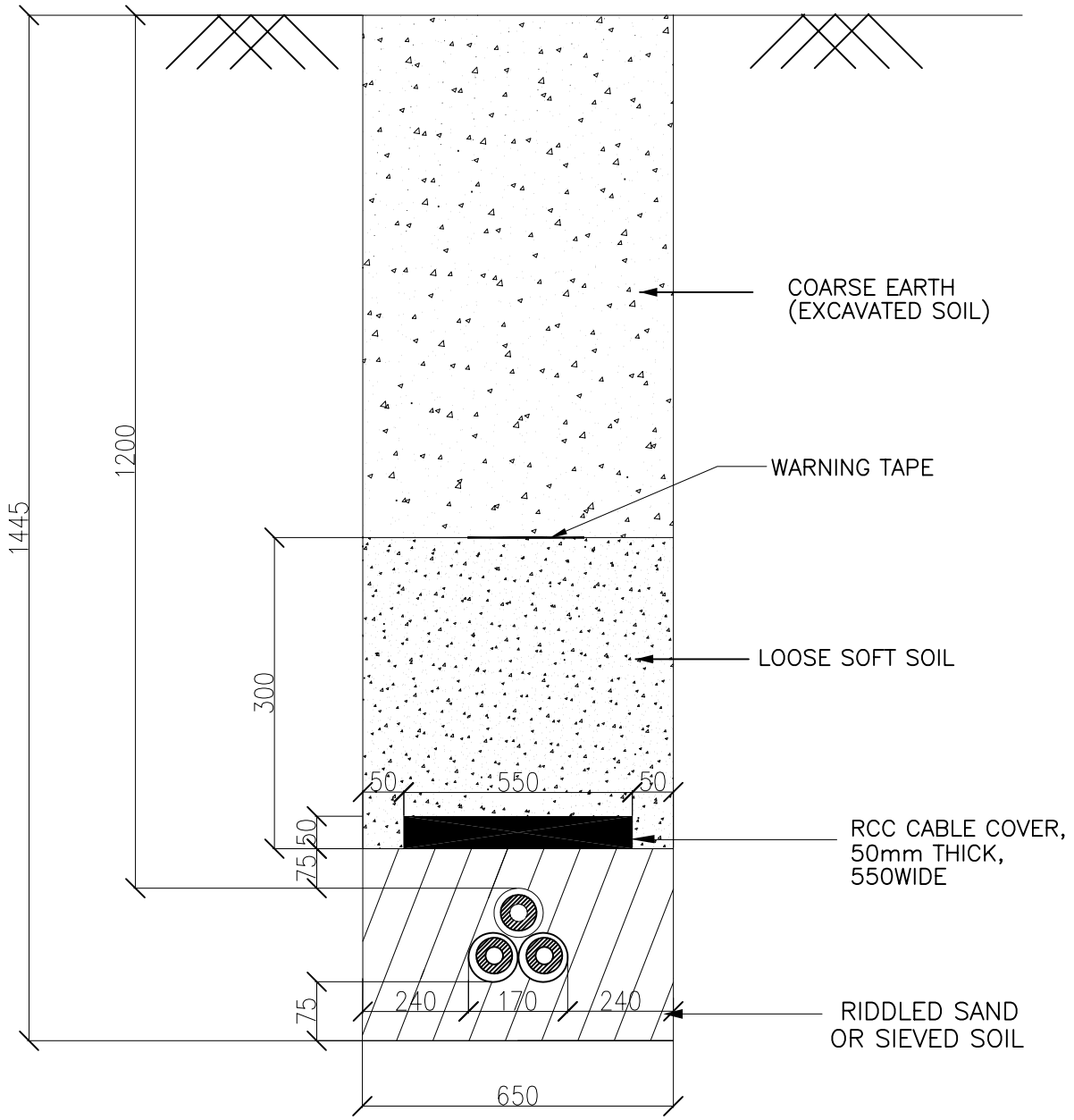
Chequerred Tiles .



Asphaltic Road .

Annexure # 6 – DRAWINGS (CABLE TRENCH AND RCC CABLE COVER)

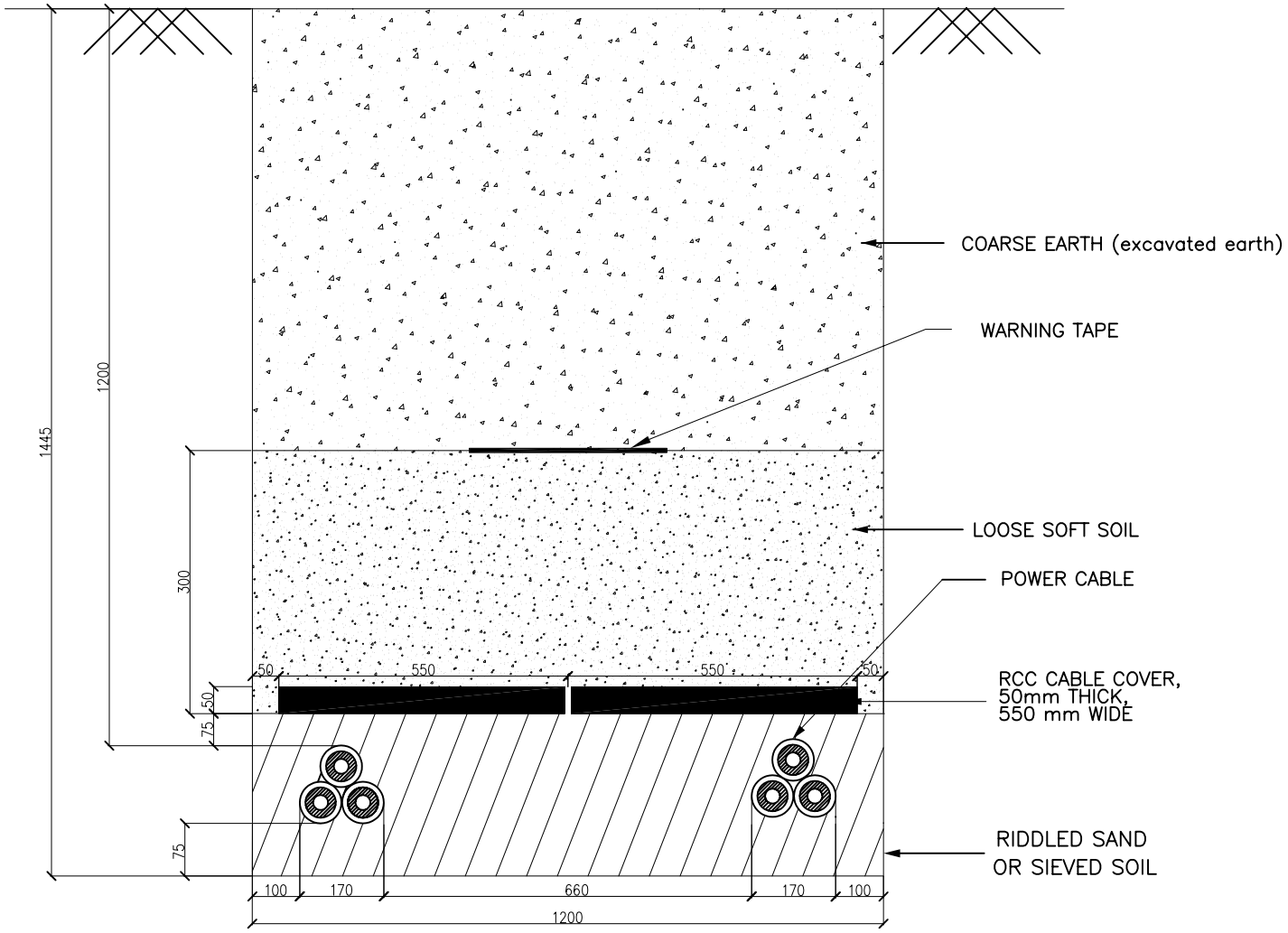
DRAWING # 1



TYPICAL DETAILS FOR 66KV BURRIED CABLE FOR SINGLE CIRCUIT
TYPE – B 4

DRAWN	DS	TITLE:– TRENCH DRAWING FOR 1C X 630 Sq. mm 66KV SINGLE CIRCUIT XLPE CABLE	BSES
CHECKED	SGD		
APPD.	D.GUHA		
DATE			REV. 00
SCALE			

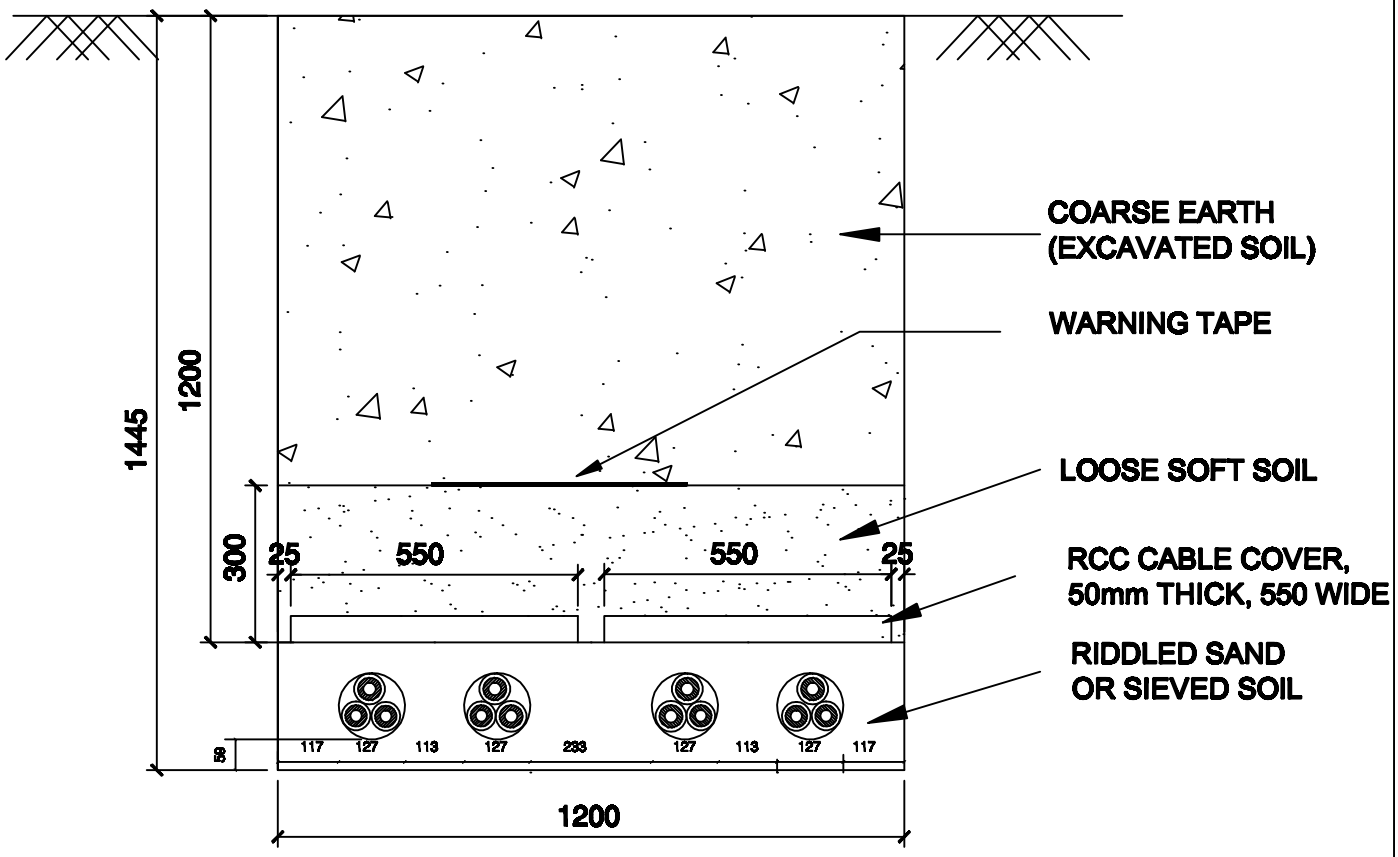
DRAWING # 2



TYPICAL DETAILS FOR 66KV BURRIED CABLE FOR TWO CIRCUIT
TYPE – C 2

DRAWN	DS	TITLE:– TRENCH DRAWING FOR 1C X 630 Sq. mm 66KV DOUBLE CIRCUIT XLPE CABLE	BSES
CHECKED	SGD		
APPD.	D.GUHA		
DATE			REV. 00
SCALE			

DRAWING # 2 A

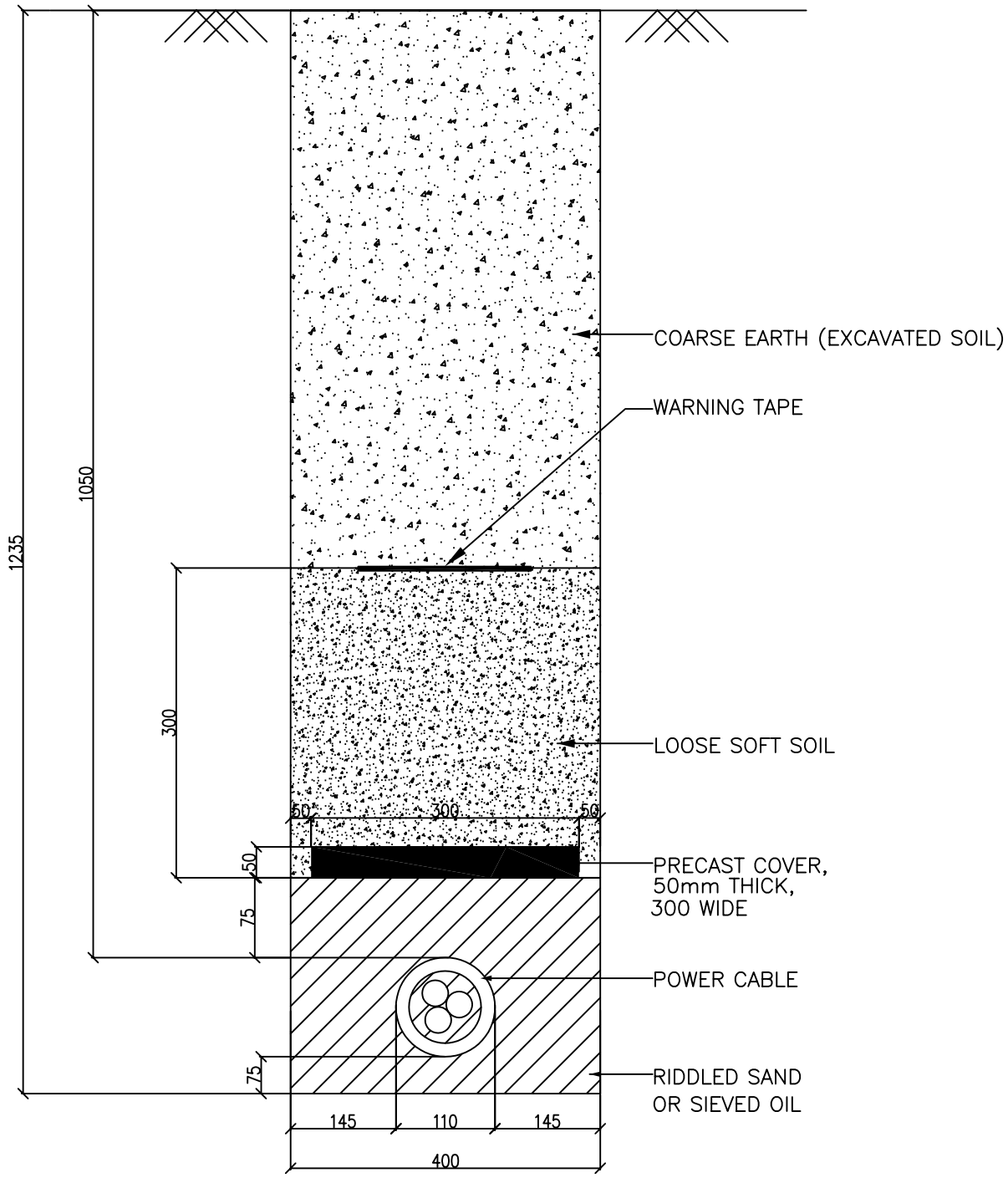


TYPICAL TRENCH SECTION DETAILS FOR 66KV SINGLE CORE 300 Sq. mm. BURRIED CABLE FOR DOUBLE CIRCUIT

TYPE - C 2

DRAWN	SAURABH	TITLE:–	BSES Rajdhani Power Limited
CHECKED	A.S	TYPICAL TRENCH SECTION DETAILS FOR 66KV SINGLE CORE 300 mm BURRIED CABLE FOR DOUBLE CIRCUIT	
APPD.	K.S		
DATE	09.01.15		REV. 00
SCALE			

DRAWING # 3

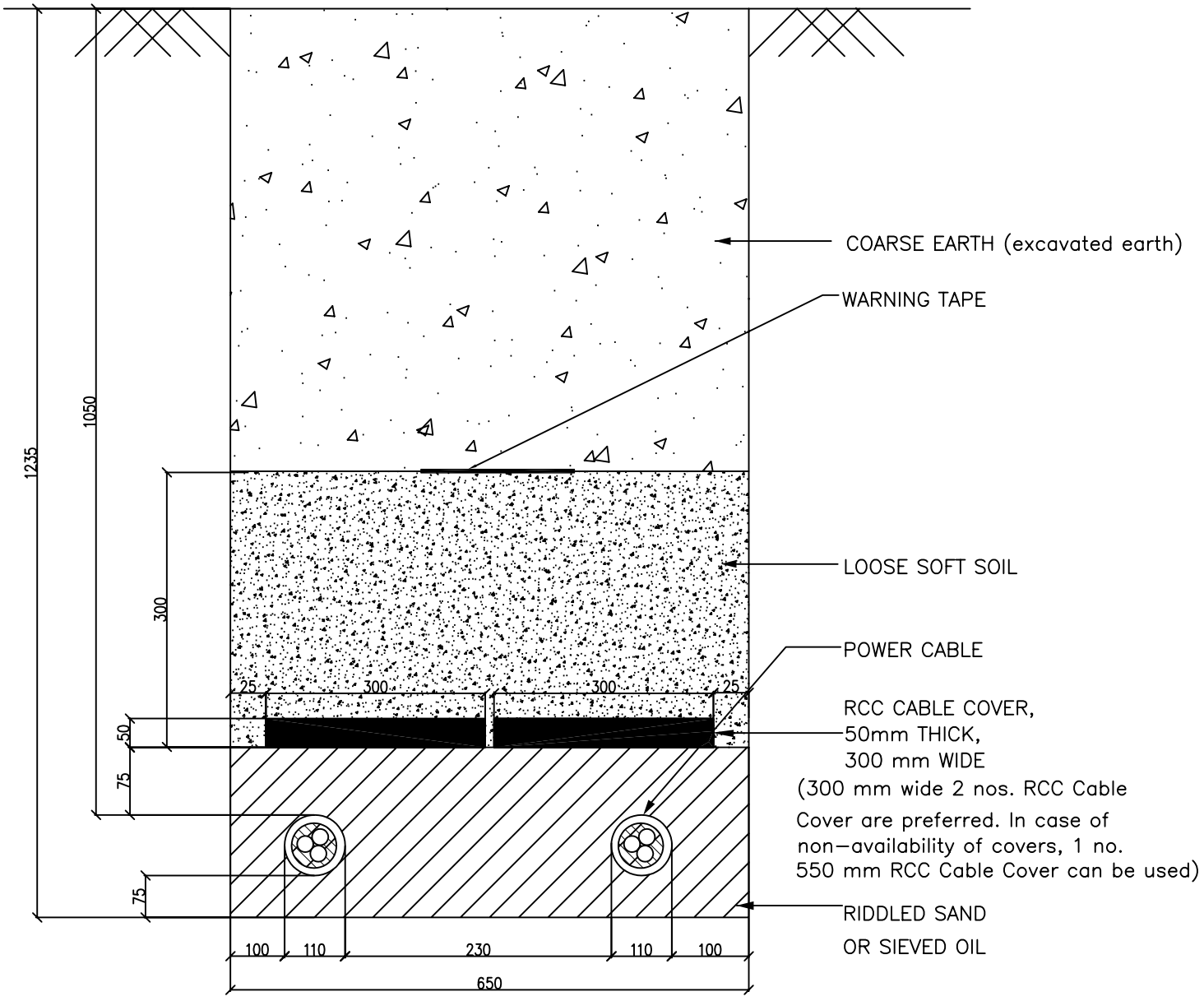


TYPICAL DETAILS FOR 33KV BURRIED CABLE FOR SINGLE CIRCUIT

TYPE – A 3

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	33KV 3CX 400 mm sq.	
DATE		SINGLE CIRCUIT	REV. 00
SCALE		XLPE CABLE	

DRAWING # 4

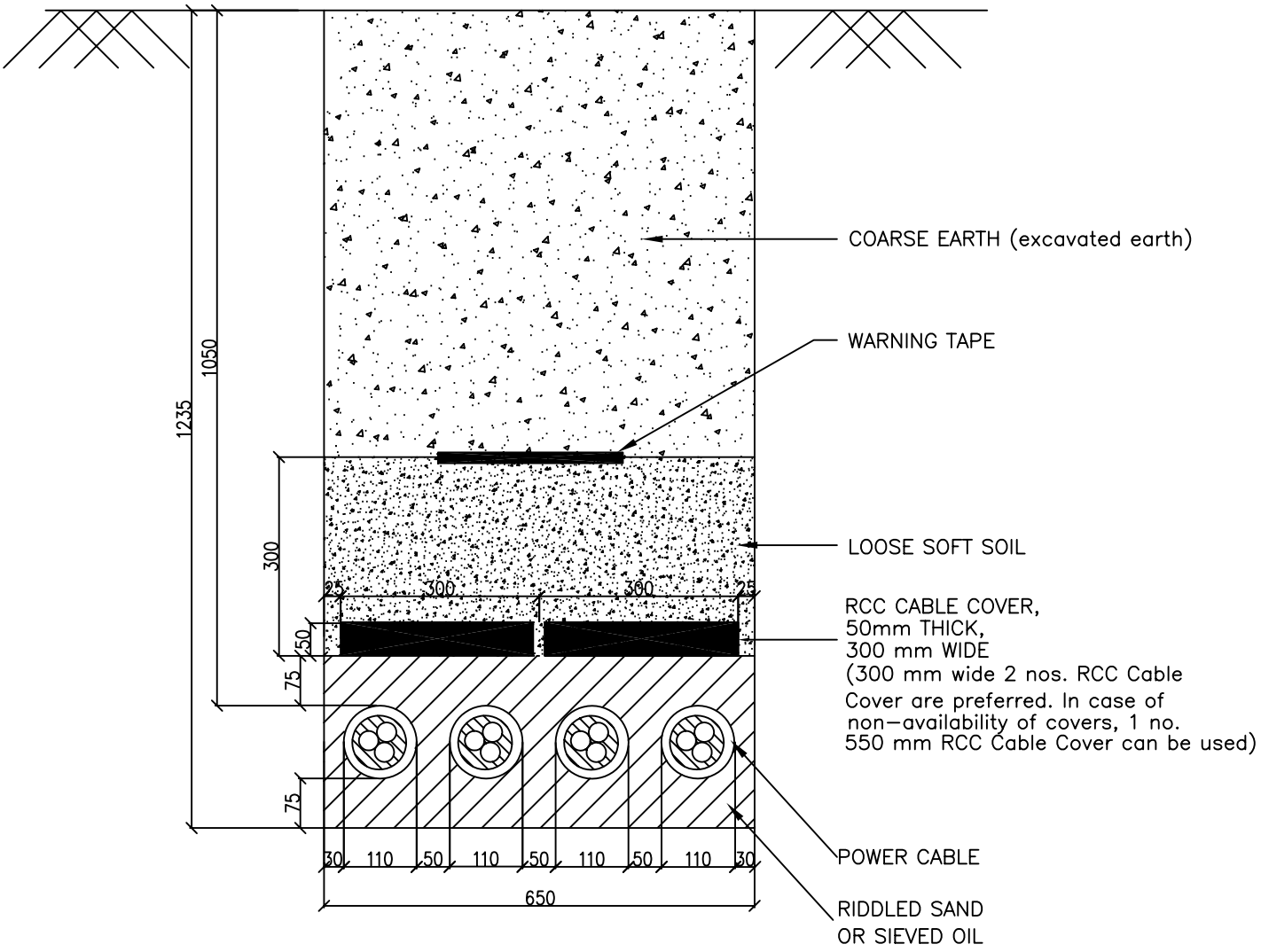


TYPICAL DETAILS FOR 33KV BURRIED CABLE FOR TWO CIRCUIT

TYPE – B–2

DRAWN	DS	TITLE:– TRENCH DRAWING FOR 3C X 400MM2, 33KV DOUBLE CIRCUIT XLPE CABLE	BSES
CHECKED	SGD		
APPD.	D.GUHA		
DATE			REV. 00
SCALE			

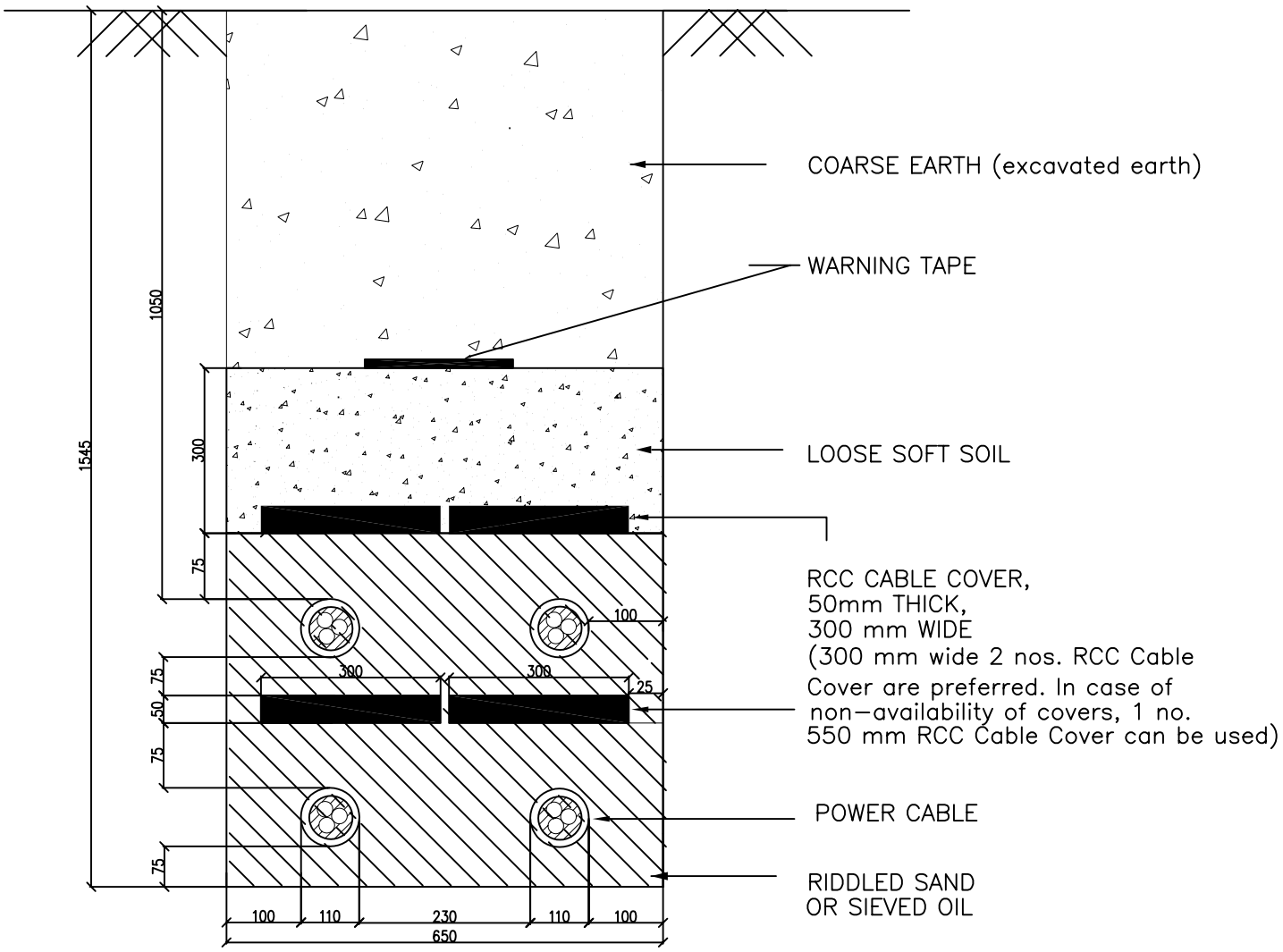
DRAWING # 5 A



TYPICAL DETAILS FOR 33KV BURRIED CABLE FOR FOUR CIRCUIT
TYPE – B 2

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	3C X 400MM2, 33KV	
DATE		FOUR CIRCUIT	REV. 00
SCALE		XLPE CABLE	

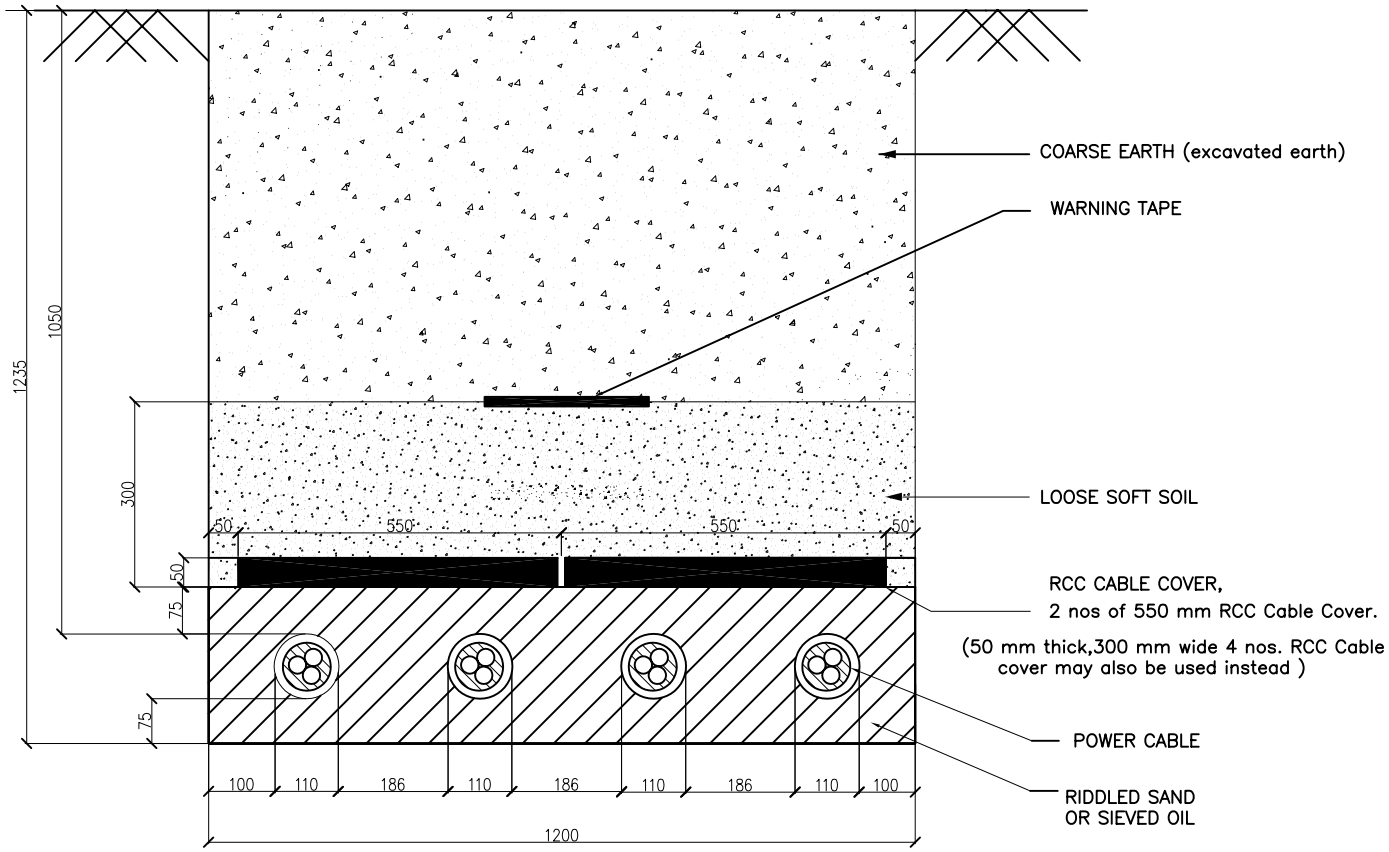
DRAWING # 5 B



TYPICAL DETAILS FOR 33KV BURRIED CABLE FOR FOUR CIRCUIT
TYPE – B 3

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	3C X 400MM2, 33KV	
DATE		FOUR CIRCUIT	REV. 00
SCALE		XLPE CABLE	

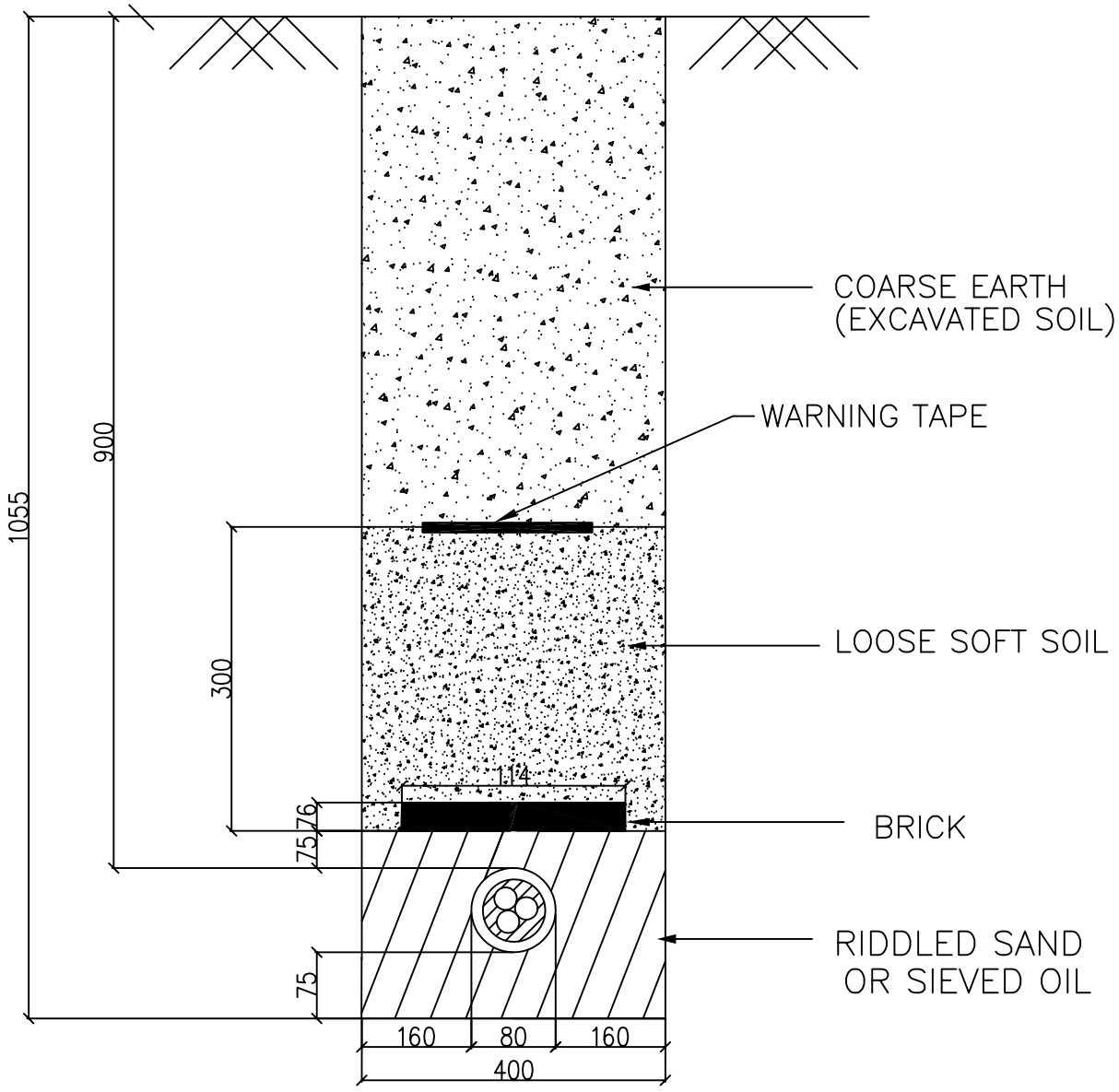
DRAWING # 5 C



TYPICAL DETAILS FOR 33KV BURRIED CABLE FOR FOUR CIRCUIT
TYPE – C 1

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	3C X 400MM2, 33KV	
DATE		FOUR CIRCUIT	REV. 00
SCALE		XLPE CABLE	

DRAWING # 6

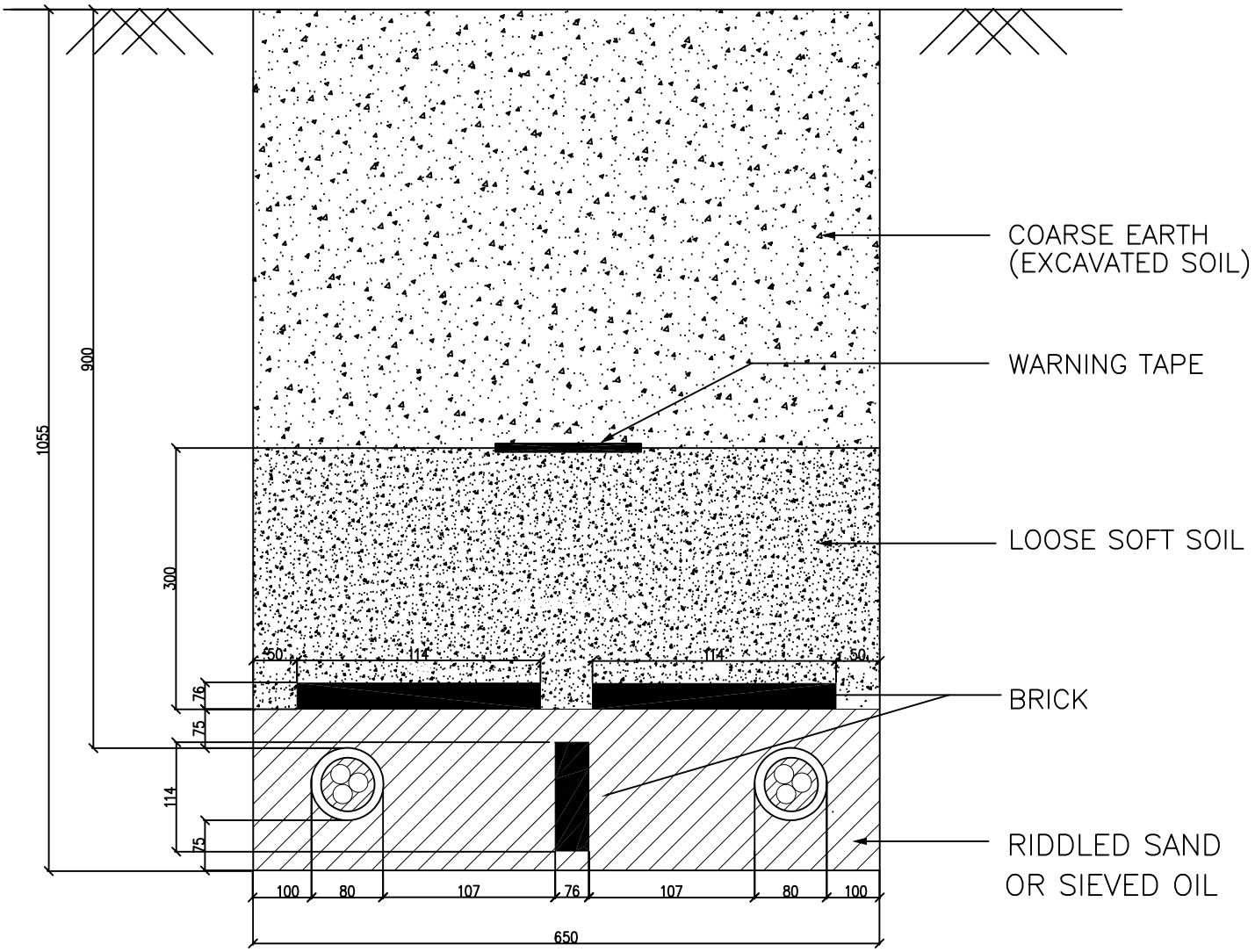


TYPICAL DETAILS FOR 11KV BURRIED CABLE FOR SINGLE CIRCUIT

TYPE – A 2

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	3C X 300 Sq. mm	
DATE		11KV SINGLE CIRCUIT	REV. 00
SCALE		XLPE CABLE	

DRAWING # 7

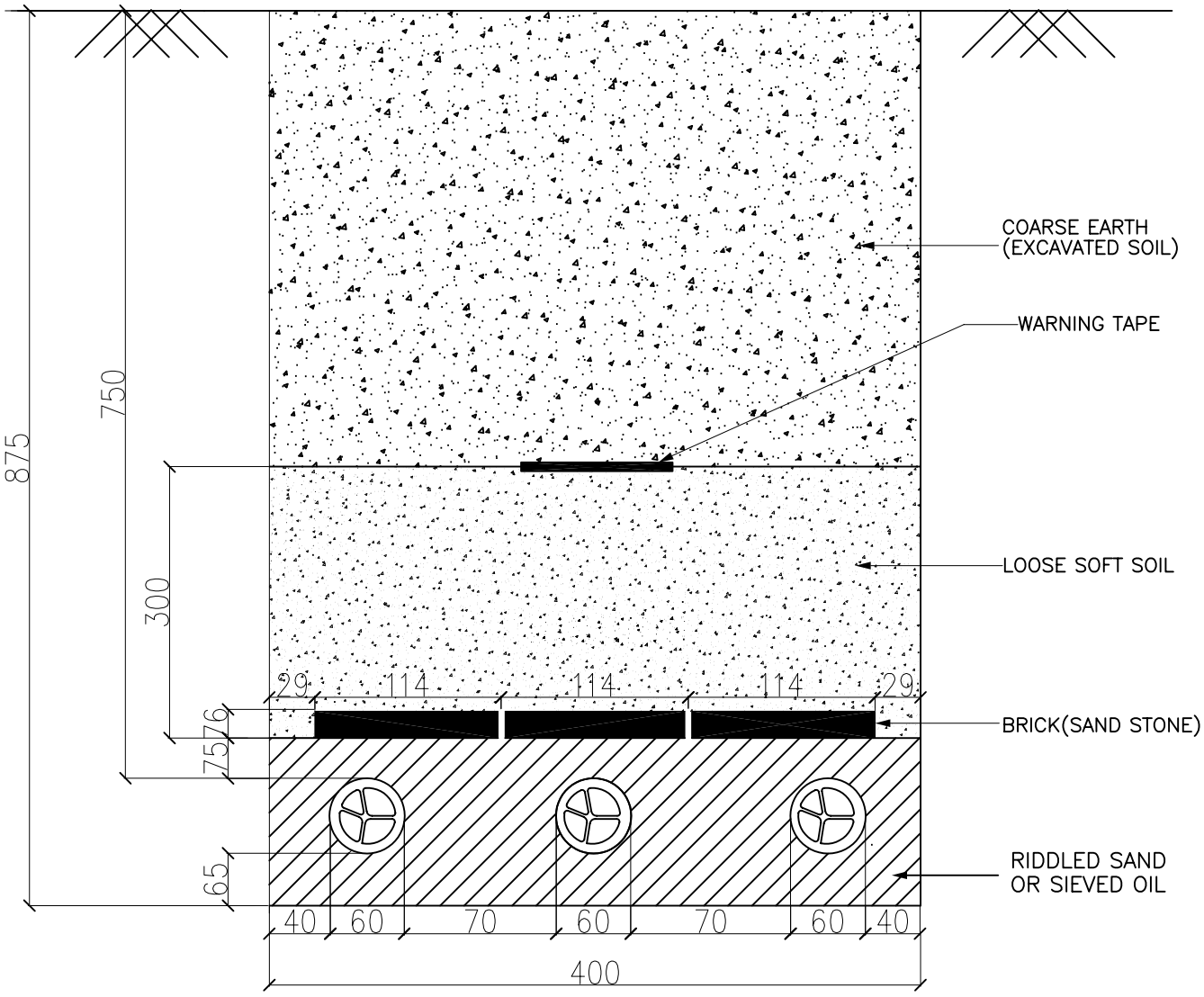


TYPICAL DETAILS FOR 11KV BURRIED CABLE FOR TWO CIRCUIT

TYPE – B 1

DRAWN	DS	TITLE:– TRENCH DRAWING FOR 3C X 300 mm Sq. or 3C X 150 mm sq II KV DOUBLE CIRCUIT XLPE CABLE	BSES
CHECKED	SGD		
APPD.	D.GUHA		
DATE			REV. 00
SCALE			

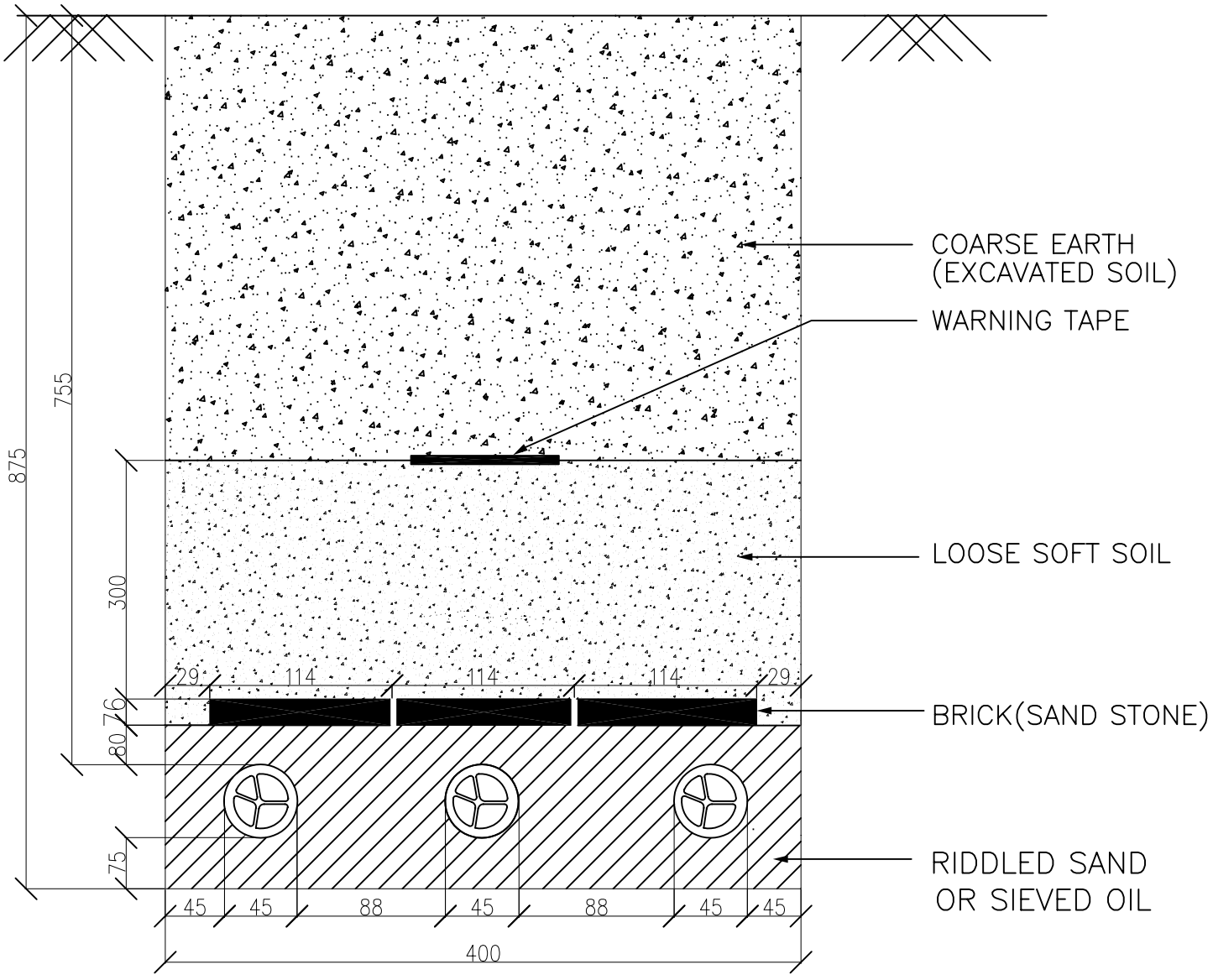
DRAWING # 8



TYPICAL DETAILS FOR 1.1KV BURRIED CABLE
TYPE – A 1

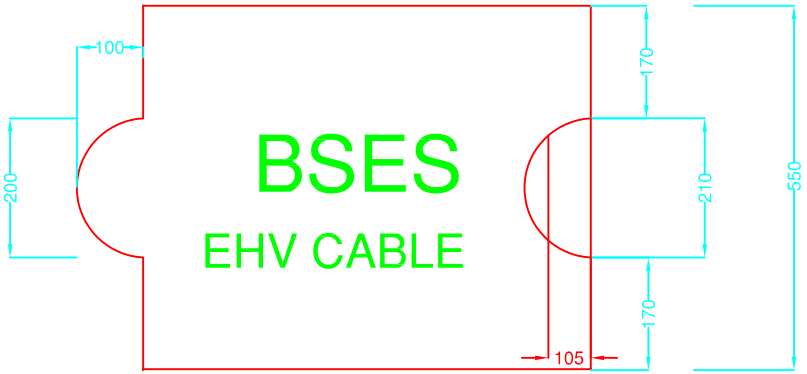
DRAWN	DS	TITLE:– TRENCH DRAWING FOR 3.5Cx300Sqmm 1.1 KV XLPE CABLE	BSES
CHECKED	SGD		
APPD.	D.GUHA		
DATE			REV. 00
SCALE			

DRAWING # 9



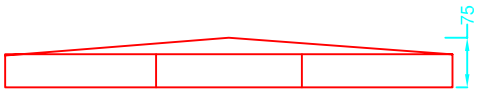
TYPICAL DETAILS FOR 1.1KV BURRIED CABLE
TYPE – A 1

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	3.5Cx150Sqmm 1.1 KV	
DATE		XLPE CABLE	REV. 00
SCALE			

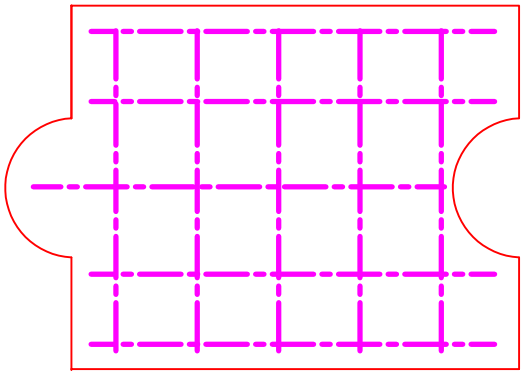


PLAN

ELEVATION



SIDE VIEW



NOTE -

(i) All dimensions are in MM.

(ii) Concrete Mix 1 : 2 : 4

(iii) MS rod - 6 MM Ø

CABLE COVER FOR EHV CABLES TYPE - A.

1. STEEL ROD - AS PER IS 432/1139

2. CONCRETE MIX SHALL BE NOT LESS THAN M200 GRADE AS PER IS 456.

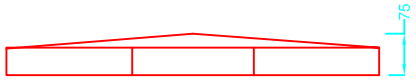
3. MOULDING SHALL BE WITH COMPACTION NOT LESS THAN 7 MN/Sq.m.(70 kgf/Sqcm)

DRAWN		TITLE:– CABLE COVER FOR EHV CABLE TYPE – A	BSES
CHECKED			
APPD.			
DATE			REV. 00
SCALE			

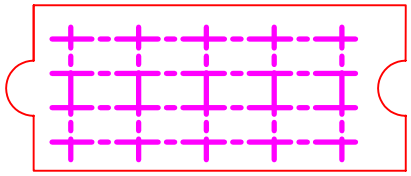
PLAN

1. STEEL ROD - AS PER IS 432/1139
2. CONCRETE MIX SHALL BE NOT LESS THAN M200 GRADE AS PER IS 456.
3. MOULDING SHALL BE WITH COMPACTION NOT LESS THAN 7 MN/Sq.m.(70 kgf/Sqcm)

ELEVATION



SIDE VIEW



NOTE -

(i) All dimensions are in MM.

(ii) Concrete Mix 1 : 2 : 4

(iii) MS rod - 6 MM Ø

CABLE COVER FOR EHV CABLES TYPE B.

DRAWN		TITLE:– CABLE COVER FOR EHV CABLES TYPE – B	BSES
CHECKED			
APPD.			
DATE			REV. 00
SCALE			

Annexure-7: Barricading and Safety

1. Dimensions of barricading- Height- 2 mtr, Length- 1.5 mtr. Refer drawing enclosed with tech spec for more details.
2. There shall not have any gap in between two barricades. Edge to edge shall be intact.
3. LED Bacon light shall be placed at 1st and 4th barricade and same shall be continue
4. Name, painting, colour, clean ness etc. shall be done on regular basis.
5. Vendor to ensure that traffic management shall not be excuse of work execution. The contactor shall not undertake loading and unloading at carriageways obstructing the free flow of vehicular traffic and encroachment of existing roads by the contactor applying the excuse of work execution.
6. Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the working area from the risk of accidents due to speedy vehicular movement. Same the way barricades protect the road users from the danger due to construction equipment and temporary structures.
7. The structure dimensions of the barricades , material and composition, its colour scheme, BSES logo and details shall be in accordance with specification and drawing laid down in the tender documents.
8. All the barricades shall be erected as per the design requirements of employer, numbered painted and maintained in good condition and also barricade in charge maintain a barricade register at site
9. All barricades shall be conspicuously seen in the dark/night time by the road users so that no vehicle hits the barricades. Conspicuity shall be ensured by affixing retro reflective strips of required size and shape at appropriate angle at bottom and middle portion of the barricades at a minimum gap of 1000 mm. In addition minimum one red light /red blinker and red beacon light should be placed at the top of each barricade.
10. No dust deposit at the front side of barricades.
11. Cable drum shall be returnable and vendor shall take it back (by bye back process) from site at their own risk and cost.
12. Once cable lying complete of a drum, within two days empty drum shall be removed from site by bye back process.
13. Trained traffic marshal with all PPE and traffic control light (Red and Green) shall be placed at site for 24x7.
14. No excuse of theft (beyond 6 hrs. of FIR) shall be acceptable.
15. During execution of job, any damage to other agency's properties shall be counted in vendor account and necessary action shall be taken by vendor to recover, repair etc.
16. Excess earth shall be removed from site after back filling. Site to be cleared to avoid flowing of dust. Barricades to be removed from site with in 24 hrs. after completion of job.
17. During non working hrs. vendor to ensure presence of supervisor for controlling any event from locals.
18. PPEs

    - Helmets

- Mask
- Jacket
- Shoes
- First Aid Box etc.

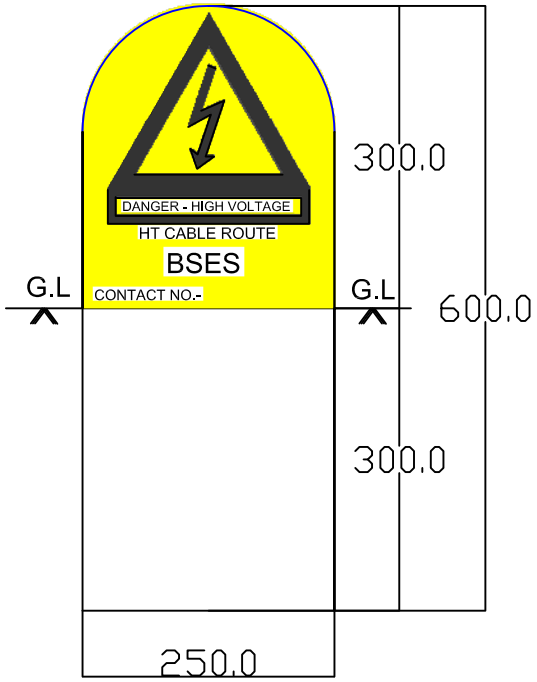
Shall be available at site 24x7. Zero tolerance on absence of PPEs to the working personnel. No excuse shall be acceptable in this regards.

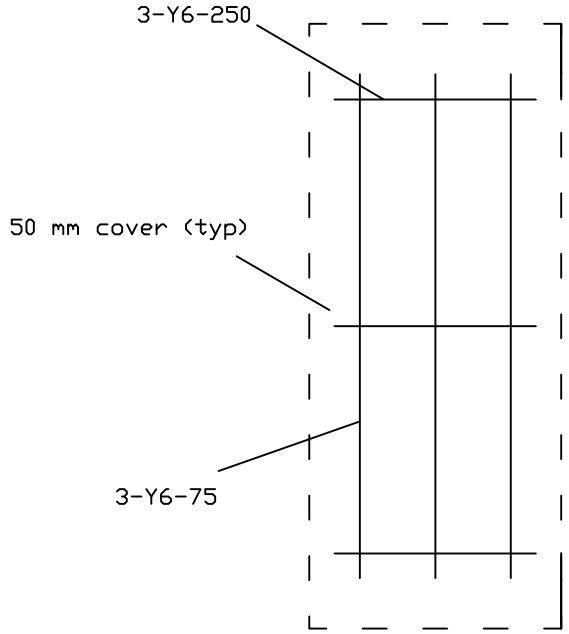
19. GPR/Scanning shall be done by vendor of whole the route and same shall be submitted to BRPL. This work shall be done by vendor before execution of job.
20. Jointing TAT- Jointing to start within 48 hrs. and shall be completed by 96 hrs.+1 day.
21. Lifting of cable drums with hydraulic machine, pulling of cable from top end of drum with pulling machine (hydraulic winch) is mandatory.
22. Violation on barricading guideline and safety norms, a fine of Rs.5000 /day shall be imposed. BRPL inspector/engineer in-charge shall be empowered to impose the above penalty.

Annexure # 8 – ROUTE MARKER AND BARRICADING DRAWING

Reinforcement Detail

DETAIL OF HT CABLE ROUTE MARKER (RCC) - BSES





Notes:-

1	RCC Cable route marker with 6 mm Dia. Road and M25 concrete grade.
2	The litter/number shall be engraved on both the side route marker.
3	All dimentions are in mm unless specified.
4	Thickness of RCC shall be 75mm.
5	Yellow colour shall be visible above ground level.
6	Each route marker to be placed at an internal 50 mtr. and at every turn of route.
7	All kind of paint on route marker shall be in the scope of manufacturer.

DRAWN	R.K.JANA
CHECKED	P.B
REVIEWED	M.B
APPO.	K.A
DATE	16.08.16

TITLE:-

DETAIL OF HT CABLE ROUTE MAKER (RCC).

BSES Rajdhani Power Ltd.

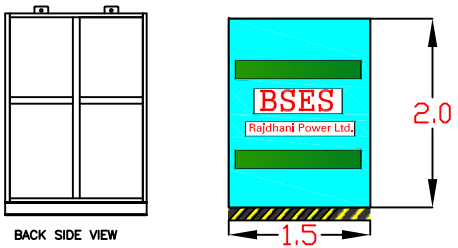
DWG. NO.

BSES-RM-RCC-01, R0

BARRICADING FOR CABLE LAYING WORK

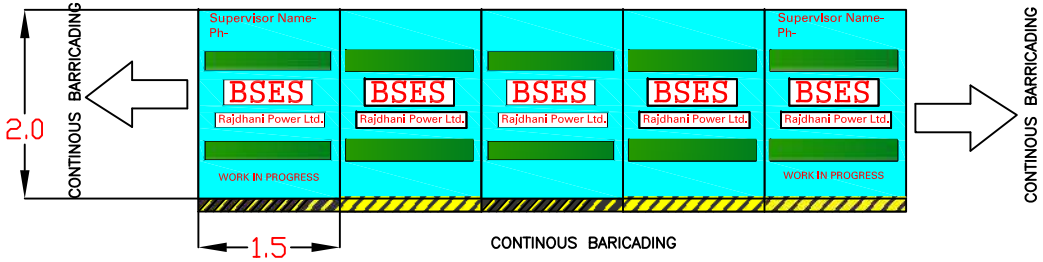
NOTE:

1. Barricading shall provided through out the route length as well as project location.
2. Plate shall be MS
3. Supervisour name, ph no, work in progress, shall be mentioned at every 1st and 4th plate of barricading through out the route.
4. Becon Light shall be provided through out the length.
5. Traffic marshal shall be Provided for traffic control by vendor.
6. Violation of safety norms and barricading shall be reviewed by BRPL and shall impose fine of Rs.5000/day as well as termination of work and short close of award.
7. After finishing of job vendor shall take return all the plate at their own risk and cost.
8. PPE's like Helmet, Mask, Jacket, safety boot etc. shall be provided vendor to all worker.



BACK SIDE VIEW

FRONT SIDE VIEW



CONTINOUS BARICADING

DRAWN	R.K.JANA	TITLE:– DRAWING–BARRICADING FOR CABLE LAYING WORK	BSES Rajdhani Power Limited
CHECKED	P.B.		
REVIEWED	A.S.		
APPD.	V.P.		
DATE	29.06.17		

Annexure#9-Note for HDPE Pipe Diameter in Cable Laying

1) Primarily our intent for laying cable will be through open trench only.
2) Trench dimensions shall be as per the standards which mentioned as below table

Sl. no.	Cable	Trench Details (mm)		
		Depth (single and double run)	Width (Single Run)	Width (Double Run)
1	LT Cable	875	400	400
2	11 kv	1055	400	650
3	33 kv	1235	400	650
4	66 Kv	1445	650	1200

3) QC team will do stage inspection after completion of digging to validate the depth of trench and will give approval for issuing of cable.
4) Execution in charge to ensure the cable laying work.
5) QC team will also inspection the laying work to validate the laying as per standards before back filling.
6) In case of site constraints, trench less cable laying shall be allowed as per the followings-
   a) Cable laying up to 50 mtr through trenchless will be allowed with approval of circle head (O&M) for road crossing or site constraints. Site photos of constraints shall be reviewed before approval by circle head.
   b) Absence of permission for digging- written disapproval by road owing agency and appropriate approval by circle head (for O&M Jobs), by O&M head (for 11kV, P&C job) and by EHV head (for EHV Jobs)
   c) The size of HDPE (PN6, PE80) pipe shall be as per the guidelines of IS-1255, 1983, clause no-6.3.4.3. Details mentioned below in below table-

Sl. No	Cable	Recommended Dia of HDPE pipe (mm)
1	66kV, 3CX300	225
2	66kV, 1CX630	180
3	66kV, 1CX1000	180
4	33kV, 3CX400	180
5	11kV, 3CX300	160
6	11kV, 3CX150	160

d) In-case of using lower size of HDPE pipe due to site conditions, the deviation for using lower HDPE pipe from above table, written approval must be taken through technical committee. Photos of the challenges while apparently the same will be reviewed by technical committee.

(However, HDPE pipe size with less than 1.5XOD of cable shall not be allowed at any stage)

Technical Specification for

Feeder Pillar Panel

(Distribution panel without ACB)

Specification no – GN101-03-SP-18-01

Prepared / Reviewed by	Approved by:	Rev	Date
Hemanshi Kaul	Devender Sharma	R1	January 12,2010

Index

1. Scope of supply

This shall include Design, manufacture, testing at manufacturers works before dispatch, packing, delivery of material to BSES Stores and submission of documents to purchaser.

2. Codes & Standards

The equipment shall confirm to this specification and latest revision of following codes with all amendments:-

	Title	Indian Standard
2.1	IS 5039	Specification for distribution pillars below 1000v AC
2.2	IS 13947 part 2	Low Voltage switchgear
2.3	IS 8623	Specification for low voltage switchgear
2.4	IS 12063	Classification of degrees of protection provided by enclosures of electrical equipment
2.5	IS 13703	Low voltage HRC fuses
2.6	IS 5	Color of ready mixed paints
2.7	IS 191	Specification for copper
2.8	IS 5082	Wrought Aluminum & Al alloy plates & sheets for electrical applications

3. Service Conditions

The feeder pillar panel shall be designed to work satisfactorily under following service conditions:-

	Title	Indian Standard
3.1	Supply Voltage	3 phase neutral, AC 433Volt +/-10%
3.2	Supply Frequency	50 Hz +/- 5%
3.3	Location of panel	Outdoor, on foot path or roadside
3.4	Pollution	Heavily Polluted and Dry
3.5	Humidity	90% maximum
3.6	Ambient Temperature	Average 40 Deg C, Maximum 50 Deg C
3.7	Incoming supply to feeder pillar panel	From distribution transformer or Main feeder pillar panel
3.8	Seismic Zone	4

4. Feeder Pillar Configuration

The feeder pillar panel shall have following configuration:-

4.0	Feeder Pillar Type	Incoming feeder (Circuit ways) & Cable size	Outgoing feeder (Circuit ways) & Cable size
4.1	A-1 , 8-Way	2 X 400A TP fuse / cable size 4CX300Sqmm	6 X 250A TP fuse / cable size 4CX150Sqmm
4.2	B-1, 5-Way	1 X 400A TP fuse / cable size 4CX300Sqmm	4 X 250A TP fuse / cable size 4CX150Sqmm
4.3	C-1, 7-Way	1 X 250A TP fuse / cable size 4CX150Sqmm	5 X 100A TP fuse 1 X 250A TP fuse / cable size 4CX95Sqmm

5. Panel Construction

The feeder pillar panel construction shall confirm to following features:-

5.0	Panel Construction	Free Standing floor mounted with steel frame,
	Welded Construction	Continuous welding from inside, Spot welding not acceptable.
5.1	Ingress Protection class for enclosure	IP 55 as per IS 12063
5.2	Material	Galvanized sheet Steel CRCA
5.3	Sheet Steel Thickness	3mm - Support frames 2mm Galv. - Covers, Doors & Canopy
5.4	Base frame for 8 Way & 7 way panel	3mm MS Channel 50mm height painted in Black Color
5.5	Bottom holes on four Sides	Oval Shape, for grouting bolts
5.6	Pedestal for 5 way	Of height 400mm with side covers of FRP or Galvanized MS painted in black
5.7	Cable entry	From Bottom only
5.8	Lifting Lug	2 nos lug welded on top
5.9	Canopy on top	With minimum 10 Deg C slope extended 50mm outside panel front and rear

5.10	Door type for front & rear access	Centre Opening double leaf with insulating rubber grip handle
5.11	Double leaf doors	Right hand side leaf can be opened only after left hand side leaf
5.12	Door Hinges	Minimum three anti theft type hinges
		MS screw -3mm dia & 8mm length
		Tight fit brass tube – 100mm ID, 12.7mm OD & 20mm length
5.13	Door Opening angle	Min 120 Deg
5.14	Padlocking facility	For Front and Rear door by total 4 nos L- drop arrangement. 2 nos front door and 2 nos rear door.
5.15	Locking facility on door	By L- drop type arrangement
5.16	Tower bolts at top and bottom of door	On left hand side door
5.17	External hardware	Galvanized steel nut and bolts
5.18	Phase & Neutral bus as per IS 5082	Aluminum grade 19501 (H2)
5.19	Bus bar color coding for R, Y , B and Neutral	Heat shrinkable tape of color Red , Yellow , Blue & Black respectively.
5.20	Bus Bar size in mm	Phase Neutral
5.20.1	8 - Way	50X10 mm 50X10 mm
5.20.2	5 - Way	50X6 mm 50X6 mm
5.20.3	7 - Way	50X6mm 50X6 mm
5.21	Bus for 8 – Way	Bolted type removable link to be provided at middle of all the phases and neutral bus bar to adapt two incomers from separate source.
5.22	Earth Bus at panel bottom	25X6mm Aluminum
5.23	Bus bar arrangement	Horizontal, with R phase bus at top
5.24	Neutral bus bar	With holes for connection incoming and outgoing cables up to 300Sqmm
5.25	Bus Bar support insulators	SMC / DMC, 1100v Grade
5.26	Bus Bar phase barriers	FRP / Acrylic insulating sheet

5.27	Cable size Incoming for 8 way panel	4CX300Sqmm cable		
5.28	Incoming for 5 & 7-Way panel	4CX300Sqmm cable for 5 Way & 4CX150Sqmm cable for 7 Way panel		
5.29	Outgoing for 8 way panel	4CX150Sqmm cable		
5.30	Outgoing for 5 & 7-Way panel	4CX150Sqmm cable for 5 Way & 4CX95Sqmm cable for 7 Way panel		
5.31	Terminals for cables	Al grade 19501 (H2) as per IS 5082, with galvanized steel nut bolts size M10 & two plane washers + spring washers & spacers M16 size nut bolt for incomer of 8 way panel		
5.32	Terminal shape	‘ z ‘ Strips , 2nos per terminal		
5.33	Z Strip dimensions supported on insulators	8 way panel incomer	50 X 10 mm	
		5 & 7 way panel incomer	50X6 mm	
		All outgoing feeders	40X6mm	
5.34	Ease of taking current reading with open clamp type ammeter	Possible with Z Strip terminal		
5.35	Gland plate at panel bottom	Galvanized MS, 3mm thick for multi core cable		
5.36	Cable supports	Non ferrous clamps at bottom		
5.37	Cable termination clearance from gland plate	300mm minimum		
5.38	Earth studs on both side of panel bottom	With M10 galvanized steel nut bolts		
5.39	Flexible earth connection to doors	Flexible PVC Cu wire 2.5Sqmm green color		
5.40	Panel maximum dimensions in mm	Width	Depth	Height
	8 - Way	1225	650	1650
	5 - Way	900	550	1850
	7- Way	1050	650	1650
5.41	Holder for lamp for 8 way panel	230v Incandescent lamp controlled through 2amp SPMCB		
5.42	Small power socket for 8 way panel	5/15 amp 3pin socket controlled through 16amp SPMCB		

6. Fuse Base

The equipment shall have all the following features –

6.1	Fuse base connection to main bus bar	By bus bar and not by flexible jumpers
6.2	Size	2as per IS 13703 for 400A
6.3	Current rating of fuse base at maximum ambient temperature 50Deg C	8 way & 5 way 400A, 7 way – 250A
6.4	Fuse base current carrying part	Plated copper as per IS191
6.5	Fuse base insulating material	DMC / Porcelain
6.6	Make	For DMC - GE, Siemens, L& T, ABB For porcelain – Sample to be approved by BSES.
6.7	Fuse base mounting screws	With insulating caps
6.8	FRP Barriers for open live parts	1.6mm thick white colored sheet
6.9	HRC fuse pullers – 1 no / Type of fuse	Suitable for 400A, 250A & 100A HRC fuse

7. Operational requirements

7.1	Clearance between phase to phase and phase to earth	Minimum 25mm
7.2	Continuous rated operating voltage	433 volt +/- 10 %
7.3	Power frequency high voltage withstand capacity for one minute	2000Volt
7.4	Insulation resistance value for phase and neutral bus bar	Minimum 100MOhm with 500V Megger
7.5	Temperature rise above ambient 45 Deg C	As per IS 13947_1

8. Name Pate and Finish

8.1	Name plate	On front door top left side showing
		1) Purchase name and PO number
		2) Manufacturer name
		3) Month & year of manufacturing
		4) No of ways
		5) Property of BSES
8.2	Labels for incoming and outgoing feeders	Sticker type labels inside panel door
8.3	SLD	SLD to be screen printed inside the front door.

8.4	Marking for panel earth stud	Green letter 'E', on riveted AL label
8.5	Danger board in English and local language, riveted on doors	Red color background with black lettering on 1.6mm thick Al plate
8.6	Surface preparation for painting	Sand blasting or 7 tank process
8.7	Painting	Powder coated grade A polyester paint with min thickness 60 microns
8.8	Paint shade	Shade – 538 as per IS:5 – Post office red
8.9	Fluorescent strip painting on panel	50mm wide horizontal strip of fluorescent paint around panel in the middle of panel

9. Compacted feeder pillars.

9.1	Door type for front access	Centre Opening double leaf with insulating rubber grip handle only front side.
9.2	Rear side	No door at read side. Panel to be access only from front.
9.3	All other constructions shall be as per above mentioned construction	
9.4	Use of compacted feeder pillars	Where sufficient space at rear side is not available due to space constraints at site.

10. Testing and Inspection

The equipment shall have all the following features –

10.1	Type test	Only type tested components – fuse base, insulators and aluminum bus bar shall be accepted
		Test reports as per relevant IS to be submitted by vendor
10.2	Test report validity	*Valid for last 5 years*
10.3	Acceptance and routine test (Inspection test witness by purchaser)	1) Visual inspection, dimension checks and paint thickness check.
		2) Bill of material check
		3) Wiring checks.
		4) Insulation resistance test for main and auxiliary circuit
		5) High voltage test on main and auxiliary circuit
		6) Operational check
10.4	Tolerances on panel dimensions	Maximum +/- 5mm

10.2.9	No negative tolerance on bus bar dimensions and bus bar clearances
10.2.10	Prototype panel to be approved by BSES

11. Packing and Delivery

11.1	Packing protection	Against Shocks, vibration and corrosion
11.2	Packing identification labels	To show purchaser name, PO number, Manufacturer serial number
11. 3	Handling instruction	To be marked on packing boxes

12. Deviation

Deviation to specification to be submitted in writing by vendor. Bidder to submit copy of specification and GTP along with company seal and signature on each page.

List of Annexure

Annexure A – Guaranteed Technical Particular

Annexure B – General arrangement drawing for 8 Way Panel

Annexure C – General arrangement drawing for 5 Way Panel

Annexure D – General arrangement drawing for 7 Way Panel

Annexure E – General arrangement drawing for compacted type 8 Way Panel

ANNEXURE A Guaranteed Technical Particulars

Bidder to submit hard copy duly filled and signed along with techno commercial offer.
Bidder to submit separate GTP for each type of feeder pillar panel

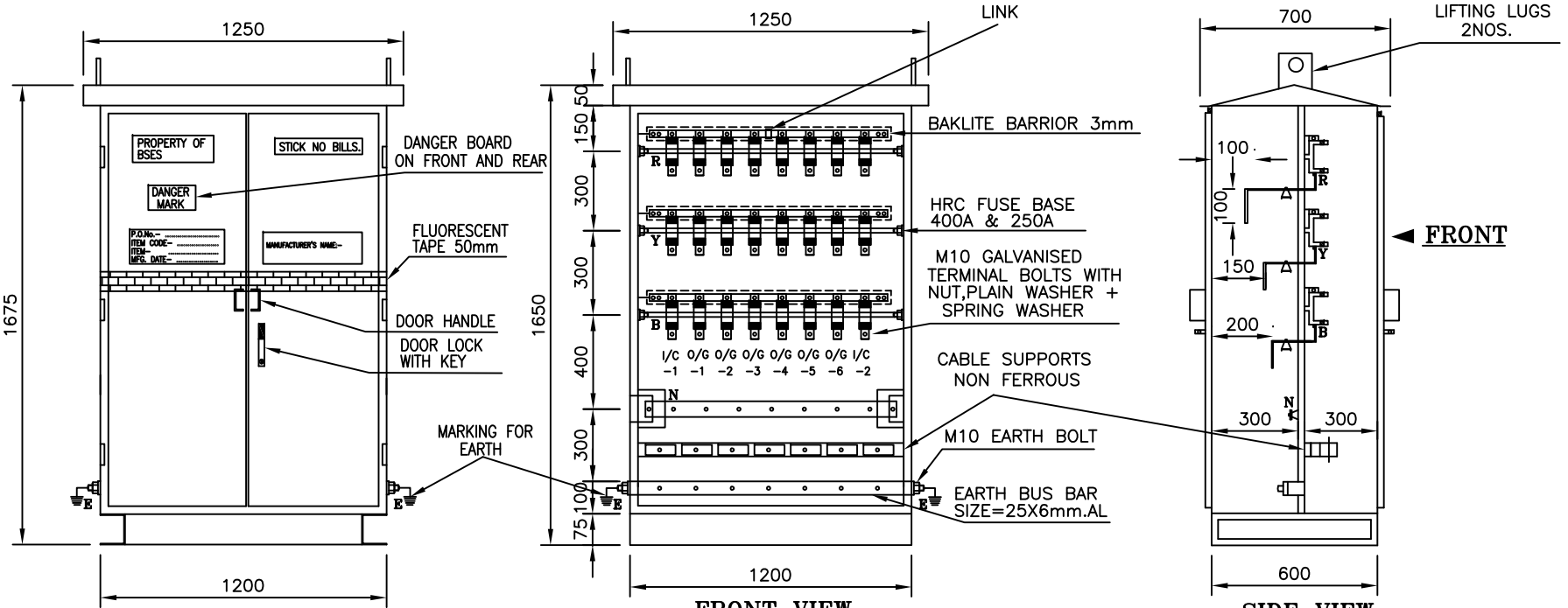
S. No	Particulars	BRPL / BYPL Requirement	Vendor Data
1	Manufacturer	Name	
		Address	
		Contact no.	
2	Type of Panel Offered	8-way , 5-Way & 7-Way	
3	Main bus bar rating	As per clause 4.1 to 4.3	
4	No. of Incoming feeders	Quantity	
		Rating in amp	
		HRC fuse type / make	
5	No. of Outgoing feeders	Quantity	
		Rating in amp	
		HRC fuse type / make	
6	Panel construction	Galvanized CRCA sheet steel	
7	Panel enclosure class	MinIP55- ingress protection	
8	Galvanized sheet steel thickness	2MM min. for cover, doors & canopy	
9	Base frame for 8 way & 7 way only	3mm MS channel 50mm height painted in black color	

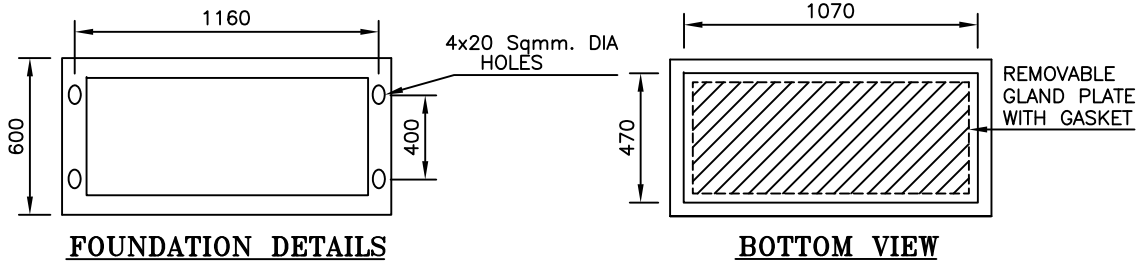
10	Pedestal for 5 Way	Of height 400mm with side covers of FRP or Galv. MS painted in black.	
11	Door type for front & rear access	Centre opening double leaf with insulating rubber grip handle	
12	Door Hinges	Minimum three anti theft type hinges	
13	Padlocking facility	Provided	
14	L- drop type locking arrangement at door	2 nos of each front and rear door	
15	External steel hardware	Galvanized nut & bolts	
16	Phase & neutral bus bar	Aluminum grade 19501 (H2) as per IS5082	
17	Bus bar color coding for R, Y , B & neural.	Heat shrinkable tape of Red, Yellow, Blue & Black color	
18	Bus bar size in mm		
	8 Way	Phase= 50X10MM Neutral= 50X10MM	
	7 Way	Phase= 50X6MM Neutral= 50X6MM	
	5 Way	Phase= 50X6MM Neutral= 50X6MM	
18	Earth bus size	25x6mm Aluminum	
19	Main bus bar short circuit withstand capacity	……In KA for 1sec	
20	Main bus bar maximum temperature rise	above ambient of 45 deg C	
21	Bus bar support insulators	SMC / DMC, 1100V grade	
22	Terminals suitable for cables size	Al grade 19501 (H2) as per IS 5082, with galvanized steel nut bolts size M16 & two plane washers + spring washers & spacers	

23	Incoming cable for 8 & 5 way panel	4CX300Sqmm	
24	Incoming cable for 7 way panel	4CX150Sqmm	
25	Outgoing cable for 8 & 5 way panel	4CX150Sqmm	
24	Outgoing cable for for 7 way panel	4CX95Sqmm	
25	Terminal shape	Z' strips supported on insulator, 2per terminal	
26	Z Strips dimensions	8 way panel 50x10mm	
		7 & 5 way panel 40x6mm	
27	Gland plate at panel bottom	Galv. MS 3mm thick for multi core cable	
28	Cable termination clearance	300mm minimum from gland plate	
29	Earth studs on both side of panel bottom	With M10 galvanized steel nut bolts	
30	Panel maximum dimensions in mm		
	8 - Way	Width - 1225, Depth - 650, Height - 1650	
	7- Way	Width - 1050, Depth - 650, Height - 1650	
	5- Way	Width - 900, Depth - 550, Height - 1850	
31	Holder for 230V Incandescent Lamp	Controlled through 2amp SPMCB	
32	5/15 amp 3pin socket power socket	Controlled through 16amp SPMCB	
33	Fuse base size as per IS13703	Size 1 for 250A	
		Size 2 for 400A	
34	Current rating of fuse base at max. ambient temperature 48deg C Fuse base current carrying part	8 & 5 -WAY - 400A 7- way - 250A	
35	Fuse base current carrying part	Plated copper as per IS 191	

36	Fuse base material	DMC/ Porcelain	
37	Make	For DMC - GE, Siemens, L&T or ABB For Porcelain - ----------	
38	HRC fuse pullers - 1no/ Type of HRC Fuse	Suitable for 400A, 250A and 100A HRC fuse & link	
39	Clearance between live parts minimum 25mm	Phase- phase &	
		Phase -earth	
40	Continuous rated operating voltage	433volt +/- 10%	
41	High voltage withstand capacity	2000V at 50Hz for 1 min.	
42	Insulation resistance Ph- Ph & Ph-earth	Minimum 100Mohm with 500v Meggar	
43	Labels & name plates	As per specification	
44	Surface preparation for painting	Sand blasting or 7 tank process	
45	Painting	Power coated grade A polyester paint min. thickness 50 microns	
46	Shade - Post office red	Shade - 538 as per IS:5	
47	Fluorescent paint strip on panel	50mm wide painted in the middle of panel	
48	Foundation Bolts	Required	

ANNEXURE B:- GENERAL ARRANGEMENT DRAWING FOR 8 WAY PILLAR

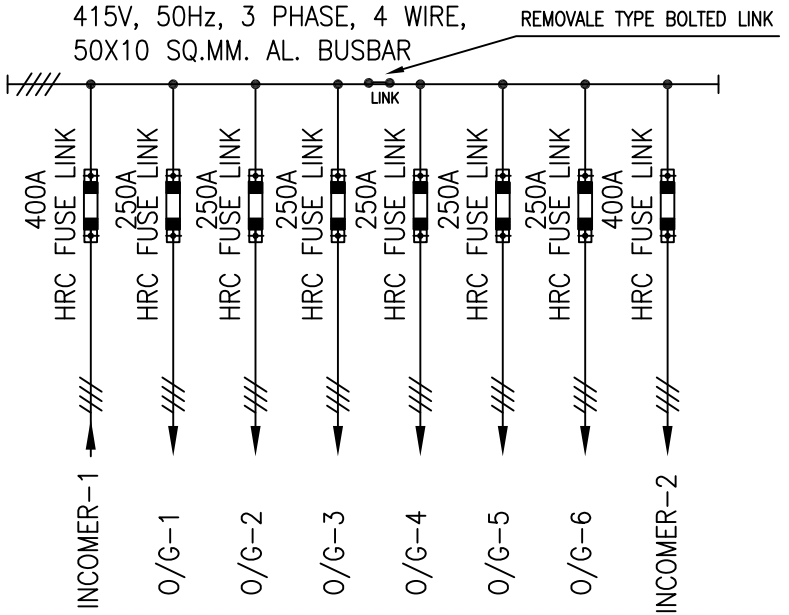




	BSES	TITLE: FEEDER PILLAR TYPE A-1 GENERAL ARRANGEMENT DRAWING			
		DRAWING No.	REVISION	1	2	3
			DATED			
			SHEET No.	1 OF 3		

GENERAL NOTES:–

1. ALL DIMENSIONS ARE IN MM & SUBJECT TO NORMAL MANUFACTURING TOLERANCES ±5.
2. ALL OTHER SPECIFICATION SHALL BE AS PER APPROVED G.T.P.& DRWs.
3. DANGER INSTRUCTION SHALL BE SCREEN PRINTED ON FRONT AND REAR SIDE IN ENGLISH,HINDI AND LOCAL LANGAUGES.
4. 3mm. BAKLITE SHEET PROVIDED AS BUS BAR BARRIER.
5. GALV. SHEET SHALL BE 2mm COVER DOOR & CAPOPY.
6. FRONT & REAR DOOR SHALL BE HINGED WITH 1 No. DOOR LOCK & 2Nos. TOWER BOLTS.
7. ALL MARKING ON DOOR ARE WITH BORDER.
8. NON–REMOVABLE COVER SHALL BE PROPERLY GASKETED WITH 3mm. THICK NEOPRENE/EPDM GASKET.
9. 50mm WIDE FLUORESCENT TAPE SHALL BE ON FOUR SIDES AT MIDDLE OF THE PANEL.
10. POWDER COATING THICKNESS SHALL BE 50–MICRONS AND SHADE–538,AS PER IS–5 (POSTOFFICE RED)
11. LABELS PROVIDED FOR INCOMER AND OUTGOING FEEDERS.
12. TOTAL FOUR NOS L– DROP TYPE LOCK TO BE PROVIDED AT FRONT & REAR DOORS.
13. CONTINUOUS WELDING TO BE DONE ON ALL THE JOINTS.



BSES

TITLE: **FEEDER PILLAR TYPE A-1**
GENERAL NOTES,
SINGLE LINE DIAGRAM

DRAWING No.	REVISION	1	2	3
	DATED			
	SHEET No.	2 OF 3		

PROPERTY OF BSES

P.O.No.- .....

ITEM CODE- .....

ITEM- FEEDER PILLAR TYPE A-1(8WAY)

MFG. Month & Year ../....

SR.NO. .....

MANUFACTURED BY:-

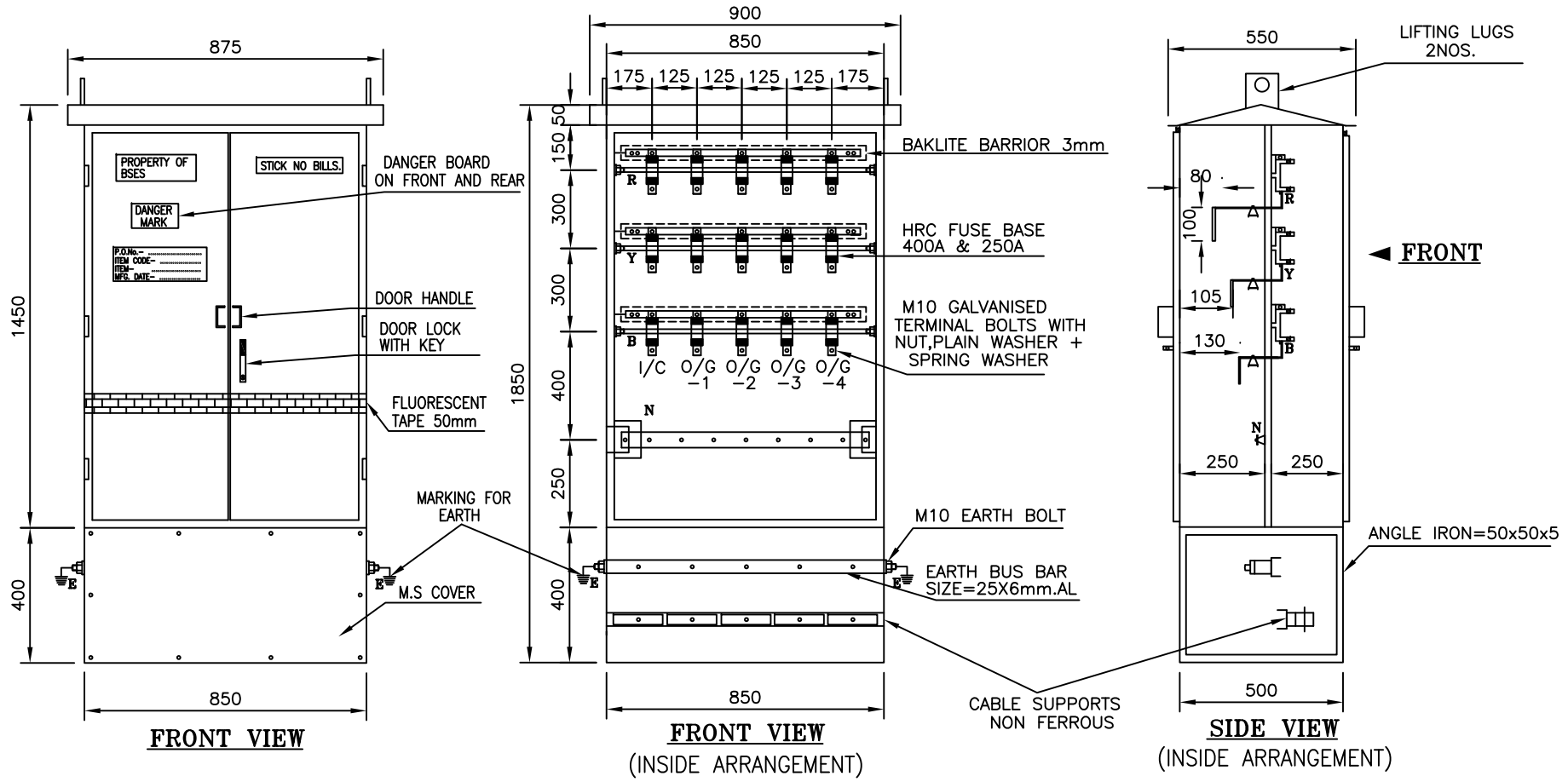
DETAILS OF NAME PLATES

BSES

TITLE: **FEEDER PILLAR TYPE A-1**
DETAILS OF NAME PLATES

REVISION	1	2	3
DATED			
SHEET No.	3 OF 3		

ANNEXURE C:- GENERAL ARRANEMENT DRAWING FOR 5 WAY PILLAR



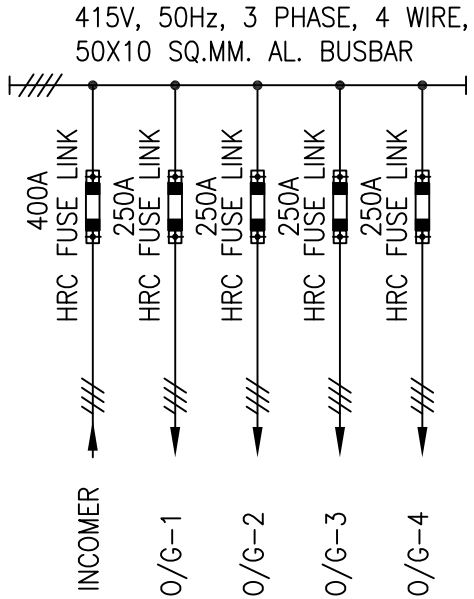
BSES

TITLE: **FEEDER PILLAR TYPE B-1**
GENERAL ARRANGEMENT DRAWING

REVISION	1	2	3
DATED			
SHEET No.	1 OF 3		

GENERAL NOTES:–

1. ALL DIMENSIONS ARE IN MM & SUBJECT TO NORMAL MANUFACTURING TOLERANCES.
2. ALL OTHER SPECIFICATION SHALL BE AS PER APPROVED G.T.P.& DRWs.
3. DANGER INSTRUCTION SHALL BE SCREEN PRINTED ON FRONT AND REAR SIDE IN ENGLISH AND LOCAL LANGAUGES.
4. 3mm. BAKLITE SHEET PROVIDED AS BUS BAR BARRIER.
5. GALV. SHEET SHALL BE 2mm COVER, DOOR & CANOPY.
6. FRONT & REAR DOOR SHALL BE HINGED WITH 1 No. DOOR LOCK & 2Nos. TOWER BOLTS.
7. ALL MARKING ON DOOR ARE WITH BORDER.
8. NON–REMOVABLE COVER SHALL BE PROPERLY GASKETED WITH 3mm. THICK NEOPRENE/EPDM GASKET.
9. 50mm WIDE FLUORESCENT TAPE SHALL BE ON FOUR SIDES.
10. POWDER COATING THICKNESS SHALL BE 50–MICRONS AND SHADE–538,AS PER IS–5 (POSTOFFICE RED)
11. CONTINUOUS WELDING TO BE DONE ON ALL THE JOINTS.
12. LABELS PROVIDED FOR INCOMER AND OUTGOING FEEDERS.
13. TOTAL FOUR NOS L– DROP TYPE LOCK TO BE PROVIDED AT FRONT & REAR SIDE OF THE PANEL.



BSES

TITLE: **FEEDER PILLAR TYPE B-1**
GENERAL NOTES,
SINGLE LINE DIAGRAM

REVISION	1	2	3
DATED			
SHEET No.	2 OF 3		

PROPERTY OF BSES

P.O.No.- .....

ITEM CODE- .....

ITEM- FEEDER PILLAR TYPE A-1(8WAY)

MFG. Month & Year ../....

SR.NO. .....

MANUFACTURED BY:-

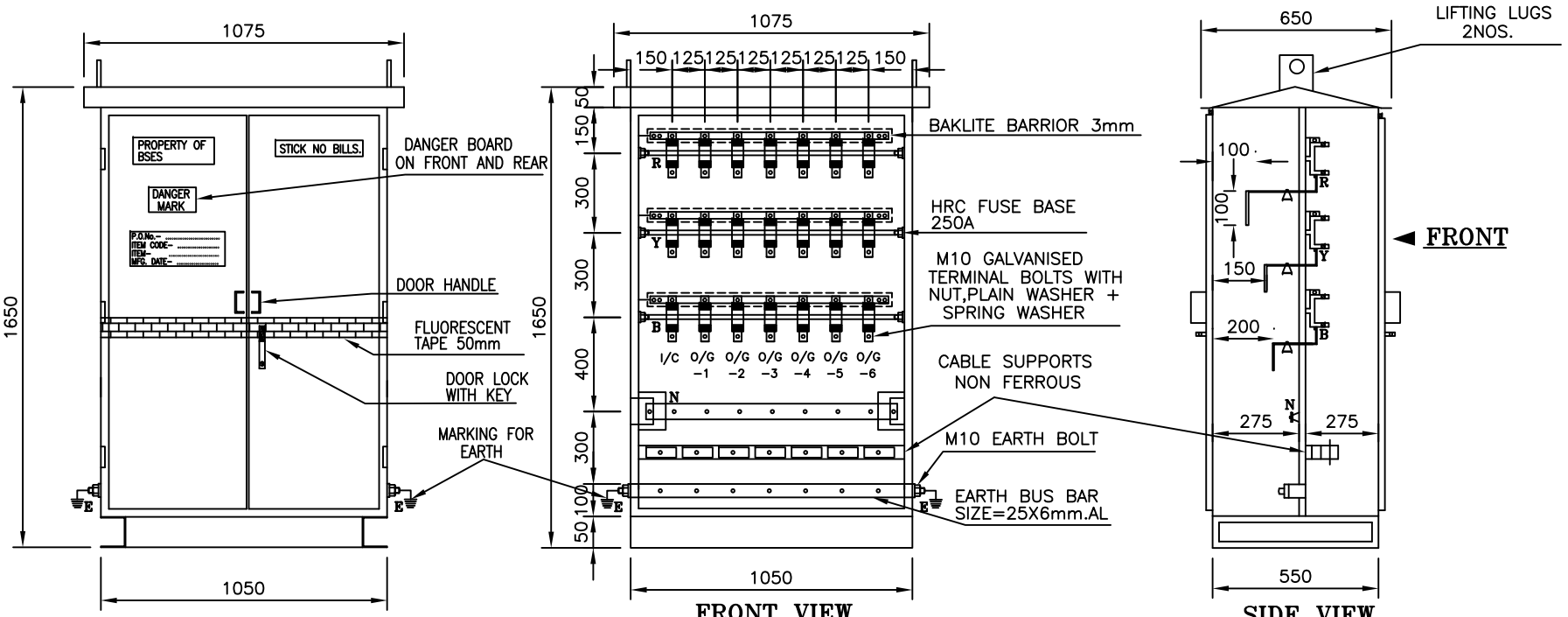
DETAILS OF NAME PLATES

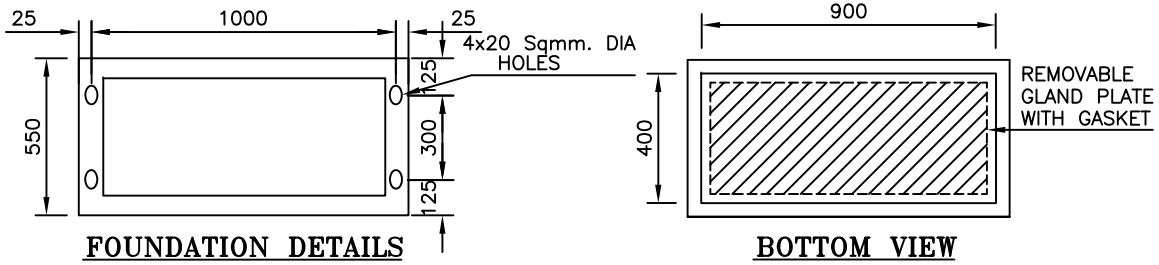
BSES

TITLE: **FEEDER PILLAR TYPE A-1**
DETAILS OF NAME PLATES

REVISION	1	2	3
DATED			
SHEET No.	3 OF 3		

ANNEXURE D:- GENERAL ARRANGEMENT DRAWING FOR 7 WAY PILLAR





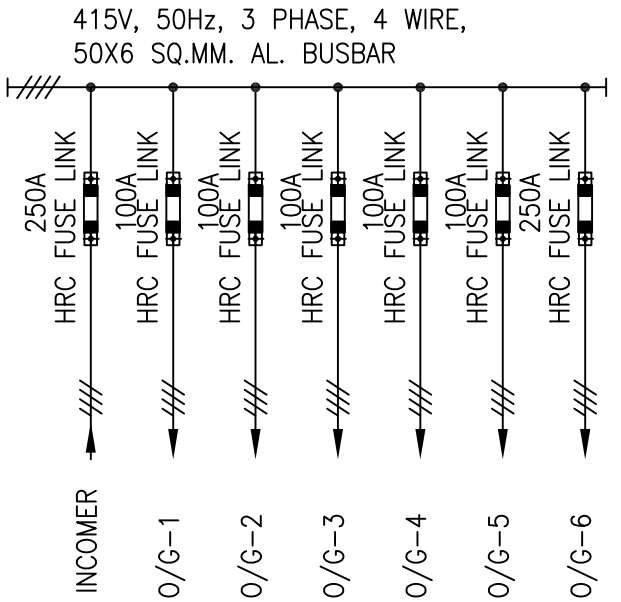
BSES

TITLE: **FEEDER PILLAR TYPE C-1**
GENERAL ARRANGEMENT DRAWING

REVISION	1	2	3
DATED			
SHEET No.	1 OF 3		

GENERAL NOTES:–

1. ALL DIMENSIONS ARE IN MM & SUBJECT TO NORMAL MANUFACTURING TOLERANCES.
2. ALL OTHER SPECIFICATION SHALL BE AS PER APPROVED G.T.P.& DRWs.
3. DANGER INSTRUCTION SHALL BE SCREEN PRINTED ON FRONT AND REAR SIDE IN ENGLISH AND LOCAL LANGAUGES.
4. 3mm. BAKLITE SHEET PROVIDED AS BUS BAR BARRIER.
5. GALV. SHEET SHALL BE 2mm COVER, DOOR & CANOPY.
6. FRON & REAR DOOR SHALL BE HINGED WITH 1 No. DOOR LOCK & 2Nos. TOWER BOLTS.
7. ALL MARKING ON DOOR ARE WITH BORDER.
8. NON–REMOVABLE COVER SHALL BE PROPERLY GASKETED WITH 3mm. THICK NEOPRENE/EPDM GASKET.
9. 50mm WIDE FLUORESCENT TAPE SHALL BE ON FOUR SIDES
10. POWDER COATING THICKNESS SHALL BE 50–MICRONS AND SHADE–538,AS PER IS–5 (POSTOFFICE RED)
11. CONTINOUS WELDING TO BE DONE ON ALL THE JOINTS.
12. LABELS PROVIDED FOR INCOMER AND OUTGOING FEEDERS.
13. TOTAL FOUR NOS L– DROP TYPE LOCK AT FRONT AND REAR SIDE OF THE PANEL



BSES

TITLE: **FEEDER PILLAR TYPE C-1**
GENERAL NOTES,
SINGLE LINE DIAGRAM

REVISION	1	2	3
DATED			
SHEET No.	2 OF 3		

PROPERTY OF BSES

P.O.No.- .....

ITEM CODE- .....

ITEM- FEEDER PILLAR TYPE C-1(7WAY)

MFG. MONTH & YEAR ../....

SR.NO. .....

MANUFACTURED BY :-

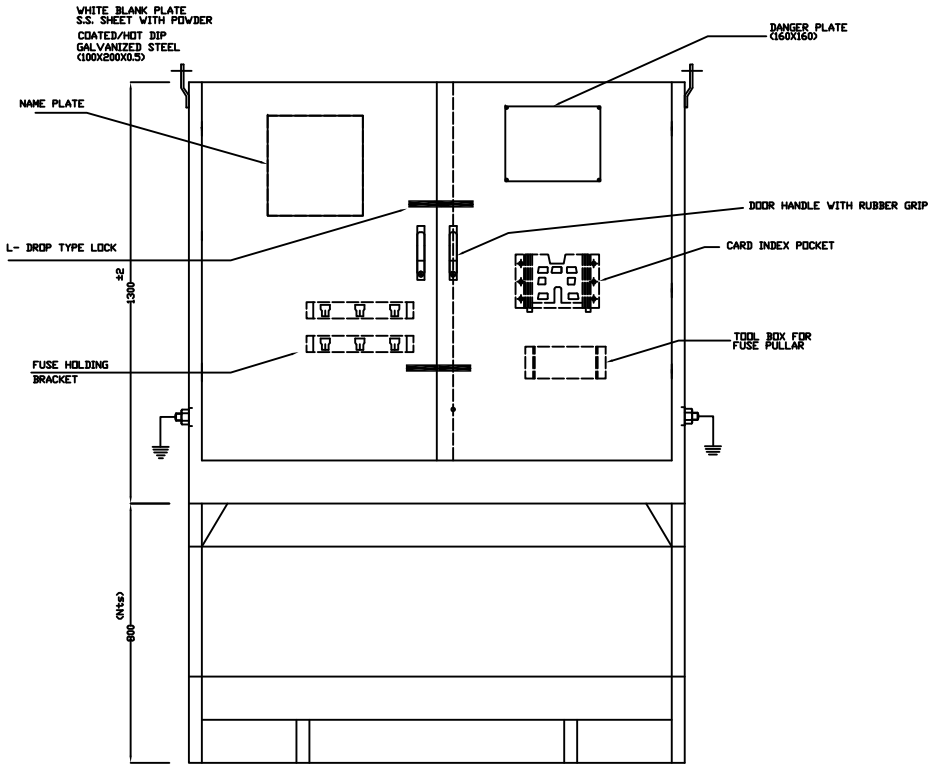
DETAILS OF NAME PLATES

BSES

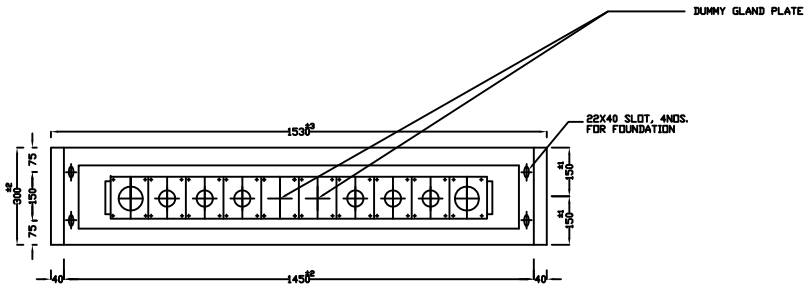
TITLE: **FEEDER PILLAR TYPE C-1**
DETAILS OF NAME PLATES

REVISION	1	2	3
DATED			
SHEET No.	3 OF 3		

ANNEXURE E: DRAWING OF COMPACTED TYPE 8 WAY PANEL.



ELEVATION WITH CLOSED DOOR



FOUNDATION PLAN

CADREF.NO:- ADWEL-ADH/FPTA-125/P6277SH-1

NOTES

SNO.	DESCRIPTION
1.	ELCLOSURE: SHEET STEEL 2MM. THK. HOT DIP
	GALVANISED SHEET
2.	FINAL PAINT : POLYESTER POWDER COATED SHADE 538
	AS PER IS:5 , POST OFFICE RED.
3.	BUSBARS: EC GRADE CU. BUSBARS TINNED HEAT
	SHRINKABLE SLEEVE INSULATED.
	SIZE OF BUSBAR - 50X 10MM. PER PHASE R Y B
	& NEUTRAL.
4.	EARTH BUS : 25X6. ALUMINUM.
5.	F1 &F2 400A FUSE BASE ASSEMBLY VERTICAL DESIGN.I/C
6.	SM1 TO SM6 250A FUSE BASE ASSEMBLY
	VERTICAL DESIGN O/G.
7.	DEGREE OF PROTECTION IP 55.
8.	CLEARANCES MINIMUM 25MM. PHASE TO PHASE
	/NEUTRAL/EARTH.
9.	DOOR LOCK BY TWO NOS L- DROP TYPE LOCKING.
	ARRANGEMENT.
10.	2 NOS 400A DIN TYPE FUSE TO BE PROVIDED FOR I/C.
11.	6 NOS 250A DIN TYPE FUSE TO BE PROVIDED FOR O/C.
12.	FUSE BASE CABLE SIDE LINKS WILL BE COLOUR
	CODED AT CABLE TERMINATION LEVEL & AT BOLT TIPS
	TOWARDS THREADS.

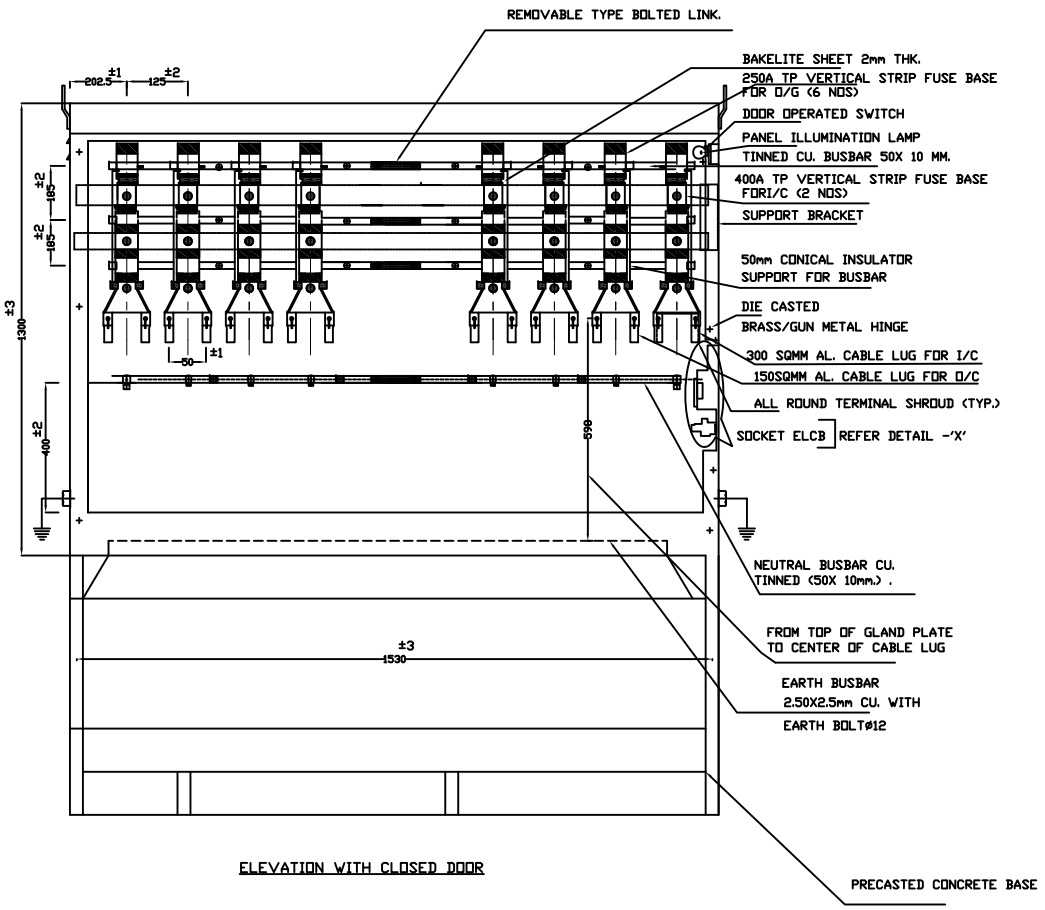
UNSPECIFIED TOLERANCE

ABOVE	UPTO & INCLUDING	TOL.
0.5	6.0	±0.1
6.0	30.0	±0.3
30.0	120.0	±0.5
120.0	315.0	±1.0
315.0	1000.0	±2.0
1000.0	2500.0	±3.0

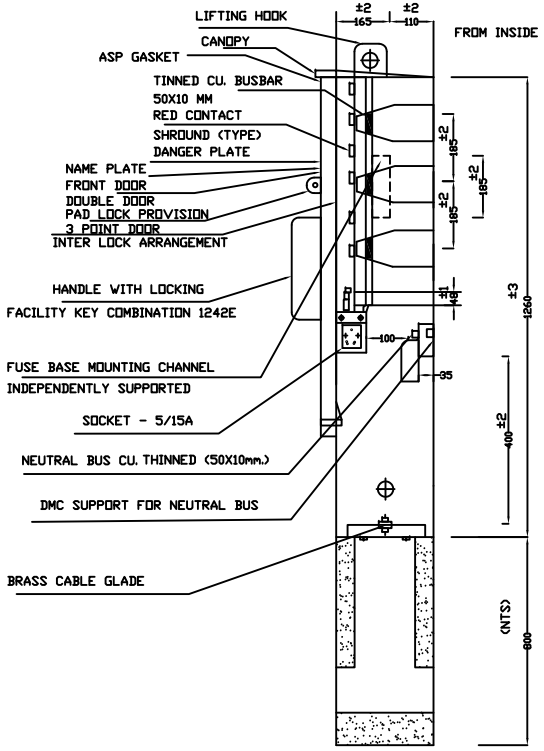
BSES

BSES YAMUNA POWER LIMITED

DRAWN	RAJAN	TITLE:- G.A WITH DOOR CLOSED FOR COMPACTED TYPE FEEDER PILLAR (8 WAY)	
CHECKED	TARUN		
APPD.	DS		
DATE	11/01/10	DWG No.:- BYPL-WDC-LAYOUT-8	REV. 01
SCALE	NTS		



ELEVATION WITH CLOSED DOOR



SECTIONAL SIDE VIEW

CADREF.NO:- ADWEL-ADH/FPTA-125/P6277SH-1

NOTES

SNO.	DESCRIPTION

UNSPECIFIED TOLERANCE

ABOVE	UPTO & INCLUDING	TOL.
0.5	6.0	±0.1
6.0	30.0	±0.3
30.0	120.0	±0.5
120.0	315.0	±1.0
315.0	1000.0	±2.0
1000.0	2500.0	±3.0

BSES

BSES YAMUNA POWER LIMITED

DRAWN	RAJAN	TITLE:- G.A WITH OPEN DOOR FOR COMPACTED TYPE FEEDER PILLAR (8WAY)
CHECKED	TARUN	
APPD.	DS	
DATE	11/01/10	DWG No.:- BYPL-WDC-LAYOUT-9
SCALE	NTS	REV. 01

BSES

TECHNICAL SPECIFICATION

OF

CHEMICAL EARTHING

Specification No- GN101-03-SP-63-01

BSES RAJDHANI POWER LTD			
Prepared by	Abhay Gupta		Rev : 01
	Pronab Bairagi		
Reviewed by	Amit Tomar		Date : 19-Sep-18
Approved by	K. Sheshadri		Page : 1 of 19
Registered Office: BSES Bhawan, Nehru Place, Delhi - 110019			

BSES Rajdhani Power Ltd	GN101-03-SP-63-01

TECHNICAL SPECIFICATIONS OF CHEMICAL EARTHING

TABLE OF CONTENTS

BSES Rajdhani Power Ltd	GN101-03-SP-63-01

TECHNICAL SPECIFICATIONS OF CHEMICAL EARTHING

REVISION RECORD

Rev. No.	Revision Date	Item/ clause no:	Page No.	Nature of Change	Approved by

1.0 SCOPE

This specification provides design, manufacturing, testing, inspection, packing, dispatch and installation of Chemical Earthing along with required accessories to BRPL New Delhi store/ site, specified herein for their satisfactory operation in the network of BRPL, New Delhi.

Such earthing shall last for minimum of 15 – 20 years and shall maintain the ohmic values despite of seasonal changes and water conditions. The conductivity of the material shall remain uncompromised

Chemical Earthing shall be used for various EHV, HV and LV equipments such as PTRs, Panels, Feeders, Distribution Transformers, Poles, Distribution boxes, RMUs etc.

2.0 STANDARDS

Chemical Earthing shall conform to the following International/Indian Standards and shall also abide the guidelines of CEA of India, which shall mean latest revisions, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification.

S.No	International/ Indian standard	Title
1	IS 3043	Code for practice of Earthing
2	IEEE Std. 80	Guide for Substation Grounding

3.0 CLIMATIC CONDITIONS

1	Average grade atmospheric condition	Heavily polluted, dry
2	Maximum altitude above sea level	1000 M
3	Air temperature Ambient	i) Highest : 50°C ii) Average : 30°C iii) Minimum : 0°C
4	Relative Humidity	100 % max
5	Thermal Resistivity of Soil	150°C. cm / W (max.)
6	Seismic Zone	4
7	Rainfall	750 mm concentrated in four months

4.0 GENERAL TECHNICAL REQUIREMENT

4.1 GROUND RESISTANCE VALUE

Ideally the ground resistance value should be "ZERO". As per IEEE recommendation the ground resistance value should be 5 ohms or less for effective grounding for small sub-station.

In BSES, the primary guidelines shall be followed for a good earthing system in a Distribution Sub-Station & down stream LT Equipments / Installations are as under-

a) The impedance to ground should be as low as possible. In large Sub-Stations , it should not exceed 1 ohm and in small **Sub-Stations 5 ohm as per IEEE Std.80, cl no 14.1** and as per cl. no. 3.2.6 of Chapter-III of CBIP Technical report no. 3 (Revised) Reprinted 1990 & 1995 on Manual on Layout of Sub-Stations.

b) At condition in BRPL area, Mesh resistance shall not cross 5ohm and that shall maintain throughout the warranty period without any maintenance.

c) Max. soil resistivity at BRPL area is 100ohm-mtr.

The specification generally covers the technical parameters of Chemical Earthing kit, earthing pit and installation of chemical earthing.

The Chemical Earthing shall therefore be suitable for satisfactory operation under the climatic conditions listed in clause 3.0.

4.2 GENERAL REQUIREMENT

A. Supply:

1. Copper bonded electrode/Rod electrode or any suitably designed copper electrode of length of 3 meter with 17.2 mm dia shall be used. Copper bonded rod shall be UL certified and type tested from CPRI/ERDA which are mandatory. Copper coating shall be 250 micron minimum.

2. Earth enhancing material shall have lower ground resistivity, better conductivity, corrosion protection of electrode, non leaching and environment friendly properties. 25kg shall be normal packaging.

3. Inspection joint which shall be used for testing of pit resistance

4. Heavy duty Polyplastic cover for Earth pit

5. Copper bonded steel conductor (18mm dia) for mesh formation

6. Exothermic joint (L, T and Cross joint)

7. Exothermic welding accessories

8. GI Strip for connection of equipment to mesh

B. Service:

1. All the erathing shall be in mesh formation
2. Mesh resistance shall not cross 5ohm and that shall maintain throughout tha warranty period without any maintenance

3. All tools & tackles, equipment, boring equipment, hardware and services required for successful completion of the work shall be in OEM scope of work.
4. BRPL reserves the right of inspection and monitor work progress time to time and ask for amendment / rework if the job is not up to the requirement.
5. Time is the essence of the contract and the bidder shall comply with the schedule and complete the execution of the contract within the time frame specified during award of contract.
6. All safety rules and codes as applicable to work shall be followed without exception. All safety and protective devices / appliances including belts, hand gloves, aprons, helmets, shields, goggles, and safety shoe shall be provided by the contractor to his personnel.

4.3 DESIGN PARAMETERS

1. Mesh resistance shall be less than 5 ohm and should never exceed 5 ohms throughout the warranty period
2. Fault current sustainability shall be 30.68 KA for 1 sec
3. Enhancing material shall provide better conductivity, corrosion protection of electrode, non leaching and environment friendly
4. Chemical Earthing arrangement should be maintenance free for the warranty period
5. Minimum Warranty of 10 years
6. General Arrangement as per approved in Annexure –B
7. Soil resistivity shall be considered 100ohm mtr max.

4.4 INSTALLATION OF EARTH PIT

1. The pits shall be drawn with the help of a boring machine, an auger or any other means as required by site conditions and nature of ground strata
2. The pit for electrode shall be of 200 mm larger than the length of the pipe.
3. The top of the pipe will be approximately **150 mm** below the level of the Grade/ground level.
4. No. of Earth pits shall be as per BRPL requirements.

5. The earth pit shall be placed at a distance of 3.0M apart minimum

6. In case of congested area , the distance between the earth pits shall not be less than 2.50 M.

7. Minimum of 1.0 M distance of Earth pit from electrical equipment and structures shall be maintained.

8. The earth pits shall be backfilled with Earth enhancing material.

9. Top of the pit shall be covered by polyplastic pit cover

10. After completion of earthing, area dressing shall be done by OEM

4.5 EARTH CONDUCTOR

1. 50X6 GI strip shall be used for equipments connection

2. Copper bonded conductor (18mm) shall be laid 500mm below FGL for mesh formation

3. The connection of GI flat (50x6) with the Copper bonded electrode/Rod shall be done by Exothermic welding joint (L,T or Cross)

4. The connection of GI flat (50x6) with equipments (with the earthing provision given by equipment OEM) shall be done by M12 GI bolt. GI Bolt shall be provided by OEM of Earthing.

5. In case the copper bonded rod/GI flat is to cross any obstruction, it shall be laid below the obstruction.

6. Wherever bolted connection is taken, it shall be taken through two bolts at each joint to ensure tightness and avoid loosening with passage of time.

4.6 GROUND EARTH ENHANCEMET MATERIAL

Earth enhancement material is a superior conductive material that improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.). It may contain conductive cement, graphite, hydrous aluminium silicate, sodium montmorillonite etc. It improves conductivity of the earth electrode and ground contact area. It shall have following characteristics-

1. It should have low resistivity preferably bellow 0.2 Ohm-meters. Resistivity shall be tested by making a 20cm. cube of the material and checking resistance across the opposite face of the cube.

2. It shall not depend on the continuous presence of water to maintain its conductivity.

3. It should be a little alkaline in nature with pH value >7 but <9, test certificate from NABL approved laboratory to be provided for the composition so designed.

4. It should have better hygroscopic properties to absorb moisture. It should absorb and release the moisture in dry weather condition and help in maintaining the moisture around the earth electrode.

5. It should have capacity to retain >10% moisture at 105°C. Test certificate from NABL approved lab to be submitted for the composition so designed.

6. It should have water solubility < 5%. Test certificate from NABL approved lab be submitted for the composition so designed.

7. It should be granular with granule size 0.1 mm to 3 mm.

8. It should be non toxic, non reactive, non explosive & non corrosive.

9. It shall be thermally stable between 0 degree centigrade to +60 degree centigrade ambient temperature.

10. It shall not decompose or leach out with time.

11. It shall not pollute the soil or local water table and meets environmental friendly requirement for landfill.

12. It should expand & swell considerably and removes entrapped air to create strong connection between earth electrode and soil.

13. It should be diffuses into soil pores and creates conductive roots enlarging conductive zone of earth pit.

14. It shall be permanent & maintenance free and in its "set form", maintains constant earth resistance with time.

15. It shall not require periodic treatment or replacement.

16. It shall be suitable for any kind of electrode and all kinds of soils of different resistivity.

17. It shall not cause burns, irritation to eye, skin etc.

18. The Earth enhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with Manufacturer's name or trade name, quantity, batch no & date of manufacture, Buyer's name, PO no, date of PO.

5.0 TESTS

5.1 GENERAL

BRPL reserves the right to inspect the material at the time of tests. All tests shall then be performed in the presence of BRPL representative. The Bidder shall have to give intimation in advance to witness the test. All the test results must be recorded in presence of the inspecting authority.

5.2 TYPE TESTS

All the product shall be type tested from CPRI/ERDA .Type test report shall not be more that 5 years old.

Type test report is valid only 5 years from the date of tender floating. In case of type test report is more than 5 years old, bidder has to conduct the type test from BRPL sample at CPRI/ERDA without any cost implication to BRPL.

5.2 ACCEPTANCE TESTS

1. Visual examination test
2. Dimensional verification
3. Resistivity verification

5.3 TESTING CHARGES

5.3.1	The testing charges for the type tests specified and as per relevant standard shall be borne by the bidder. All the manufacturers irrespective of quantity allotted to them, will have to carry out the Type Tests at their own cost and BRPL will not have any bearing on this account. The type test reports shall not be older than 5 yrs and shall be valid till the validity of offer
5.3.2	In case of failure in any of the type tests, the manufacturer is required to modify the design of the material if required and repeat the particular type test and same shall pass within three times at his own expenses. The decision of the BRPL in this regard shall be final. BRPL at its own desecration may also cancel the order at the risk and cost of the manufacturer if the material fails twice in the type test.

5.3.3	Type test shall be done from CPRI/ERDA. Ensure that the tests can be completed in these laboratories within the time schedule guaranteed by them in the appropriate schedule. BRPL reserves the right to specify the name of the laboratory also, if so felt.
5.3.4	The entire cost of testing for the acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted unit price of conductor.

5.4 ADDITIONAL TESTS

BRPL reserves the right of getting done any other test(s) of reasonable nature carried out at Manufacturer's premises, at site, or in any other place/ third party lab in addition to the aforesaid type, acceptance and / or routine tests to satisfy with the fact that the material comply with the specifications. In such case all the expenses will be to Manufacturer's account.

5.5 TEST REPORTS

5.5.1	Soft copies of type test reports shall be furnished through mail only. BRPL may ask original type test report to verify soft copy. BRPL will not receive any hard copy for their office record. BRPL will give final dispatch clearance after validating type test report.
5.5.2	Record of routine test reports shall be maintained by the Manufacturer at their works for periodic inspection by the BRPL's representative and shall be reviewed during inspection.
5.5.3	Test Certificates of tests done during manufacturing shall be maintained by the Bidder. These shall be produced for verification as and when desired by the BRPL.

6.0 INSPECTION

6.0.1	BRPL representative shall at all times be entitled to have access to the works and all places of the manufacturer and the representative shall have full facilities for unrestricted inspection of the Manufacturer's works, raw materials, store process and process of manufacture and conducting necessary tests as may be deemed fit, for certifying the quality of product.
6.0.2	The Manufacturer shall keep BRPL informed in advance of the time of starting and of the

	progress of manufacturing of materials in its various stages so that arrangements can be made for inspection.
6.0.3	No material shall be dispatched from its point of manufacture and works before it has been satisfactorily inspected, tested, and necessary dispatch instructions are issued in writing, except for the cases where waiver of Inspection is granted by BRPL, and even in this case also, written dispatch instructions will be issued. Any dispatches before the issue of Dispatch Instructions in writing will be liable for rejection and non acceptance by the consignee.
6.0.4	The acceptance of any quantity of material shall in no way relieve the Manufacturer of any of his responsibilities for meeting all requirements of the specification, and shall not prevent subsequent rejection if such material is later found to be defective.
6.0.8	Only soft copy of inspection report shall be furnished by manufacturer through mail. BRPL shall not receive any hard copy of report for their office record.

7.0 QUALITY ASSURANCE PLAN

7.1 The bidder shall invariably furnish following information along with his offer, failing which his offer shall be rejected.

7.1.1	Statement giving list of important raw materials, names of sub manufacturers for the raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials in presence of manufacturer's representative and as routine and / or acceptance during production and on finished goods, copies of test certificates.
7.1.2	Information and copies of test certificates as in mentioned above in respect of bought out accessories.
7.1.3	List of manufacturing facilities available.
7.1.4	Level of automation achieved and list of areas where manual processing exists.
7.1.5	List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
7.1.6	List of testing equipment available with the Manufacturer for final and calibration certificate

7.1.7	Testing of Earthing and its related accessories to be specified. In the case if the manufacturer does not possess all the Routine and Acceptance testing facilities, the bid / PO shall be rejected.
7.1.8	BRPL reserves the right for factory inspection to verify the quoted offer. If any of the facts are found to be misleading or incorrect the offer of that Bidder will be out rightly rejected and he may be black listed.
7.1.9	Special features provided to make it maintenance free.

7.2 The bidder shall also submit following information to the BRPL along with the technical Bid.

7.2.1	List of raw materials as well as bought out accessories, and the name of manufacturers of raw materials as well as bought out accessories.
7.2.2	Type test certificates of the raw material and bought out accessories.
7.2.3	Quality assurance plan (QAP) with hold points for BRPL's inspection.

7.3 The Manufacturer shall submit the routine test certificates (only soft copy through mail) of all the bought-out items, accessories etc.

NOTE: Final QAP shall be approved by BRPL.

8.0 DOCUMENTATION

Submission of drawings, calculations, catalogues, manuals, test reports shall be as mentioned below:

8.1 Drawing, Data and Manuals

The vendor shall submit-

- Cross sectional drawing
- GTP (all data to appear)
- Type test certificates
- Fault level calculation

Document Submission

Submission of drawings, calculations, catalogues, manuals, test reports shall be as follows.

Legend:

GTP : Guaranteed Technical Particulars

TTR : Type Test Report

RTR : Routine Test Report

	Documents along with offer	After award of contract for approval	Final documents(after Approval)
GTP	1 copies	** 1 soft copy	** 1 soft copy + CD
Drawings	1 copies	** 1 soft copy	** 1 soft copy + CD
Calculations	1copies	** 1 soft copy	** 1 soft copy + CD
Catalogues & Manual	1 copy each		** 1 soft copy + CD
Test Report	1 copy each of TTR and sample RTR		** 1 soft copy + CD

** Soft copy and CD shall contain documents duly approved, signed and scanned

9.0 PACKING & FORWARDING

9.0.1	Shipping Information	The seller shall give complete shipping information concerning the weight, size of each package
9.0.2	Transit damage	The seller shall be responsible for any transit damage due to improper packing
9.0.3	Markings	• PO number and date • SAP item code • Manufacturer's name • Buyer's name
9.0.4	Delivery Schedule	• Delivery period Start Date : From date of LOI / LOA • Delivery period End Date : As agreed with manufacturer • Material dispatch Clearance : After inspection by purchaser
9.0.5	Accessories	• Accessories shall be packed separately item wise with proper protection to prevent damage and easy handling.

		• Marking • Material description • Type • Dimension • PO number and date • SAP item code • Total weight • Manufacturer's name • Buyer's name • Month and year of manufacturing • Storage type

10.0 DEVIATIONS

10.0.1 Deviations from this specification shall be listed separately by bidder clause wise (format given below) along with optional offer and has to submit the list along with bid/quotation. BRPL will review the deviations and if BRPL is agreed with the deviation, seller has to take written confirmation from BRPL on deviation during tender evaluation.

10.0.2 In the absence of any separate list of deviations from the bidders with bid as well as written confirmation from BRPL on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully.

10.0.3 Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BRPL old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.

Deviation Sheet Format-

S.no	Document Name	Clause No.	Deviation	Reason	Merits to BRPL

ANNEXURE-A GUARANTEED TECHNICAL PARAMETERS

TECHNICAL SPECIFICATIONS OF CHEMICAL EARTHING

Note:

1) Every data shall be mentioned.
2) Seller may submit separate GTP for the earthing, as suitable.
3) GTP shall be read in line with purchaser's Project Site Specific Requirement.

TECHNICAL DATASHEET FOR EARTHING			
S.No.	**Parameter**	**BRPL requirement**	**Vendor data**
1	Name ,Address and ph no of Manufacturer		
2	Ref IS No	IS 1239 (Part -1) 2004	
3	Type (Light, Medium, Heavy) Medium, B class	NA	
4	Size of copper bonded rod	17.2 mm	
5	Copper coating thickness	250 micron	
6	UL marking	Yes/No	
7	CPRI/ERDA Type tested		
6	Length of Pipe	3 mtr	
11	Size of copper cladded rod	18mm	
12	Coating thickness (Min)	250Microns(min)	
13	Earth enhancing material	25kg/bag	
14	Plyplastic cover	Yes/no	
15	Exothermic Joint	L,T and cross joint	
16	Exothermic accessories	Yes/no	
17	GI Nuts and bolts	Yes/no	
18	Make of steel	SAIL /ESSAR/ TATA	
19	Embossing details	Name/logo of manufacturer, PO No., ISI, Class of tube i.e. M for Medium, Color of band (PO no provided in stencil), UL marked	
17	Colour Coding	BLUE colour band at both ends	

TECHNICAL SPECIFICATIONS OF CHEMICAL EARTHING

TECHNICAL DATASHEET FOR EARTHING

S.No.	Parameter	BRPL requirement	Vendor data
19	Details of Drawings submitted		
20	Chemical composition Test	As per IS 1239-1	
21	Test	As per IS 1239-1	

Technical Requirement

Sl no	Descriptions		Bidders Data
A	Technical Requirement	1) Mesh resistance shall be less than 5 ohm	
		2) Fault current sustainability shall be 30.68 KA for 1 sec	
		3) Enhancing material shall be leaching free	
		4) All materials shall be corrosion free.	
		5) Warranty for maintaining pit resistance below 5 ohm- 10 years minimum. pit resistance shall be verified every 6 months by bidder.	
		6) Copper bonded rod and copper cladded steel shall be CPRI/ERDA tested and UL marked	
B	Materials	1) Minimum dimension of copper bonded rod shall be 17.2 mmX3 Mtr. copper coating 250 micron.UL mark is mandatory	
		2) Pit shall be filled completely by earth enhancement material. 25Kg chemical shall be packed per bag	
		3) Polyplastic pit cover shall be provided. test report to submitted for review.	
		4) Inspection joint to be provided.	
		5) Exothermic joint (L,T and Cross Joint)	
		6) Exothermic Accessories	
		7) Copper Bonded stell (18mm dia)	
		8) 50x6 GI Strip	

C	Services	1) All the drawings and installation manual to be submitted to CES for approval.	
		2) All kind of activity including tools for pit installation, resistance measurement shall be in bidder scope.	
		3) Exothermic welding, welding accessories	
		4) Nuts and bolt for connection of GI strips with equipments	
		5) Each pit resistance shall be verified by BSES. record of resistance value to be maintained by bidder and same shall be submitted to CES.	
		6) Laying of 50X6 mm GI strip shall be in bidder scope- for connection of equipements	
		7) Laying of copper cladded rod below 500mm depth for formation of mesh	
		8) Chemical earthing kit (copper bonded rod, chemical and polyplastic pit cover) installation	

11.0 SCOPE DEMARCATION

Supply:

Sl no	Descriptions	BRPL	Vendor	Remarks
1	Chemical Earthing Kit (Copper Bonded Rod, 25 kg chemical and Polyplastic Pit Cover)	X	√	
2	Copper Bonded Steel conductor for mesh formation	X	√	
3	Exothermic Joint	X	√	
4	Exothermic Joint Accessories	X	√	
5	50X6 GI Strip	√	x	
6	GI Bolt required for connecting the GI strip with equipment	X	√	

Services:

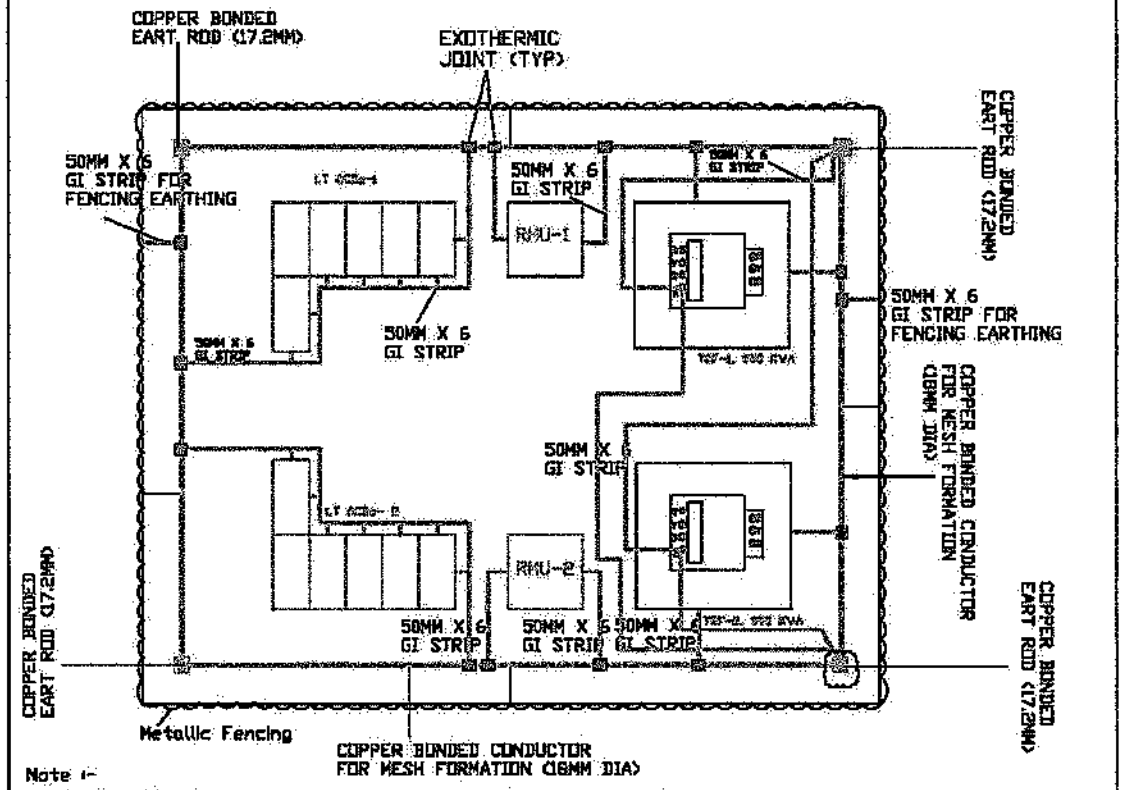
Sl no	Descriptions	BRPL	Vendor	Remarks

TECHNICAL SPECIFICATIONS OF CHEMICAL EARTHING

Sl no	Descriptions	BRPL	Vendor	Remarks
1	Transportation of all kind of materials from BRPL store to site	X	√	
2	Vehicle arrange for material transport	X	√	
3	Digging of Pit	X	√	
4	Installation of pit	X	√	
5	Digging for laying of copper bonded steel at 500mm depth for mesh formation	X	√	
6	Laying of copper bonded rod	X	√	
7	Exothermic jointing	X	√	
8	Connecting of equipment to mesh by 50X6 GI strip	X	√	
9	GI Bolting	X	√	
10	Any kind of drilling, hole making, welding for the job	X	√	
11	Measurement of soil resistivity	X	√	
12	Measurement of mesh resistance after finishing of earthing work (mesh resistance must be less than 5 ohm)	X	√	
13	MOM after job finishing	X	√	
14.	All kind of instrument, equipment required for job execution and for finishing	X	√	
15	PPE for workers	X	√	
16	Returning of scrap to BRPL store if any	X	√	
17	Backfilling of trench, pit etc.	X	√	
18	Filling material reservation slip (MRS) in SAP	√	x	
19	BOQ estimation for Earthing work (type, size and length of GI strip,)	√	x	
20	Dismantling of existing earthing if any	X	√	

TECHNICAL SPECIFICATIONS OF CHEMICAL EARTHING

ANNEXURE-B: GENERAL ARRANGEMENT DRAWING OF CHEMICAL EARTHING



Note :-

1. Earthing Kit shall consist of 17.2mm Copper Bonded Rod , 25KG Chemical per Bag,Poly Plastic Pit Cover.
2. All the joint at Mesh side shall be Exothermic Joint.
3. 50x6 GI Streep Shall be Used to connect the equipment to Mesh.
4. GI Bolt shall be used to connect the GI Strip with equipment.
5. Copper Bonded Steel Shall be used to form the Mesh.

DRAWN	SUMIT
CHECKED	P.B
REVIEWED	A.T
APPD.	S.K
DATE	19.09.18

TITLE:—
GA DRAWING OF CHEMICAL EARTHING

BSES Rajdhani Power Limited

DWG No.:-BSES-EL-001, R0 | REV. 0

TECHNICAL SPECIFICATIONS

OF

PPES ITEMS (DANGER PLATE)

BSES RAJDHANI POWER LTD.				
Prepared by	Naved Ahmad	Naved Ahmed 04/05/18	Date:	04.05.2018
Reviewed by	Amit Tomar		Revision	R1
Approved by	K. Sheshadri		No of Pages:	7

Contents

1.0 Scope of Supply

1.1 The specification covers the design, manufacturing, inspection, testing & supply of PPES items
1.2 Design, Engineering, Manufacturer, Assembly, Inspection, testing at manufacturer works before dispatch Packing, delivery of material to BRPL stores and submission of documents to purchaser.

2.0 Service Condition

The danger plate to be supplied against this specification shall be suitable for satisfactory continuous operation under outdoor environment. Following are the climatic condition:

Sl no	Parameters	Requirements
i.	Peak ambient temp.	55°C
ii.	Min ambient temp. in shade	45°C
iii.	Max.average ambient temp in 24 hours period in shade	40°C
iv	Min ambient temp.	(-)5°C
v	Max. temp. attainable by an object exposed to sun	70°C
vi	Max. relative humidity	95%
vii	Average number of thunder storm days per annum	40
viii	Average number of rainy storm days per annum	120
ix	Average annual rainfall	1250mm
x	No of months of tropical monsoon condition	4 months
xi	Max. wind pressure	150kg/m2
xii	Altitudes	Not exceeding 1000mtrs

3.0 Applicable Standards

Unless otherwise modified in this specification, the Danger notice plates shall comply with IS: 2551-1982 or the latest version thereof.

3.1 Codes & Standards

Following Indian/International Standards, which shall mean latest revision, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification

Sl. no.	Indian Standard	Title
1.	IS:2551-1982	Visual examination
2.	IS:2551-1982	Dimensional check
3.	IS:8709-1977 (or its latest version)	Test for weather proofness
4	IS:5-1978	crossbones in signal red colour

4.0 Requirements

4.1 **Composition**

This Specification covers Danger notice plates to be displayed in accordance with rule No. 35 of Indian Electricity Rules, 2003.

4.1.2 Construction

4.1.2.1 Lettering

- All letterings shall be centrally spaced
- All letterings shall be engraving type
- The dimensions of the letters, figures and their respective position shall be as per the drawing given with this specification
- The size of letters in the words in each language and spacing between them shall be so chosen that these are uniformly written in the space earmarked for them.

4.1.2.2 Languages

- Under Rule No. 35 of Indian Electricity Rules, 2003, the owner of every medium, high and extra high voltage installation is required to affix permanently in a conspicuous position a danger notice in Hindi and English with the sign of skull and bones.
- The type and size of lettering to be done is indicated in the specimen danger notice plates shown in the drawing with this specification.
- Adequate space has been provided in the specimen danger notice plates for having the letterings in local language for the equivalent of' Danger', '11000' and 'Volts'.

5.0 Workmanship

5.1 The plate shall be made from mild steel sheet of at least 1.6mm thick and vitreous enameled white, with letters, figures and the conventional skull and cross-bones in signal red colour (refer IS:5-1978) on the front side. The rear side of the plate shall also be enameled.

5.2 Tests: The following tests shall be carried out:
i) Visual examination as per IS:2551-1982
ii) Dimensional check as per IS:2551-1982
iii) Test for weather proofness as per IS:8709-1977 (or its latest version)

6.0 Packing and Marking

The plates shall be packed in wooden crates suitable for rough handling and acceptable for rail/road transport. The box shall be marked indelibly at the back with the following information.

a. Size and type
b. Identification of the source of manufacture
c. Month and year of manufacture and
d. Property of "BRPL"

7. Inspection:

Manufacturer shall intimate the manufacturing schedule in advance. The manufacturer shall give minimum 15 days advance notice about readiness of material at their works. The material shall be inspected for conformity with BRPL specification before the same is accepted.

7.1 Certificates required

- Manufacturing certificates
- Test certificates
- Authorization of dealership/ distribution ship

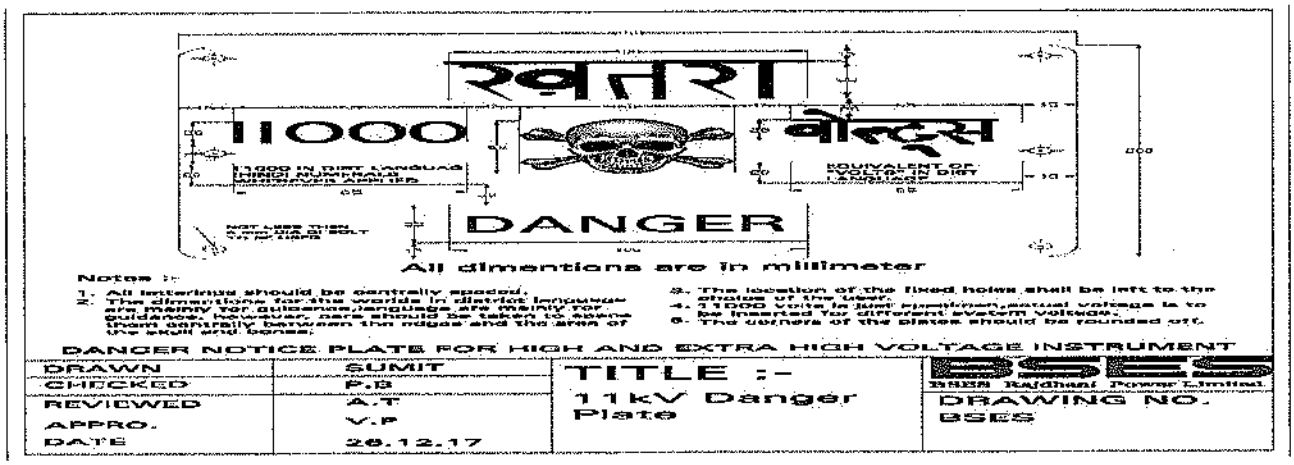
8. Deviation

a) Deviations from this specification shall be listed by bidder clause wise along with optional offer and has to submit the list along with bid./quotation. BRPL will review the deviations and if BRPL is agreed with the deviation, seller has to take written confirmation from BRPL on deviation during tender evaluation..

b) In the absence of any list of deviations from the Seller with bid as well as written confirmation from BRPL on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully.

c) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BRPL old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not be considered as a deviation from this tech spec at any stage of contract.

8. Drawings



8. GTP

GUARANTEED TECHNICAL PARTICULAR FOR 11KV DANGER PLATE			
SL.NO.	Technical Particulars	BSES Requirement	To be filled by Bidder
1	Name of the Manufacturer.		
2	Place of the Manufacturer.		
3	Contact persons of the Manufacturer.		
4	Purchase Req.No.		
5	Guarantee period:(Min)	60 Months (From date of commissioning)/66 Months (From date of receipt at purchaser's store whichever is earlier)	
6	Type of Danger plate		
7	Material used for Danger plate	Steel Sheet & Strip-Cold-Rolled,Electrolytic Zinc-Coated	
8	Dimension of Danger plate	SIZE=250mmX200mm	
9	Overal Thickness of Danger plate	>1.6mm	
10	Thickness of Steel Sheet & Steip.	AS PER IS Standard.	
11	Chemical Composition	AS PER IS Standard.	
12	Mechanical Property		
	A.Tensile Strength	AS PER IS Standard.	
	B.Elongation at Breake	AS PER IS Standard.	
13	Thickness of Electrolytic zinc-coating	AS PER IS Standard.	
14	Coating Mass	AS PER IS Standard.	
15	Fixing arrangement of Danger plate	As per drawing	

GUARANTEED TECHNICAL PARTICULAR FOR 11KV DANGER PLATE			
SL.NO.	Technical Particulars	BSES Requirement	To be filled by Bidder
16	Holes for fixing at Danger plate	6 No.of Holes	
17	Diameter of holes of fixing	6mm	
18	Weight of Danger plate	As per manufacturer	
19	As per drawing note at danger plate	Yes/No.	
20	Identification Marking at plate.(Language)		
	A.English	Yes/No.	
	B.Hindi	Yes/No.	
21	Packing	Packed in wooden	
22	Test		
	A.Visual examination.	IS: 5-1978	
	B.Dimensinal check	As Per Drawing	
	C.Test for weather-proofness	IS:8709-1971	
23	Type Test	AS PER IS Standard.	

BSES

Technical Specification for

Nut, Bolts & Washers

Specification no – GN101-03-SP-80-00

Prepared By		Reviewed By		Approved By		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
SY	23/5/17	AT	23.05.17	VP		R0	23.05.17

INDEX

TECHNICAL SPECIFICATION OF NUT, BOLTS & WASHERS

1. SCOPE OF SUPPLY

The specification covers the manufacturing, testing and inspection of Nut, Bolts & Washers.

2. CLIMATIC CONDITION

The material to be supplied against this specification shall be suitable for satisfactory operation under following climatic condition

Location	At various location in the Delhi
Maximum ambient temperature (^oC)	50
Minimum ambient temperature (^oC)	0
Maximum altitude above mean sea level (m)	1000
Relative Humidity (%)	100
Rainy month	June to October
Maximum Rainfall (mm)	1450
Wind Pressure (Kg/Sq.m)	195
Seismic Zone	Zone IV as per IS : 1893

3. CODES & STANDARDS

The Nut & bolt shall be designed, manufactured and tested in Accordance with the following Indian standards.

IS- 12427	Specification for Transmission Tower Bolts
IS-4072	Steel for Spring Washer
IS-3063	Single Coil Rectangular section Spring Washer for bolt, nut & Screw
IS-1586	Methods for Rockwell Hardness test for steel
IS-2016	Plain Washer
ISO 898/1-1988	Metric Bolts, Screws and Studs
IS-2633	Methods of testing of uniformity of coating of zinc coated articles
IS-6745	Method of determining of mass zinc coating on zinc coated iron & steel articles
IS-1363 (All parts)	Hexagonal bolts & nuts
IS-1367 (Part-iii)	Technical supply condition for threaded steel Fastner
IS-4759	Hot dip Zinc coating on structural Steel & other allied Products
DIN 127 A	Spring Lock Washers

4. TESTS

All types of test including routine test shall be carried out according to IS : 1367-1967 or its latest amendment.

5. INSPECTION:

The material shall be inspected and tested before dispatch by an authorized representative of the BSES in respect of quality. In case the supplier is not in position to get these tests carried out at his work, such test may get be carried out by hum at any NABL accredited lab at his own expenses.

6. TEST CERTIFICATES:

The supplier shall supply one set of test certificates from any NABL accredited lab in respect of quality as per IS: 1363-1967 with latest amendment for approval of the purchaser.

7. INSPECTION AFTER RECEIPT AT STORE:

BSES inspector will inspect the material received at BSES Store and shall have right to reject if found different from the reports of pre-dispatch inspection.

8. MARKING:

The material shall be marked with the ISI certification mark.

I. Manufacture's name or trade mark.
II. Place of manufacturers.
III. The name & designation of consignee
IV. Ultimate destination as required by the purchaser.
V. Net weight with description of material.
VI. The marking shall be stencilled in delible link on gunny bag.
VII. The manufacturer's identification symbol.
VIII. The hexagonal head bolts shall be marked with the following symbols on the top surface of the bolt head either embossed or identified as given below. The manufacturer's identification symbol.
IX. Minimum height of marking shall be 3.0 mm. When embossed, marking shall project not less than 0.3 mm above the surface of the head and total head height (Head plus marking) shall not exceed the specified maximum head height plus 0.4 mm.

9. PACKING:

The supplier shall be responsible for suitable packing of all the material and marking on the consignment, so as to avoid any damage during transport and storage and to ensure correct dispatch

to the destination. The packing shall be conforming to the requirement laid down in IS : 3256-1965 or its latest amendment.

Electro galvanized spring washers shall be packed in cartons of 500 or 1000 numbers.

Each carton containing the spring washers shall be marked with the manufacturer's name

Or trade mark, type, nominal size and quantity of the washers.

.

10. GTP FOR NUT, BOLTS & WASHERS :

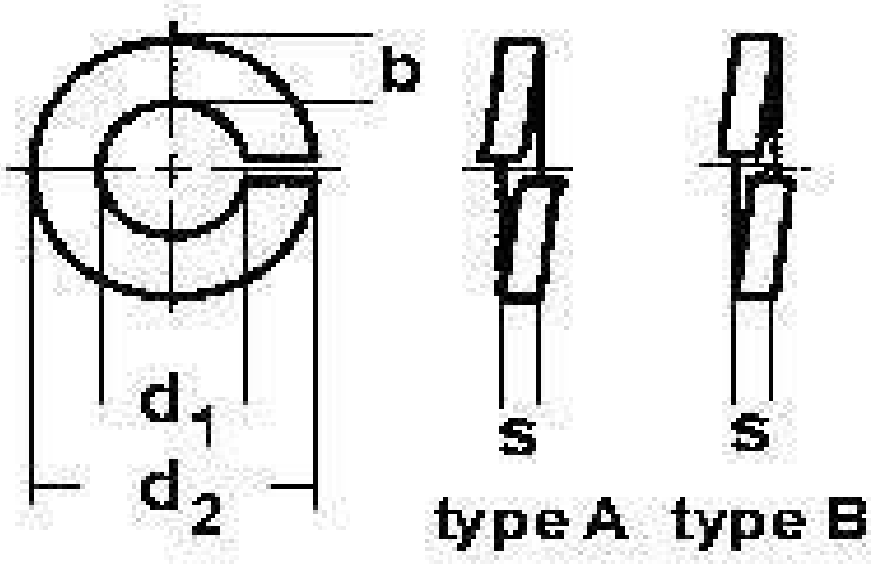
S. No.	Technical particular	Hot Dip galvanized Hexagonal bolt
1	Mechanical Properties/ particular to which the Bolt will confirm IS 1367 (Part -2)-1979 product grade –C	
i	Tensile Strength	N/mm2 (Strength under wedge loading)
ii	Rockwell hardness	HRB
iii	Yield Stress	N/mm2
Iv	Stress under proof load	N/mm2
v	Strength under wedge loading	Kg/mm2
vi	Wt of Zinc Coating	g/mm2
vii	Shear strength	N/mm2
2.	Specification & standards for M.S. Bolts & Nuts(Black)	As per IS 1363(part 1 & 3) IS: 1367(part 3 & 6) IS: 1367 (part 17) & other Relevant standards with latest amendments
3.	Property class: a. Bolts b. Nuts	a. I) M10 to M16, length 40 mm to 80 mm min HT 4.8 grade ii)For others min 4.6 grade b. Min 5
4.	Size	Assorted size
5.	Tolerance	As per IS
6.	Raw material: a) Grade b) Type of steel used	As per IS :2062 Low Carbon Steel(Grade C) as per IS : 2062

7.	Chemical composition (%) a) For Hexagonal bolts: i) Carbon (Max.) ii) Phosphorous (Maxm.) iii) Sulphur (Maxm.) b) For Hexagonal nuts: i) Carbon (Maxm.) ii) Phosphorous(Maxm.) iii) Sulphur (Maxm.)	 0.55% 0.05% 0.06% 0.50% 0.06% 0.15%
8	Mechanical properties: i) For Hexagonal bolts: a) Tensile strength N/mm Sq. Minm. b) Stress under proof load N/mm Sq.Minm. c) Brinell Hardness HB d) Rockwell Hard HRB e) Vickers Hardness HV f) Elongation after fracture g) Strength under wedg. Loading N/mm Sq.Minm. h) Head soundness ii) For Hexagonal nuts a) Proof stress N/mm Sq.min. b) Vicker Hardness HV-HV-Minm/Maxm	As per IS: 1367(Pt. 3) 400 225 114 Min. to 258 Maxm. 67 Min. to 99.5 Max. 120 Min. to 250 Maxm. 22% 400 No Fracture As per IS: 1367 (Pt.6) 610 130 Min. to 302 Max.
9	Sampling procedure	As per IS :2614/1969 with latest amendments.
10	Packing details	Material to be supplied in double gunny bag of 50Kg

PLAIN WASHERS:

The plain washers shall be Hot dip Galvanized in accordance with the requirements of IS:4759-1984 "Specification for Hot-Dip Zinc coating on structural steel and other allied products" (Second-revision) except that the minimum value of the average mass of coating shall be 300 g/m2,shall be conforming to IS: 1363-1967. Plain washers shall be conforming to IS: 2016-1967.

SPRING WASHERS:



d_1	used for	d_2	b	s
2.1	M 2	4.4	0.9	0.5
2.4	M 2.3	4.9	1	0.6
2.6	M 2.5	5.1	1	0.6
3.1	M 3	6.2	1.3	0.8
3.6	M 3.5	6.7	1.3	0.8
4.1	M 4	7.6	1.5	.09
5.1	M 5	9.2	1.8	1.2
6.1	M 6	11.8	2.5	1.6
7.1	M 7	12.8	2.5	1.6
8.1	M 8	14.8	3	2
10.2	M 10	18.1	3.5	2.2
12.2	M 12	21.1	4	2.5
14.2	M 14	24.1	4.5	3
16.2	M 16	27.4	5	3.5
18.2	M 18	29.4	5	3.5
20.2	M 20	33.6	6	4

11. INSPECTION TESTING CRITERIA :

Sr No.	Requirement	Product	Testing Standards	Lot Size (Manufacturers)	BSES lot Size
1	Chemical Composition	NBW	IS : 228	Each Consignment	Every 20th Consignment
2	Dimension	NBW	IS : 2141 - 2000	Each Consignment	Every 20th Consignment l
3	Tensile Strength	NBW	As per relevant IS	Every Fifth Consignment	Every 20th Consignment
4	Proof load Test	NBW	IS : 898-2 1992	Every Fifth Consignment	Every 20th Consignment
5	Coating Test	NBW			
5.1	Wt of of Zinc Coating	NBW	IS : 6745 - 1972	Every Fifth Consignment	Every Fifth Consignment
5.2	Uniformity of Zinc Coating	NBW	IS : 2633 - 1986	Every Fifth Consignment	Every Fifth Consignment
5.3	Adhesion of Zinc Coating	NBW	IS : 4826 - 1979	Every Fifth Consignment	Every Fifth Consignment

Note: -

- Corrosion Protection (all items shall be hot-dip galvanised in accordance with AS 4680 or AS1214)
- Hot dip Galvanized Bolt with one Nut, two Plain Washer and one Spring Washer which is electro galvanised
- Nickel chromium plated bolts with one Nut, two Plain Washer and one Spring Washer which is electro galvanised
- Full threading is required for bolts sizes up to length 100mm and minimum thread length of 38mm for bolts sizes having length more than 100mm
- All electrical connection hardware (M10 to M16, length 40 mm to 80 mm) shall be minimum HT 4.8 grade for other size 4.6 grade.

S.No	Description
	Bolt (G.I)
1	BLT,HEX,M16X150MM;GI
2	BLT,HEX,M16;175MM;GI
3	BLT,HEX,M16;225MM;GI
4	BLT,HEX,M16;250MM;GI
5	BLT,HEX,M16X300MM;GI
6	BLT,HEX,M16;350MM;GI
7	BLT,HEX,M16;125MM;GI
8	BLT,HEX,M10;40MM;GI;4.8
9	BLT,HEX,M12X40MM;GR 4.8
10	BLT,HEX,M16;100MM;GI
11	BLT,HEX,M16;75MM;GI GR 4.8
12	BLT,HEX,M6X20MM;GI
13	BLT,HEX,M16;200MM;GI
14	BLT,HEX,M16;400MM;GI
15	BLT,HEX,M16;25MM;GI GR 4.8
16	BLT,HEX,M12X60MM;GI;FULL THRD GR 4.8
17	BLT,HEX,M16X40MM;GI GR 4.8
18	BLT,HEX,M8X130MM;GI;MET
19	BLT,HEX,M12;60MM;GI; GR 4.8
20	BLT,HEX,M6X35MM;GI;GR 4.6;FULL THRD
	Bolt (Nickel Chromium)
21	BLT,HEX,M16X100MM;NKL CHROMIUM
22	BLT,HEX,M12X50MM;NKL CHROMIUM GR 4.8
23	BLT,HEX,M16X 50MM;NKL CHROMIUM GR 4.8
24	BLT,HEX,M10X75MM;NKL CHROMIUM GR 4.8
25	BLT,HEX,M12X75 MM;NKL CHROMIUM GR 4.8
26	BLT,HEX,M16X75MM;NKL CHROMIUM GR 4.8
	Bolt (MS)
27	BLT,HEX,M16MM;80MM;MS; GR 4.8 MET

28	NUT,HEX,M10X40MM;MS;NUT BLT WSHR
29	BLT HEX MS -- MC 150MM M16
30	NUT,HEX,M10X40MM;MS;NUT BLT WSHR
31	BLT,HEX,M8X75MM;GALVANIZED ZN COATED MS
	Eye Bolt
32	BLT,EYE,25MM;240MM;M12
33	OEM,EYE BLT OPERTG RD;1HYN400075P1
	Washer (Spring)
34	WSHR,SPRNG,21MM;13MM;2.5MM;GALVANIZED MS
35	WSHR,SPRNG,11MM;17MM;2.5MM;GALVANIZED MS
	Washer (Flat)
36	WSHR,FLT,37MM;13MM;3MM;NKL CHROMIUM
37	WSHR,FLT,50MM;17MM;3MM;NKL CHROMIUM
38	WSHR,FLT,24MM;13MM;2MM;GALVANIZED MS
39	WSHR,FLT,21MM;11MM;2.35MM;GALVANIZED MS
40	WSHR,FLT,30MM;10.5MM;2.5MM;NKL CHROMIUM
41	WSHR,FLT,23.8MM;8.4MM;2MM;NI CHROMIUM
	Washer (Sling)
42	WSHR,SLNG,NEOPRENE;FOR M12STM
43	WSHR,SLNG,NEOPRENE;10MM;14MM;2MM
	Washer (Teflon)
44	WSHR,TEFLON;22X32X5MM
45	WSHR,TEFLON;12X20X5MM
46	WSHR,TEFLON;18X22X5MM
47	WSHR,TEFLON;15X30X5MM
48	WSHR,TEFLON;20X30X5MM
49	WSHR,TEFLON;35X22X5MM
50	WSHR,TEFLON;46X32X5MM
51	WSHR,TEFLON;25X15X5MM
	Washer (Brass)
52	WSHR,BRASS;LV FOR 990KVA XMER
53	WSHR,HEX;LV BRASS;FOR 630KVA TRAFO
54	WSHR,PLN;LV BRASS WSHR FOR 100KVA XMER
55	WSHR,CLAMPING MEMBER;AL;FOR HV BSHG
56	WSHR,BRASS;FOR HV SIDE TRNSF
	Hex Nut (MS)
57	NUT,HEX,M10X40MM;MS;NUT BLT WSHR
58	NUT,LOCK,SHEARING;M6X25MM;5;SHEA;MS;A
59	NUT,HEX,M16;GALVANIZED MS

BSES

Technical Specification

for

PVC Electrical insulation Tape

Specification No.: GN101-03-SP-211-00

Prepared by:		Checked by :		Approved by:		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
S.K. Yadav	S.K. Yadav 19 mar 2020	Amit Tomar	19/03/2020	K. Sheshadri	19/03/2020	00	19.03.2020

Contents

1. SCOPE OF SUPPLY

This specification covers the design, manufacturing, testing & supply of PVC Electrical insulation Tape for insulation of all wires and cables splices upto 440V For strengthening and insulating Resistor, Capacitor leads in circuit boards, transformers, regulator leads etc., used for colour coding of communication cables for arresting ingress of water in telecom and optical cable joints in BRPL area.

2. SERVICE CONDITION

The PVC Electrical insulation Tape to be supplied against this specification shall be suitable for satisfactory continuous operation under the following service condition.

2.1	Maximum ambient temperature(deg. C)	50
2.2	Minimum ambient temperature(deg C)	0
2.3	Relative Humidity (%)	100
2.4	Maximum annual rainfall(mm)	1450
2.5	Maximum wind pressure (Kg/Sq.m)	150
2.6	Maximum altitude above sea level (Meters)	1000
2.7	Climate Condition:	Moderately hot and humid tropical climate conducive to rust and fungus growth.

3. DESIGN REQUIREMENTS

- Tape shall be based on PVC or its copolymers and shall have rubber-based, pressure sensitive adhesive.
- Tape shall be Flame Retardant Cold and Weather Resistant.
- Tape shall be classified for use in both indoor and outdoor environment.
- Shall be compatible with synthetic cable insulations, jackets and splicing compounds.

4. TECHNICAL REQUIREMENT OF PVC ELECTRICAL TAPE

S. No	PROPERTY	OUR TYPICAL VALUE
1	BIS standard	IS 7809 (Part 3, Sec.1)
2	Colour of the Tape	Black, Blue, Green, Yellow & Red
3	Width of the Tape, in cm	1.80
4	Length of the Tape, in mtr	6.5
5	Total Thickness of the Tape, in mm	0.125
6	Adhesion to Steel, in N/10 mm width (Min.)	1.6
7	Adhesion to Backing, in N/10 mm width (Min.)	1.3
8	Tensile Strength in N/10mm per width per mm thickness (Min.)	150
9	Electrical Strength at room temp. In kV/mm (Min)	40
10	Electrical Strength after humid conditioning in kV/mm (Min.)	35

S. No	PROPERTY	OUR TYPICAL VALUE
11	Flammability	Self Extinguishing
12	Electrolytic Corrosion	No Corrosion of Cu wire
13	Insulation Resistance (in ohms) (Min.)	1.0 X 10^11
14	Stability to Accelerated Aging at 65±1°C & 80 % Relative Humidity for 96 Hrs. in N/10 mm width	No deterioration or change in properties of the backing 1.3 N minimum
15	Temperature range (Min.)	0 to 90^0 C

5. INSPECTION

The material shall be inspected and tested at vendor's work as per relevant IS 7809 (Part 3, Sec.1) before dispatch by an authorized representative of the BRPL in respect of quality. In case the supplier is not in position to get these tests carried out at his work, such test may get be carried out at any NABL accredited lab at his own expenses.

6. TEST CERTIFICATES

The supplier shall supply one set of test certificates from any NABL accredited lab in respect of quality as per IS 7809 (Part 3, Sec.1) with latest amendment for approval of the purchaser.

7. INSPECTION AFTER RECEIPT AT STORE

BRPL inspector will inspect the material received at BRPL Store and shall have right to reject if found different from the reports of pre-dispatch inspection

8. PACKING & DELIVERY

8.1	Packing protection	Against wear and tear & corrosion
8.2	Handling instruction	To be marked on packing boxes

9. DEVIATIONS

9.1	Deviation from the specification	Deviation from the specification shall be stated in writing with the tender by reference to the specification clause/GTP and a description of the alternative offer. In absence of such a statement. It will be assumed by the Buyer that the seller complies fully with this specification.

10. DRAWING SUBMISSIONS

10.1	Along with the Bid	a) Guaranteed Technical Particulars(GTP duly filled-in) b) Test certificate c) Catalogue

BSES

Technical Specification for

G.I. Conduit Pipes

and

Earthing Pipe

Specification no – GN101-03-SP-97-00

Prepared By		Reviewed By		Approved By		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
S.K. Yadav Pronab Bairagi		Amit Tomar	11/01/18	Vijay Panpalia		R0	11.01.18

TECHNICAL SPECIFICATION OF G.I. CONDUIT PIPES & EARTHING PIPE

INDEX

TECHNICAL SPECIFICATION OF G.I. CONDUIT PIPES & EARTHING PIPE

1. SCOPE OF SUPPLY

The specification covers the manufacturing, testing and inspection of G.I Conduit & Earthing Pipe

2. CLIMATIC CONDITION

The material to be supplied against this specification shall be suitable for satisfactory operation under following climatic condition

Location : At various location in the Delhi	
Maximum ambient temperature (^{o}C)	50
Minimum ambient temperature (^{o}C)	0
Maximum altitude above mean sea level (m)	1000
Relative Humidity (%)	100
Rainy month	June to October
Maximum Rainfall (mm)	1450
Wind Pressure (Kg/Sq.m)	195
Seismic Zone	Zone IV as per IS : 1893

3. CODES & STANDARDS

The G.I. Conduit Pipe shall be designed, manufactured and tested in Accordance with the following Indian standards.

IS :1239 Part (1)	Steel Tubes, Tubular And Other Wrought Steel Fittings - Specification
IS: 2633/72 & IS: 6745/72	For galvanising testing
IS 1161 : 1998	Steel Tubes for Structural Purposes
IS 1387: 1993	General requirements for the supply of metallurgical materials
IS 228 :1987	Methods of chemical analysis of steels
IS 1161 : 1998	Steel Tubes for Structural Purposes
IS 2629 : 1985	Recommended Practice' for Hot-Dip Galvanizing of Iron and Steel
IS 2633 : 1986 IS	Methods for testing uniformity of coating of zinc coated articles
IS 2629 : 1985	Recommended Practice for Hot-Dip Galvanizing of Iron and Steel
IS 2500 :2000	Sampling of lot by lot

4. TESTS

All types of test including routine test shall be carried out according to IS: 1239-1 or its latest amendment.

5. INSPECTION:

The material shall be inspected and tested before dispatch by an authorized representative of the BSES in respect of quality. In case the supplier is not in position to get these tests carried out at his work, such test may get be carried out by hum at any NABL accredited lab at his own expenses.

6. TEST CERTIFICATES:

The supplier shall supply one set of test certificates from any NABL accredited lab in respect of quality as per IS: 1239-1 with latest amendment for approval of the purchaser.

7. INSPECTION AFTER RECEIPT AT STORE:

BSES inspector will inspect the material received at BSES Store and shall have right to reject if found different from the reports of pre-dispatch inspection.

8. MARKING:

The material shall be marked with the ISI certification mark.

I. Manufacture's name or trade mark
II. ISI mark with CML No.
III. Purchase no. shall be stencilled indelible link
IV. The manufacturer's identification symbol
V. Hot marking at every running meter Name/logo of manufacturer, ISI, class of tube i.e. L for Light colour of Band

9. PACKING:

The supplier shall be responsible for suitable packing of all the material and marking on the consignment, so as to avoid any damage during transport and storage and to ensure correct dispatch to the destination.

10. GTP FOR G.I. PIPE (40 MM):

S. No.	Technical particular	Unit	BSES Requirement	Vendor Data
1	Name of the manufacturer			
2	Ref IS No.		IS: 1239(Part-1) 2004	
3	Type(Light , Medium, Heavy)		Light	
4	Ends (Plain/ Screwed)		Plain	
5	Size	mm	40mm NB	
6	Thickness	mm	2.90mm	
7	Max & Min outside diameter	mm	48.4 (Max), 47.8 (Min)	
8	Length of pipe	mm	06 Mtrs. (±2%)	
9	Mass of tube	Kg/m	3.23	
10	Tolerance on thickness	%	(+) Not limited, (-) 8%	
11	Tolerance on Mass	%	+10 %, -8%	
12	Galvanizing thickness	Gm/m2	360gm/m2 (Min.)	
13	Tensile strength	N/mm2	320 N/mm2 (Min.)	
14	Elongation percent	%	20% (Min.)	
15	Embossing details		Hot marking on every metre Name/ logo of manufacturer, IS No., Class, ISI monogram	Name/logo of manufacturer, PO No,ISI,Class of tube i.e L for light,Colour of Band (PO no provided in stencil)
16	Color Coding		Yellow color band	
17	Make of steel		Tata/SAIL/Reputed make	
18	Chemical composition certificate		As per Table 1 of IS:1239 (Pt-I)-2004	
19	Max. permissible variation of chemical composition		As per Table 2 of IS:1239 (Pt-I)-2004	
20	Leak proof test		5MPA for atleast 3 sec.	
21	Tests			
21.1	Test of tensile strength		As per IS:1239 (Pt-I)-2004	
21.2	Bend test		As per IS:1239 (Pt-I)-2004	

11. GTP FOR G.I. PIPE (20 MM / 32 MM) :

S. No.	Technical particular	Unit	BSES Requirement	Vendor Data
1	Name of the manufacturer			
2	Ref IS No.		IS: 1239(Part-1) 2004	
3	Type(Light , Medium, Heavy)		Light	
4	Ends (Plain/ Screwed)		Plain	
5	Size	mm	20mm NB/ 32 mm NB	
6	Thickness	mm	2.30mm/2.60mm	
7	Max & Min outside diameter	mm	26.9 (Max), 26.4 (Min) for 20mm &42.5 (Max), 41.9 (Min) for 32mm	
8	Length of pipe	mm	06 Mtrs. (±2%)	
9	Mass of tube	Kg/m	1.38 for 20 mm & 2.54 for32 mm	
10	Tolerance on thickness	%	(+) Not limited, (-) 8%	
11	Tolerance on Mass	%	+10 %, -8%	
12	Galvanizing thickness	Gm/m2	360gm/m2 (Min.)	
13	Tensile strength	N/mm2	320 N/mm2 (Min.)	
14	Elongation percent	%	12% (Min.)	
15	Embossing details		Hot marking on every metre Name/ logo of manufacturer, IS No., Class, ISI monogram	Name/logo of manufacturer, PO No,ISI,Class of tube i.e L for light,Colour of Band (PO no provided in stencil)
16	Color Coding		Yellow color band	
17	Make of steel		Tata/SAIL/ESSAR	
18	Chemical composition certificate		As per Table 1 of IS:1239 (Pt-I)-2004	
19	Max. permissible variation of chemical composition		As per Table 2 of IS:1239 (Pt-I)-2004	
20	Leak proof test		5MPA for atleast 3 sec.	
21	Tests			
21.1	Test of tensile strength		As per IS:1239 (Pt-I)-2004	
21.2	Bend test		As per IS:1239 (Pt-I)-2004	

12. GTP FOR G.I. PIPE (100 MM) :

S. No.	Technical particular	Unit	BSES Requirement	Vendor Data
1	Name of the manufacturer			
2	Ref IS No.		IS: 1239(Part-1) 2004	
3	Type(Light , Medium, Heavy)		Light	
4	Ends (Plain/ Screwed)		Plain	
5	Size	mm	100mm NB	
6	Thickness	mm	3.60 mm	
7	Max & Min outside diameter	mm	113.9 (Max), 113.0 (Min)	
8	Length of pipe	mm	06 Mtrs. (±2%)	
9	Mass of tube	Kg/m	9.75	
10	Tolerance on thickness	%	(+) Not limited, (-) 8%	
11	Tolerance on Mass	%	+10 %, -8%	
12	Galvanizing thickness	Gm/m2	360gm/m2 (Min.)	
13	Tensile strength	N/mm2	320 N/mm2 (Min.)	
14	Elongation percent	%	20% (Min.)	
15	Embossing details		Hot marking on every metre Name/ logo of manufacturer, IS No., Class, ISI monogram	Name/logo of manufacturer, PO No,ISI,Class of tube i.e L for light,Colour of Band (PO no provided in stencil)
16	Color Coding		Yellow color band	
17	Make of steel		Tata/SAIL/Reputed make	
18	Chemical composition certificate		As per Table 1 of IS:1239 (Pt-I)-2004	
19	Max. permissible variation of chemical composition		As per Table 2 of IS:1239 (Pt-I)-2004	
20	Leak proof test		5MPA for atleast 3 sec.	
21	Tests			
21.1	Test of tensile strength		As per IS:1239 (Pt-I)-2004	
21.2	Bend test		As per IS:1239 (Pt-I)-2004	

13.0 **GTP FOR GI EARTHING PIPE DIA 40 MM X 2.50 MTR CLASS B:**

S. No	Parameter	Unit	Requirement	Vendor Data
1	Name of Manufacturer			
2	Ref IS No		IS 1239 (Part-1) 2004	
3	Type (Light, Medium, Heavy)*		Medium	
4	Size	mm	40mm NB dia	
5	Thickness	mm	3.2 MM	
6	Max & Min outside diameter of tube	mm	48.8 mm (max) & 47.9 (min)	
7	Length of Pipe	Mtr	2500 MM (+ 6 mm & - NOT ACCEPTABLE)	
8	Mass of Tube	Kg/m	3.56 Kg/m	
9	Tolerance on thickness		(+) Not limited, (-) 8%	
10	Tolerance on Mass		(+/-)10%	
11	Galvanising thickness	Microns	80 Microns (min)	
12	Tensile strength		320 N/mm2 (Mpa) (min)	
13	Elongation percent	%	20%	
14	Embossing details		Hot marking on every meter Name/logo of manufacturer, ISI monogram, Color of band (Blue Color)	
15	Chemical composition certificate		Chemical composition test to be carried out on one sample and sealed by BSES representative	
16	Max permissible variation of chemical composition		As per IS 10748	
17	Tests			
17.1	Leak tightness test (Hydrostatic test)		NA	
17.2	Test on finished tube		As per IS 1239 (Part-1)	
17.3	Bend test		As per IS 1239 (Part-1)	
18	General			
18.1	Supply of 6 Nos of M10*30mm elctrogalvanised Nuts+bolts+Plain & Spring Washer		Shall be provided	
18.2	Drawing		Shall be submitted	
19	GI Strip Size	mm	50 X 6	

*Pipe may be perforated or non-perforated, BRPL may ask as per requirement. Bidder has to provide the same.

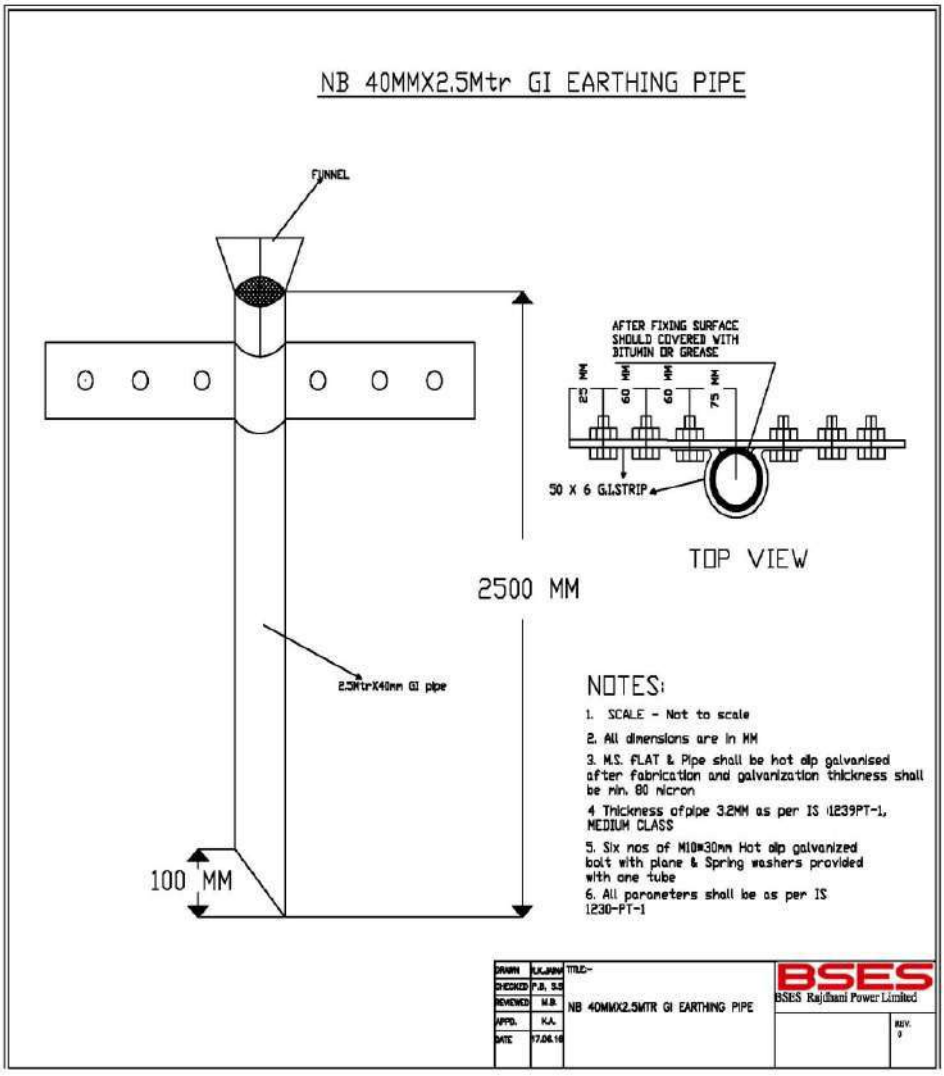


Fig. 1 G.I. EARTHING PIPE DIA 40 MM X 2.50 MTR CLASS B

13. INSPECTION TESTING CRITERIA:

QUALITY ASSURANCE PLAN FOR ERW PIPES

ITEM : Conduit Pipe Galvanized as per IS:1239(Pt.-I)

S. NO.	COMPONANT / OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	INSP. AGENCY M	INSP. AGENCY TPI	REMARKS
01.	RAW MATERIAL H.R.COIL	1) CHEMICAL COMPOSITION 2) Physical Properties (Mechaneal tests) 3) Thickness & Widt	MAJOR	Chemical Analysis	Each Cast/Heat	IS:1239 & IS:1078	IS:1239 (Part-I)-04 & IS:1078	Raw Material Test Certificates/ Mfr. Test Certificate	W	R	
02	IN PROCESS INSPECTION	i) Visual & Dimensional	MAJOR								
		a) Surface Finish		Visual	One hour production (Shift Wise)	IS:1239	IS:1239 (Part-I)-04	In-process inspection report	W	--	
		b) Diameter		Dimensional							
		c) Thickness									
		d) Length									
		e) Weight:									
		f) Straightness									
		ii) Physical Properties		Mechanical Testing	Two sample per shift	-- do --	-- do --	Test report	W	--	
		Tensile Strength									
		Bend Test									
		iii) Galvanizing Tests		Galvanizing Testing	Two sample per shift	IS:4736	IS:4736	Test report	W	--	
		Mass of zinc & uniformity									
		vii) Leak test		Hydrostatic Pressure	100% in process	-- do --	IS:1239	Test report	W	--	
		viii) Identification & marking		Visual	Each Pipe	IS:1239	IS:1239 & P.O.	--------	W	--	
03	FINAL INSPECTION (ERW PIPES)	i) Visual & Dimensional	MAJOR	Visual and Measurement	As per IS:4711	S:1239 & Approved data sheet	IS:1239 & Approved data sheet	Test report	P	W	
		iii) Mechanical Testing		Tensile Strength Bend/Flattening test	One sample per Heat	S:1239 & Approved data sheet	IS:1239 & Approved data sheet	Test report	P	W	
		iv) Galvanizing Testing		Mass of zinc coating	One sample per Lot	IS:4733	IS:4736	Test report	P	W	
		v) Colour Band		Colour identification	IS:4711	IS:1239	IS:1239	------	P	R/W	
		vii) Identification marking & Workmanship		Visual	Random	IS:1239 & P.O.	IS:1239 & P.O.	--------	P	R/W	
		viii) Inspection Release Note & Documents		All documents	100%	IS:1239 & P.O.	IS:1239 & P.O.	All documents	P	Issued	

Note: One sample to be identified by TPI for Chemical Testing at NABL approved Lab.

R= Review W= Witness H= Hold M= Manufacturer R/W= Random Witness TPI = Third Party Inspection

Note: -

- GI Earthing pipe : Hot marking on every meter Name/logo of manufacturer, ISI monogram, Color of band (Blue Color)
- GI conduit pipe : Hot marking on every meter Name/logo of manufacturer, ISI monogram, Color of band (Yellow Color)

BSES

Technical Specification for

G.I. Conduit Pipes

and

Earthing Pipe

Specification no – GN101-03-SP-97-00

Prepared By		Reviewed By		Approved By		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
S.K. Yadav Pronab Bairagi		Amit Tomar	11/01/18	Vijay Panpalia		R0	11.01.18

INDEX

1. SCOPE OF SUPPLY

The specification covers the manufacturing, testing and inspection of G.I Conduit & Earthing Pipe

2. CLIMATIC CONDITION

The material to be supplied against this specification shall be suitable for satisfactory operation under following climatic condition

Location : At various location in the Delhi	
Maximum ambient temperature (°C)	50
Minimum ambient temperature (°C)	0
Maximum altitude above mean sea level (m)	1000
Relative Humidity (%)	100
Rainy month	June to October
Maximum Rainfall (mm)	1450
Wind Pressure (Kg/Sq.m)	195
Seismic Zone	Zone IV as per IS : 1893

3. CODES & STANDARDS

The G.I. Conduit Pipe shall be designed, manufactured and tested in Accordance with the following Indian standards.

IS :1239 Part (1)	Steel Tubes, Tubular And Other Wrought Steel Fittings - Specification
IS: 2633/72 & IS: 6745/72	For galvanising testing
IS 1161 : 1998	Steel Tubes for Structural Purposes
IS 1387: 1993	General requirements for the supply of metallurgical materials
IS 228 :1987	Methods of chemical analysis of steels
IS 1161 : 1998	Steel Tubes for Structural Purposes
IS 2629 : 1985	Recommended Practice' for Hot-Dip Galvanizing of Iron and Steel
IS 2633 : 1986 IS	Methods for testing uniformity of coating of zinc coated articles
IS 2629 : 1985	Recommended Practice for Hot-Dip Galvanizing of Iron and Steel
IS 2500 :2000	Sampling of lot by lot

4. **TESTS**

All types of test including routine test shall be carried out according to IS: 1239-1 or its latest amendment.

5. **INSPECTION:**

The material shall be inspected and tested before dispatch by an authorized representative of the BSES in respect of quality. In case the supplier is not in position to get these tests carried out at his work, such test may get be carried out by hum at any NABL accredited lab at his own expenses.

6. **TEST CERTIFICATES:**

The supplier shall supply one set of test certificates from any NABL accredited lab in respect of quality as per IS: 1239-1 with latest amendment for approval of the purchaser.

7. **INSPECTION AFTER RECEIPT AT STORE:**

BSES inspector will inspect the material received at BSES Store and shall have right to reject if found different from the reports of pre-dispatch inspection.

8. **MARKING:**

The material shall be marked with the ISI certification mark.

I. Manufacture's name or trade mark
II. ISI mark with CML No.
III. Purchase no. shall be stencilled indelible link
IV. The manufacturer's identification symbol
V. Hot marking at every running meter Name/logo of manufacturer, ISI, class of tube i.e. L for Light colour of Band

9. **PACKING:**

The supplier shall be responsible for suitable packing of all the material and marking on the consignment, so as to avoid any damage during transport and storage and to ensure correct dispatch to the destination.

10. GTP FOR G.I. PIPE (40 MM):

S. No.	Technical particular	Unit	BSES Requirement	Vendor Data
1	Name of the manufacturer			
2	Ref IS No.		IS: 1239(Part-1) 2004	
3	Type(Light , Medium, Heavy)		Light	
4	Ends (Plain/ Screwed)		Plain	
5	Size	mm	40mm NB	
6	Thickness	mm	2.90mm	
7	Max & Min outside diameter	mm	48.4 (Max), 47.8 (Min)	
8	Length of pipe	mm	06 Mtrs. (±2%)	
9	Mass of tube	Kg/m	3.23	
10	Tolerance on thickness	%	(+) Not limited, (-) 8%	
11	Tolerance on Mass	%	+10 %, -8%	
12	Galvanizing thickness	Gm/m2	360gm/m2 (Min.)	
13	Tensile strength	N/mm2	320 N/mm2 (Min.)	
14	Elongation percent	%	20% (Min.)	
15	Embossing details		Hot marking on every metre Name/ logo of manufacturer, IS No., Class, ISI monogram	Name/logo of manufacturer, PO No,ISI,Class of tube i.e L for light,Colour of Band (PO no provided in stencil)
16	Color Coding		Yellow color band	
17	Make of steel		Tata/SAIL/Reputed make	
18	Chemical composition certificate		As per Table 1 of IS:1239 (Pt-I)-2004	
19	Max. permissible variation of chemical composition		As per Table 2 of IS:1239 (Pt-I)-2004	
20	Leak proof test		5MPA for atleast 3 sec.	
21	Tests			
21.1	Test of tensile strength		As per IS:1239 (Pt-I)-2004	
21.2	Bend test		As per IS:1239 (Pt-I)-2004	

11. GTP FOR G.I. PIPE (20 MM / 32 MM) :

S. No.	Technical particular	Unit	BSES Requirement	Vendor Data
1	Name of the manufacturer			
2	Ref IS No.		IS: 1239(Part-1) 2004	
3	Type(Light , Medium, Heavy)		Light	
4	Ends (Plain/ Screwed)		Plain	
5	Size	mm	20mm NB/ 32 mm NB	
6	Thickness	mm	2.30mm/2.60mm	
7	Max & Min outside diameter	mm	26.9 (Max), 26.4 (Min) for 20mm &42.5 (Max), 41.9 (Min) for 32mm	
8	Length of pipe	mm	06 Mtrs. (±2%)	
9	Mass of tube	Kg/m	1.38 for 20 mm & 2.54 for32 mm	
10	Tolerance on thickness	%	(+) Not limited, (-) 8%	
11	Tolerance on Mass	%	+10 %, -8%	
12	Galvanizing thickness	Gm/m2	360gm/m2 (Min.)	
13	Tensile strength	N/mm2	320 N/mm2 (Min.)	
14	Elongation percent	%	12% (Min.)	
15	Embossing details		Hot marking on every metre Name/ logo of manufacturer, IS No., Class, ISI monogram	Name/logo of manufacturer, PO No,ISI,Class of tube i.e L for light,Colour of Band (PO no provided in stencil)
16	Color Coding		Yellow color band	
17	Make of steel		Tata/SAIL/ESSAR	
18	Chemical composition certificate		As per Table 1 of IS:1239 (Pt-I)-2004	
19	Max. permissible variation of chemical composition		As per Table 2 of IS:1239 (Pt-I)-2004	
20	Leak proof test		5MPA for atleast 3 sec.	
21	Tests			
21.1	Test of tensile strength		As per IS:1239 (Pt-I)-2004	
21.2	Bend test		As per IS:1239 (Pt-I)-2004	

12. GTP FOR G.I. PIPE (100 MM) :

S No.	Technical particular	Unit	BSES Requirement	Vendor Data
1	Name of the manufacturer			
2	Ref IS No.		IS: 1239(Part-1) 2004	
3	Type(Light , Medium, Heavy)		Light	
4	Ends (Plain/ Screwed)		Plain	
5	Size	mm	100mm NB	
6	Thickness	mm	3.60 mm	
7	Max & Min outside diameter	mm	113.9 (Max), 113.0 (Min)	
8	Length of pipe	mm	06 Mtrs. (±2%)	
9	Mass of tube	Kg/m	9.75	
10	Tolerance on thickness	%	(+) Not limited, (-) 8%	
11	Tolerance on Mass	%	+10 %, -8%	
12	Galvanizing thickness	Gm/m2	360gm/m2 (Min.)	
13	Tensile strength	N/mm2	320 N/mm2 (Min.)	
14	Elongation percent	%	20% (Min.)	
15	Embossing details		Hot marking on every metre Name/ logo of manufacturer, IS No., Class, ISI monogram	Name/logo of manufacturer, PO No,ISI,Class of tube i.e L for light,Colour of Band (PO no provided in stencil)
16	Color Coding		Yellow color band	
17	Make of steel		Tata/SAIL/Reputed make	
18	Chemical composition certificate		As per Table 1 of IS:1239 (Pt-I)-2004	
19	Max. permissible variation of chemical composition		As per Table 2 of IS:1239 (Pt-I)-2004	
20	Leak proof test		5MPA for atleast 3 sec.	
21	Tests			
21.1	Test of tensile strength		As per IS:1239 (Pt-I)-2004	
21.2	Bend test		As per IS:1239 (Pt-I)-2004	

13.0 GTP FOR GI EARTHING PIPE DIA 40 MM X 2.50 MTR CLASS B:

S. No	Parameter	Unit	Requirement	Vendor Data
1	Name of Manufacturer			
2	Ref IS No		IS 1239 (Part-1) 2004	
3	Type (Light, Medium, Heavy)*		Medium	
4	Size	mm	40mm NB dia	
5	Thickness	mm	3.2 MM	
6	Max & Min outside diameter of tube	mm	48.8 mm (max) & 47.9 (min)	
7	Length of Pipe	Mtr	2500 MM (+ 6 mm & - NOT ACCEPTABLE)	
8	Mass of Tube	Kg/m	3.56 Kg/m	
9	Tolerance on thickness		(+) Not limited, (-) 8%	
10	Tolerance on Mass		(+/-)10%	
11	Galvanising thickness	Microns	80 Microns (min)	
12	Tensile strength		320 N/mm2 (Mpa) (min)	
13	Elongation percent	%	20%	
14	Embossing details		Hot marking on every meter Name/logo of manufacturer, ISI monogram, Color of band (Blue Color)	
15	Chemical composition certificate		Chemical composition test to be carried out on one sample and sealed by BSES representative	
16	Max permissible variation of chemical composition		As per IS 10748	
17	Tests			
17.1	Leak tightness test (Hydrostatic test)		NA	
17.2	Test on finished tube		As per IS 1239 (Part-1)	
17.3	Bend test		As per IS 1239 (Part-1)	
18	General			
18.1	Supply of 6 Nos of M10*30mm elctrogalvanised Nuts+bolts+Plain & Spring Washer		Shall be provided	
18.2	Drawing		Shall be submitted	
19	GI Strip Size	mm	50 X 6	

*Pipe may be perforated or non-perforated, BRPL may ask as per requirement. Bidder has to provide the same.

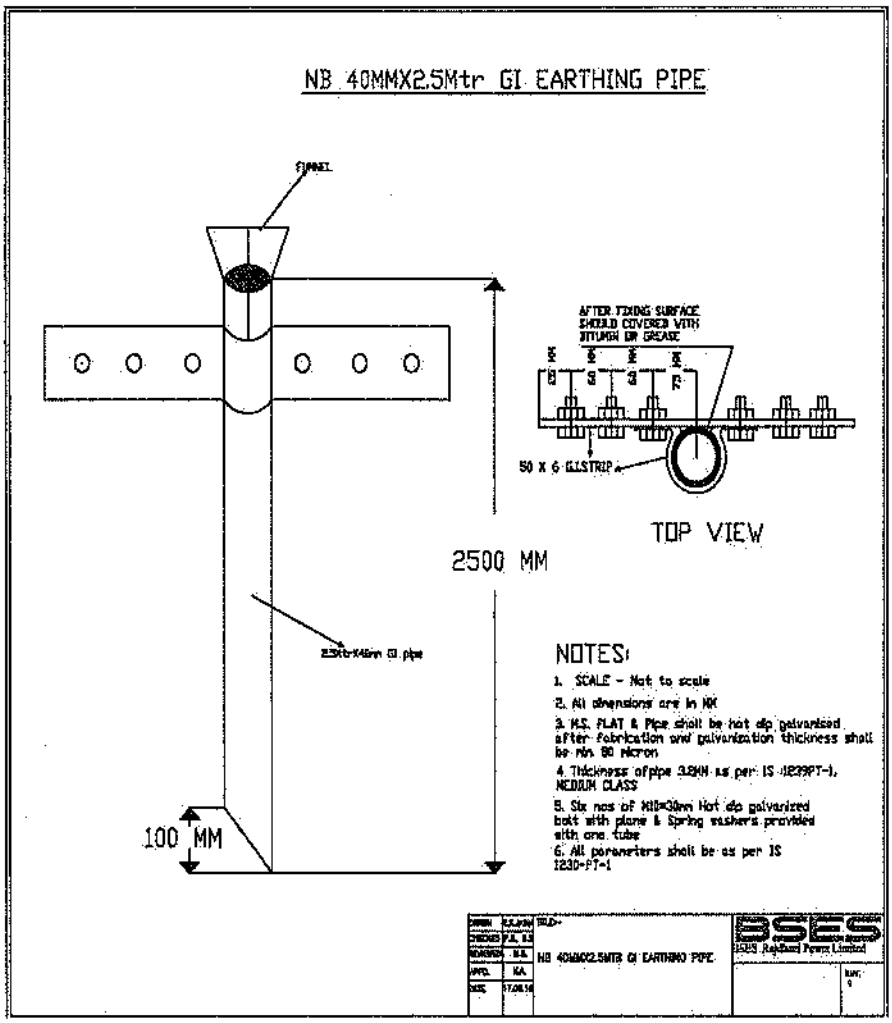


Fig. 1 G.I. EARTHING PIPE DIA 40 MM X 2.50 MTR CLASS B

13. INSPECTION TESTING CRITERIA:

QUALITY ASSURANCE PLAN FOR ERW PIPES

ITEM : Conduit Pipe Galvanized as per IS:1239(Pt-I)

S. NO.	CONSTITUENT OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	INSP. AGENCY M	INSP. AGENCY TP	REMARKS
01	RAW MATERIAL IN COIL	i) CHEMICAL COMPOSITION 2) Physical Properties (Mechanical tests) 3) Thickness & Width	MAJOR	Chemical Analysis	Each Cast/Heat	IS:1239 & IS:1730	IS:1239 (Part-I)-04.5 & IS:1045	Raw Material Test Certificate/ Mill Test Certificate	W	R	
02	IN PROCESS INSPECTION	ii) Visual & Dimensional									
		a) Surface Finish	MAJOR	Visual	One hour production (Shift Wise)	IS:1239	IS:1239 (Part-I)-04	In-process inspection report	W	-	
		b) Diameter		Dimensions							
		c) Thickness									
		d) Length									
		e) Weight									
		f) Straightness									
		g) Physical Properties Tensile Strength Bend Test		Mechanical Testing	Two sample per shift	-do-	-do-	Test report	W	-	
		h) Galvanizing Test. Mass of Zinc & Uniformity		Galvanizing Testing	Two sample per shift	IS:4736	IS:4736	Test report	W	-	
		i) Leak test		Hydrostatic Pressure	100% process	-do-	IS:1239	Test report	W	-	
		ii) Identification & marking		Visual	Each Size	IS:1239	IS:1239 & P.O.	------	W	-	
03	FINAL INSPECTION (ERW TUBES)	i) Visual & Dimensional	MAJOR	Visual and Measurement	As per IS:4711	IS:1239 & Approved data sheet	IS:1239 & Approved data sheet	Test report	P	W	
		ii) Mechanical Testing		Tensile Strength Bend/Flattening test	One sample per lot	IS:1239 & Approved data sheet	IS:1239 & Approved data sheet	Test report	P	W	
		iii) Galvanizing Testing		Mass of zinc coating	One sample per Lot	IS:4736	IS:4736	Test report	P	W	
		c) Coarse Earth		Colour identification	IS:4711	IS:1239	IS:1239	------	P	R/W	
		d) Identification marking & Workmanship		Visual	Random	IS:1239 & P.O.	IS:1239 & P.O.	------	P	R/W	
		e) Inspection Release Note & Documents		All comments	100%	IS:1239 & P.O.	IS:1239 & P.O.	All documents	P	Issued	

Note: One sample to be identified by TPI for Chemical Testing at NABL approved Lab.

R=Review W= Witness H= Hold M=Manufacturer RW= Random Witness TPI = Third Party Inspection

Note: -

- GI Earthing pipe : Hot marking on every meter Name/logo of manufacturer, ISI monogram, Color of band (Blue Color)
- GI conduit pipe : Hot marking on every meter Name/logo of manufacturer, ISI monogram, Color of band (Yellow Color)

BSES

TECHNICAL SPECIFICATION

OF

GI STRIP

Specification No- GN101-03-SP-150-00

BSES RAJDHANI POWER LTD			
Prepared by	Abhay Gupta		Rev : 00
	Pronab Bairagi		
Reviewed by	Amit Tomar		Date : 5-Nov-18
Approved by	K. Sheshadri		Page : 1 of 13
Registered Office: BSES Bhawan, Nehru Place, Delhi - 110019			

BSES Rajdhani Power Ltd	GN101-03-SP-150-00

TECHNICAL SPECIFICATION OF GI STRIP

TABLE OF CONTENTS

TECHNICAL SPECIFICATION OF GI STRIP

REVISION RECORD

Rev. No.	Revision Date	Item/ clause no:	Page No.	Nature of Change	Approved by

TECHNICAL SPECIFICATION OF GI STRIP

1.0 SCOPE

This specification covers design, manufacture, testing, inspection and supply of GI strip for earthing (50X6mm and 25X6mm) (Heavy duty) for satisfactory operations in Sub-station / Project site at different locations under BSES Rajdhani Power Ltd, New Delhi.

2.0 STANDARDS

Material shall confirm to the latest applicable Indian standards (IS) which shall mean latest revisions, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification.

S. No.	International/ Indian Standard	Title
1	IS:2629 (1966)	Recommended practice for hot dip galvanized iron Earthing strips
2	IS:2633 (1986)	Methods of testing uniformity of coating on Zinc coated articles
3	IS:5358 (1969)	Specification for hot dip galvanized coating on fasteners
4	IS:3203	Specification for electroplating
5	IS:4759 (1968)	Specification for hot dip Zinc coating on structural & other allied products
6	IS:2062 Grade 'A' quality	Specification for MS channel and MS flat
7	IS:2062	Chemical and physical composition material
8	IS:1852	Rolling and cutting tolerances for Hot rolled steel products
9	IS:6745	Specification for methods for the determination of the mass of Zn coated Iron and steel articles

TECHNICAL SPECIFICATION OF GI STRIP

3.0 CLIMATIC CONDITIONS

a)	Average grade atmospheric condition	Heavily polluted, dry
b)	Maximum altitude above sea level	1000 M
c)	Air temperature Ambient	i) Highest : 50°C ii) Average : 30°C iii) Minimum : 0°C
e)	Relative Humidity	100 % max
f)	Thermal Resistivity of Soil	150°C. cm / W (max.)
g)	Seismic Zone	4
h)	Rainfall	750 mm concentrated in four months

4.0 GENERAL TECHNICAL REQUIREMENT

4.1 GENERAL REQUIREMENTS

- The specification is for the sizes 50X6 mm and 25X6 mm GI Strip
- Fully galvanized iron strips shall be used in switchyard. Galvanized Iron strips shall confirm to IS: 2629 (1966). The Zinc deposition should not be more than 610 g / m^2 of the galvanized surface area of the MS strip.
- All galvanized materials shall withstand test as per IS: 2633 (1972). The weight of zinc coating shall be determined as per the method stipulated in IS: 2633(1964).
- The standard length of Galvanized Iron Earthing Strip shall be minimum 7 Meters and not exceeding 10 Meters.

- Uniform Zinc coating is required.

4.2 PHYSICAL AND CHEMICAL PROPERTIES

Physical-

The GI flat shall be supplied in 7m to 10m lengths.

The weight of GI flat shall be witnessed by BRPL at the time of taking delivery. The weight recorded in the material receipt certificate issued by BRPL shall be final.

Mechanical Properties (minimum requirement)		
1	Tensile strength (kgf/mm2)	410 kgf/mm^2
2	Yield stress (min.) for thickness <20mm	26 kgf/mm^2 or 250 N/mm^2
3	Elongation (%)	23%
4	Bend test	Minimum 3 times the thickness of material
5	Zinc coat thickness	70 microns

Chemical-

Chemical Properties		
S.No	**Element**	**%**
1	Iron	98.32
2	Carbon	0.204
3	Silicon	0.158
4	Manganese	0.510
5	Sulphur	0.028

TECHNICAL SPECIFICATION OF GI STRIP

Chemical Properties		
S.No	**Element**	**%**
6	Phosphorous	0.0320
7	Nickel	0.040
8	Chromium	0.086
9	Molybdenum	<0.01
10	Aluminium	<0.01
11	Copper	<0.104
12	Titanium	<0.005
13	Niobium	<0.01
14	Cobalt	<0.01
15	Boron	<0.0005
16	Lead	<0.01
17	Vanadium	<0.01
18	Zirconium	<0.006

4.3 METHODS OF GALVANIZING

S.No	Tests	For GI Flat
1	Dip test	4 dips of 1 min each
2	Mass of Zinc coating	610 g/m^2 (minimum)

- Pre dispatch inspection shall be performed to witness following tests:
  - Freedom from defects
  - Verification of dimensions
  - Galvanization tests
  - Mechanical tests
  - Chemical composition tests
- These tests are to be performed and certified at NABL accredited third party laboratory.
- MS Flat shall conform to IS 2062 and its latest amendments for steel and galvanization as per IS 4759 and its latest amendments.
- The flat shall be coated with Zn 98- Zinc grade
- The minimum Zn coating shall be 610 g/m^2 for thickness more than 5mm

4.4 MARKING

The bidder shall put his identification marks on the finished materials along with ISI mark, Manufacturer's name, PO No. and BRPL name. This mark shall be in "legible English letters".

4.5 DIMENSIONS TOLERANCE

Width = ±2.5%

Thickness = ±0.5%

5.0 TESTING

Type Test

Product shall be type tested from NABL accredited lab and same shall be submitted to BRPL. Type test report should not be older than 5 years old. Vendor shall conduct the type test (as per the relevant IS (Refer Clause 2.0 of this technical specification)) from BRPL sample from NABL accredited lab if type test report is older than 5 years without any cost implications to BRPL. Following type tests shall be conducted mandatorily-

i. Uniformity in thickness
ii. Mass of Zn coating
iii. Adhesion test
iv. Knife test for Zn coated hardware and assembled Steel products
v. Bend and wrapping test

vi. Tensile test

vii. Chemical composition test

viii. Freedom from defects

BRPL reserve the right to seal the sample once per PO for type testing from NABL accredited lab if required. Bidder has to conduct the type test on BRPL requirement. Expenses for type testing shall be borne by bidder.

Acceptance test

i. **Freedom from defects**

The Zinc coating shall be adherent, smooth, reasonably bright, continuous and free from imperfections as flux, ash and dross inclusions, bare and black spots, lumpiness and runs, rust stuns, bulky white deposits and blisters.

ii. **Uniformity in thickness**

Galvanized articles shall be tested for uniformity in thickness of coating in accordance with Preece test given in IS 2633- 1986.

iii. **Mass of Zn Coating**

Mass of Zinc coating shall be determined in accordance with IS 6745- 1972.

iv. **Adhesion test**

The adherence of the Zinc coat on steel shall be determined by the pivoted hammer test. The hammer shall be made of normalized 0.3 – 0.4 percent carbon steel (Shall be in accordance with IS: 2629 – 1985).

v. **Knife test for Zn coated hardware and assembled Steel products**

When the coating is cut or pried into, such as with a stout knife applied with considerable pressure in a manner tending to remove a portion of the coating, it shall only be possible to remove small particles of the coating and it shall not be possible to peel any portion of the coating so as to expose the underlying iron or steel (Shall be in accordance with IS: 2629 – 1985).

vi. Bend and wrapping test

vii. Tensile test

viii. Chemical composition test

6.0 INSPECTION

- The representative of Purchaser shall pick up samples at random from the GI strips offered for carrying out routine tests as per specified IS.
- The materials to be supplied will be subject to inspection and approval by BRPL's representative before dispatch and / or on arrival at the destination.
- Inspection before dispatch shall not relieve the bidder of their responsibility to supply the steel section strictly in accordance with the specification.
- The bidders shall abide by all the statutory provisions, acts such as the Indian Electricity Act, Indian factory Act, Indian Boiler Act etc. and corresponding rules and regulations as may be applicable and as amended from time to time.
- BRPLs representative shall be entitled at all reasonable time during manufacturing to inspect, examine and test at the bidders premises the materials and workmanship of the steel section to be supplied.
- As soon as the steel section is ready for testing, the bidder shall intimate BRPL well in advance.
- The material shall not be dispatched unless waiver of inspection is obtained or inspected by BRPL's authorized representative.
- The test certificate shall be in accordance with the latest version of the relevant Indian Standard or any equivalent International standards.
- The acceptance of any batch /lot shall in no way relieve the bidder of any of his responsibilities for meeting all the requirements of the specification and shall not prevent subsequent rejection of any item if the same later found defective.
- The purchaser reserves the right to reject on inspection after the same is received at destination.

7.0 STORING, PACKING AND HANDLING

Sufficient care shall be exercised while storing, packing and handling of galvanized products. While storing and transporting them, adequate ventilation shall be provided as otherwise 'rust' or 'wet storage stain' may result when galvanized coatings reacts with humidity and atmospheric gases. Galvanized articles can also be stored with spacers in between them, they shall also be kept at an inclination to facilitate drainage of water if collected on the articles. Post treatment like chromating shall be provided to minimize the chances of formation of white rust.

8.0 DOCUMENTATION

Submission of drawings, calculations, catalogues, manuals, test reports shall be as mentioned below:

8.1DRAWING, DATA AND MANUALS

Cross-Sectional drawing shall show every feature of construction. This drawing shall also state the text to be printed over the GI Strip, font sizes to be used, additional text if any etc.

8.2 DOCUMENTS TO BE SUBMITTED ALONG WITHBID FOR TECHNICAL JUSTIFICATION

The vendor shall submit-

- Cross sectional drawing
- GTP (all data to appear)
- Type test certificates

Document Submission

Submission of drawings, calculations, catalogues, manuals, test reports shall be as follows.

Legend:

GTP : Guaranteed Technical Particulars

TTR : Type Test Report

RTR : Routine Test Report

	Documents Along with offer	After award of contract- for Approval	Final documents(after Approval)
GTP	1 copies	** 1 soft copy	** 1 soft copy + CD
Drawings	1 copies	** 1 soft copy	** 1 soft copy + CD
Calculations	1copies	** 1 soft copy	** 1 soft copy + CD
Catalogues & Manual	1 copy each		** 1 soft copy + CD
Test Report	1 copy each of TTR and sample RTR		** 1 soft copy + CD

** Soft copy and CD shall contain documents duly approved, signed and scanned

- The manufacturing of the GI Strip shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the BRPL. All manufacturing and fabrication work in connection with the GI Strip prior to the approval of the drawing shall be at manufacturer's risk.
- Approval of drawing etc. by the BRPL shall not relieve the Manufacturer of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices. The GI Strip shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and BRPL shall have the power to reject any work or material which in his judgment is not in full accordance therewith.

8.3 WARRANTY

Warranty shall be 5 years minimum. All the relevant documents shall be submitted by the bidder in support to warranty terms and conditions.

9.0 DEVIATIONS

a) Deviations from this specification shall be listed separately by bidder clause wise (format given below) along with optional offer and has to submit the list along with bid/quotation. BRPL will review the deviations and if BRPL is agreed with the deviation, seller has to take written confirmation from BRPL on deviation during tender evaluation.

a) In the absence of any separate list of deviations from the bidders with bid as well as written confirmation from BRPL on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully.

b) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BRPL old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.

Deviation Sheet Format-

S.No	Document Name	Clause No.	Deviation	Reason	Merits to BRPL