

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

SL NO	COMPONENT & CHARACTERISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	arrangement				/DRG	/DRG					
3.2	Lead arrangement	Critical	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
3.3	Tap & Lead End Brazing & Insulation	Critical	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
3.4	Dimension of Coil After Shrinkage	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
3.5	Verification of Major electrical clearances	Major	Visual & Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
3.6	HV/LV Connection	Major	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
4.0	Core-Coil Assembly Before Ovening										
4.1	Initial Ratio test	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
5.0	Core-coil assembly during drying										
5.1	Measurement & recording of temperature & drying time during vacuum treatment.	Major	Visual	100%	MFR.Data /DRG	MFR.Data /DRG	QC report	--	P	R	
5.2	Check for completeness of drying	Major	Visual	100%	MFR.Data /DRG	MFR.Data /DRG	QC report	--	P	R	
5.3	Certification of all test	Major	Visual	100%	MFR.Data /DRG	MFR.Data /DRG	QC report	--	P	R	



BSES-TS-24-TRPU-R0

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

SL NO	COMPONENT & CHARACTERISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
6.0	Core-Coil Assembly After Overing										
6.1	Ratio Test & Magnetic Balance test	Major	Electrical	100%	-DO-	-DO-	-DO-	--	P	W	
6.2	Recording of time/Temp, Vacuum	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
6.3	Record of Moisture extract	Major	Measurement	100%	MFR. STD	MFR. STD	QC report	--	P	R	
6.4	Verification of completeness & Drying	Major	Verify	100%	MFR. STD	MFR. STD	QC report	--	P	R	
6.5	Insulation resistance measurement by Megger	Major	Electrical	100%	MFR. STD	MFR. STD	Test report	--	P	R	
6.6	Earthing connection	Major	Visual	-DO-	MFR. STD	MFR. STD	QC Report	--	P	R	
7.0	Tanking										
7.1	Electrical clearance arrangement	Major	Measurement	100%	MFR. DRG	MFR. DRG	QC report	--	P	R	
7.2	Verification of Core-Frame Clamping arrangement	Major	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
7.3	Core to frame insulation resistance test & HV test at 2 KV for min	Major	Electrical	100%	-DO-	-DO-	-DO-	--	P	R	



BSES-TS-24-TRPU-R0

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

SL NO	COMPONENT & CHARACTERISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
8.0	Final Assembly for testing										
8.1	Fittings of external accessories	Major	Visual	100%	MFR. STD /DRG	MFR. STD /DRG	Job Card	--	P	R	
8.2	Internal Oil leakage test on main unit	Major	Visual	100%	CBIP	CBIP	QC report	--	P	R	
C	Final testing										
1	Routine Test										
1.1	Voltage Ratio test	Major	Electrical	100%	IS 2026	IS 2026	Test Report	--	P	W	
1.2	Winding Resistance at all tap corrected to 75°C	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.3	No Load Loss & Current @90%,100%&110% of rated voltage	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	To be repeated after type test.
1.4	Impedance Voltage/Short Circuit Impedance(Principal Tap) Load Loss @Principal, Max, Mini Tap	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.5	Induced over voltage	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	To be repeated after Impulse test
1.6	Separate Source Voltage	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

SL NO	COMPONENT & CHARACTERISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	Test										
1.7	Insulation Resistance & PI(10 min / 1 min)	Major	Electrical	100%	--	--	Test report	--	P	W	By 5 KV Megger PI Shall be more than 1.5
1.8	Voltage Vector Relationship & Polarity	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.9	Magnetic Balance Test	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.10	Oil leakage test	Major	Visual	100%	CBIP	CBIP	Test report	--	P	W	
1.11	Auxiliary circuit insulation test for OLTC, 2.0 KV AC for 1 min	Major	Electrical	100%	--	Withstand 2 KV for 1 min	Test report	--	P	W	
1.12	Polarity check & Ratio Test of LVWTI CT/ HVWTI CT & NCT	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.13	Magnetic circuit Test at 2KV between Core & Frame	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.14	Measurement of auxiliary losses(Losses taken by Fan)	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.15	BDV test on Transformer Oil	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

SL NO	COMPONENT & CHARACTERISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
1.16	Routine Test on Tank	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.17	Power frequency withstand on auxiliary circuit	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.18	Measurement of Cap & tandelta of Wdg, Oil and HV bushing	Major	Electrical	100%	--	--	Test report	--	P	W	
1.19	Excitation & Knee point Vol. of PS Core of NCT.	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.20	Routine (Functional) Test on OLTC	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.21	SFRA	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
2.0	Type test (One unit of each type and rating of Transformer)										
2.1	Heat Run Test (Temp. Rise Test)	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	--	P	W	
2.2	Impulse withstand Test on all HV & LV Limb for Chopped wave.	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	--	P	W	
2.3	DGA Test Before & After temperature rise	Major	Testing	One Unit	Relevant std.	Relevant std.	Test Report	--	P	W	
2.4	Pressure relief device test	Major	Testing	One Unit	MFR. STD	MFR. STD	Test Report	--	P	W	
3.0	Other test										

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

SL NO	COMPONENT & CHARACTERISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
3.1	Marshalling cum cooler control box										
3.1.1	BOM verification	Major	Verification	100%	App MFR.Drg	App MFR.Drg	QC report	--	P	W	
3.1.2	Operation / Continuity of Wiring with OTI, WTI operation & other accessories	Major	Electrical	100%	MFR. STD	MFR. STD	QC report	--	P	W	
3.1.3	2 KV (HV test) on Marshalling cum cooler control box	Major	Electrical	100%	MFR. STD	MFR. STD	QC report	--	P	W	
3.1.4	Operation of Instruments(BR)	Major	Electrical	100%	MFR. STD	MFR. STD	QC report	--	P	W	
3.1.5	Visual & Dimensional check	Major	Measurement	100%	APPD MFR.Drg.	APPD MFR.Drg.	QC report	--	P	W	
4.0	Special Test (One unit of each type and rating of Transformer)										
4.1	Zero Phase Sequence Test	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	--	P	W	
4.2	Noise Level Test	Major	Testing	One Unit	NEMA TR-1	NEMA TR-1	Test Report	--	P	W	
4.3	No Load Harmonic Test	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	--	P	W	
4.4	HV Test on all auxiliary equipment and wiring after complete assembly	Major	Testing	One Unit	--	--	Test Report	--	P	W	



BSES-TS-24-TRPU-R0

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

SL NO	COMPONENT & CHARACTERISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
D	Dispatch & Packing										
1.1	Identification & packing	Major	Visual	100%	As per packing list	As per packing list	Packing List	--	P	--	
1.2	Check for proper Packing	Major	Visual	100%	As per packing list	As per packing list	Packing List	--	P	--	
1.3	Visual check before dispatch	Major	Visual	100%	As per packing list	As per packing list	Packing List	--	P	--	

LEGEND:

S: Supplier
M: Main Contractor (Manufacturer)
O: Owner (BYPL)

P - Perform
V - Verify
R - Review
W - Witness

ANNEXURE – H – TECHNICAL SPECIFICATION OF MATERIAL TRACKING -GPS DEVICE

Supply of GPS Device shall be in Vendors scope, however it shall be returned to Vendor once Goods are received.

Detailed requirement of GPS Device is as below:

Once the material is dispatched after Final clearance Transport Vehicle shall have GPS Tracking Device and status of dispatch of material shall be sent to all the stake holders via SMS thru GPS Device.

Approve make is Map my India Asset Tracking device.

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

SCHEDULE – A –GUARANTEED TECHNICAL PARTICULARS (DATA BY SELLER)

Sr.No.	Particular	Specified / Required	Offered
1.0	General		
1.1	Make		
1.2	Type	As per Annexure C of specification	
2.0	Nominal continuous rating, KVA		
2.1	ONAN	As per CI 11.1 of Annexure C	
2.2	ONAF	As per CI 11.2 of Annexure C	
3.0	Rated voltage (KV)		
3.1	HV winding	As per CI 9.1 of Annexure C	
3.2	LV winding	As per CI 9.2 of Annexure C	
4.0	Rated current (Amps)		
4.1	HV winding, ONAN / ONAF		
4.2	LV winding , ONAN / ONAF		
5.0	Connections		
5.1	HV winding	As per Annexure C of specification	
5.2	LV winding	As per Annexure C of specification	
5.3	Vector group reference	Dyn11	
6.0	Impedance at principal tap rated current and frequency%		
6.1	Impedance (%)	As per Cl. 12.0 of Annexure C	
6.2	Reactance (%)		
6.3	Resistance (%)		
6.4	Impedance at lowest tap rated current and frequency		
6.5	Impedance at highest tap rated current and frequency		
6.6	Transformer X/R ratio		
7.0	Resistance of the winding at 75 ⁰ C at principal tap (ohm)		
7.1	a) HV		
7.2	b)LV		
8.0	Zero sequence impedance (Ohm)		
8.1	a) HV		
8.2	b) LV		
9.0	Guaranteed maximum losses at principal tap at full load and 75 ⁰ C without any positive tolerance kW		
9.1	No load losses (max.)	As per CI 13.0 Annexure C	
9.2	Load losses (max.)	As per CI 14.0 Annexure C	
9.3	Cooler fan losses (max.)		
9.4	Total I ² R losses of windings @ 75 deg C		
9.5	Total stray losses @ 75 deg C		

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

9.6	Total losses (max.)		
9.7	No load loss at maximum permissible voltage and frequency (approx.) kW		
10.0	Temperature rise over reference design ambient of 40 °C		
10.1	Top oil by thermometer °C	40° C	
10.2	Winding by resistance °C	45° C	
10.3	Winding gradient at rated current °C		
10.3.1	HV		
10.3.2	LV		
11.0	Efficiency		
11.1	Efficiency at 75° C and unity power factor %		
11.1.1	At 110% load		
11.1.2	At 100% load		
11.1.3	At 80% load	Not less than 99.5 %	
11.1.4	At 60% load		
11.1.5	At 40% load		
11.1.6	At 20% load		
11.2	Efficiency at 75° C and 0.8 power factor lag %		
11.2.1	At 110% load		
11.2.2	At 100% load		
11.2.3	At 80% load		
11.2.4	At 60% load	Not less than 99.5 %	
11.2.5	At 40% load		
11.2.6	At 20% load		
11.3	Maximum efficiency %		
11.4	Load and power factor at which Max efficiency occurs		
12.0	Regulation (%)		
12.1	Regulation at full load at 75° C		
12.1.1	At unity power factor		
12.1.2	At 0.8 power factor lagging		
12.2	Regulation at 110% load at 75° C		
12.2.1	At unity power factor		
12.2.2	At 0.8 power factor lagging		
13.0	Tapping		
13.1	Type		
13.2	Capacity		
13.3	Range-steps x % variation	As per Annexure C of specification	
13.4	Taps provided on HV winding (Yes/No)	Yes	
14.0	OLTC gear		
14.1	Make		
14.2	Type		
14.3	Reference std		

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

14.4	No of compartment		
14.5	Mounting arrangement	Side mounted type although External Intank Type is also preferable	
14.6	Rated current Amp		
14.7	Rated step capacity, kVA		
14.8	Short circuit withstand for 2 secs, kA		
14.9	Time required for one step change sec.		
14.10	Rated voltage for motor, V AC		
14.11	Rating of motor		
14.12	Rated voltage for auxiliaries V		
14.13	Consumption of auxiliaries		
14.14	OLTC features as per specification, Yes/No		
14.15	Does the overload rating of OLTC match with that of the transformer under all conditions Yes/No		
16.0	Cooling system		
16.1	Type of cooling	As per Annexure C of specification	
16.2	No. of cooling unit groups		
16.3	Capacity of cooling units		
16.4	Mounting of radiators		
16.5	Number of radiators and Size		
16.6	Type & size of radiator header main valve		
16.7	Type & size of individual radiator valve		
16.8	Total radiating surface, sq mm		
16.9	Thickness of radiator tubes, mm	Minimum 1.2 mm	
16.10	Schematic flow diagram of the cooling system furnished (Yes/No)		
16.11	Type and make of Fan motor		
16.12	No. of fan motor per bank (Working + Standby)		
16.13	Rated Power Input (kW)		
16.14	Rated Voltage, Speed of Motor		
16.15	Efficiency of motor at Full load(%)		
16.16	Locked Rotor current(Amps)		
17.0	Details of tank		
17.1	Material	Robust mild steel plate without pitting and low carbon content	
17.2	Thickness of sides mm		
17.3	Thickness of bottom mm		
17.4	Thickness of cover mm		
17.5	Confirmation of tank designed and tested for vacuum pressure (Ref: CBIP manual) (Yes/No)		
17.5.1	Vacuum mm of Hg. / (kN/m ²)	As per CBIP	

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

17.5.2	Pressure mm of Hg	Twice the normal head of oil / normal pressure + 35 kN/m ² whichever is lower , As per CBIP	
17.6	Is the tank lid slopped?	Yes	
17.7	Inspection cover provided (Yes/No)		
17.8	Location of inspection cover (Yes/No)		
17.9	Min. dimensions of inspection cover (provide list of all inspection cover with dimension), mm x mm		
18.0	Core		
18.1	Type:	Core	
18.2	Core material grade	Premium grade minimum M3 or better	
18.3	Thickness of lamination mm	Max. 0.23 mm with insulating coating on both sides	
18.4	Insulation between core lamination		
18.5	Design flux density of the core at rated condition at principal tap, Tesla		
18.6	Maximum flux density allowed in the core at extreme overexcitation / overfluxing , Tesla		
18.7	Equivalent cross section area of core, mm ²		
18.8	Guaranteed No load current at 90% / 100% / 110% rated voltage & frequency (Amp)	@ 100% - 0.5% of RFLC @ 110% - 1.0% of RFLC	
18.8.1	HV		
18.8.2	LV		
19.0	Type of winding		
19.1	HV		
19.2	LV		
19.3	Conductor material	Electrolytic copper as per relevant standard	
19.4	Maximum current density allowed, Amp per mm ²	As per Annexure C	
19.5	Gauge/area of cross section of conductor, mm ²		
19.5.1	HV		
19.5.2	LV		
19.6	Maximum current density achieved in winding (LV/HV/HVT) – Amps/ mm ²		
19.7	Insulating material		
19.7.1	HV turn		
19.7.2	LV turn		
19.7.3	LV- core		
19.7.4	HV-LV		

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

19.8	Insulating material thickness, mm		
19.8.1	HV turn		
19.8.2	LV turn	-	
19.8.3	LV to core		
19.8.4	HV to LV		
20.0	Minimum design clearance , mm		
20.1	HV to earth in air		
20.2	HV to earth in oil		
20.3	LV to earth in air		
20.4	LV to earth in oil	-	
20.5	Between HV & LV in Air		
20.6	Between HV & LV in oil		
20.7	Top winding and yoke	-	
20.8	Bottom winding and yoke		
21.0	Insulating oil		
21.1	Quantity of oil Ltrs	-	
21.1.1	In the transformer tank		
21.1.2	In each radiator		
21.1.3	In OLTC chamber		
21.1.4	Total quantity		
21.2	10% excess oil furnished?	Yes	
21.3	Type of oil	New insulating oil as per IS: 335, latest edition and Cl. 4.2.7 of the specification	
21.4	Oil preservation system provided (Yes/No)		
22.0	Bushing		
22.1	Make		
22.2	Type		
22.3	Reference standard		
22.4	Voltage class, kV		
22.4.1	HV side bushing		
22.4.2	LV side line and neutral bushing		
22.5	Creepage factor for all bushing mm / kV	As per Annexure C of specification	
22.6	Rated current , Amp		
22.6.1	HV bushing		
22.6.2	LV line and neutral bushing		
22.7	Rated thermal short current		
22.7.1	HV bushing	As per Annexure C of specification	
22.7.2	LV line and neutral bushing	As per Annexure C of specification	
22.8	Weight Kg		
22.8.1	HV bushing		
22.8.2	LV line and neutral bushing		
22.9	Free space required for bushing removal, mm		
22.9.1	HV bushing		
22.9.2	LV line and neutral bushing		

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

23.0	Terminal connections		
23.1	HV	As per Annexure C of specification	
23.2	LV	As per Annexure C of specification	
23.3	LV Neutral	As per Annexure C of specification	
24.0	H.V. Cable box/Terminals		
24.1	Suitable for cable/conductor type size	As per Annexure C of specification	
24.2	Termination height , mm	1000 mm , minimum	
24.3	Gland plate dimension mm x mm		
24.4	Gland plate material	Aluminium	
24.5	Gland plate thickness , mm	5 mm minimum	
24.6	Phase to clearance inside box / terminals , mm		
24.7	Phase to earth inside box / terminals , mm		
24.8	Cable box door arrangement as per clause 4.2.9.2		
25.0	L.V line side cable box		
25.1	Suitable for cable type , size	As per Annexure C of specification	
25.2	Termination height , mm	1000 mm , minimum	
25.3	Gland plate dimension mm x mm		
25.4	Gland plate material	Aluminum	
25.5	Gland plate thickness , mm	5 mm minimum	
25.6	Phase to clearance inside box / terminals , mm		
25.7	Phase to earth inside box , mm		
25.8	Cable box door arrangement as per clause 4.2.9.2		
26.0	LV Neutral cable box		
26.1	Suitable for cable type , size	As per Annexure C of specification	
26.2	Termination height , mm		
26.3	Gland plate dimension mm x mm		
26.4	Gland plate material	Aluminum	
26.5	Gland plate thickness , mm	5 mm minimum	
26.6	Phase to clearance inside box, mm		
26.7	Phase to earth inside box , mm		
27.0	Marshalling box cubical provided as per clause no. 4.2.11 of spec. (Yes / no)		
27.1	Mounting of marshalling box	Separate mounted	
28.0	Neutral Current Transformer (NCT)		
28.1	Type		
28.2	Make		
28.3	Reference standard		
28.4	Rated Voltage	12kV	
28.5	CT Ratios	20/25 MVA, Dyn11	25/31.5 MVA, Dyn11



BSES-TS-24-TRPU-R0

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

		Core 1	Core 2	Core 1	Core 2	
		1600/1 A	1600/1A	1600-2000/1 A	1600-2000/1 A	
28.6	Burden ,VA	-	20	-	20	
28.7	Class of Accuracy	PS	5P20	PS	5P20	
28.8	KPV , volts , minimum	40(Rct+8)	-	40(Rct+8)	-	
28.9	Resistance, ohm @ 75 deg C, maximum	1	-	1	-	
28.10	Magnetizing current @ Vk/4 , mA , maximum	30	-	100	-	
28.11	Short time withstand current	26.3 kA for 3 sec.				
29.0	Winding current transformer (WCT)					
29.1	Type					
29.2	Make					
29.3	Reference standard					
29.4	CT ratio					
29.5	Burden ,VA	Manufacturer Std.				
29.6	Class of accuracy	Manufacturer Std.				
30.0	Pressure release device					
30.1	Minimum pressure the device is set to rupture					
30.1.1	For main tank					
30.1.2	For OLTC					
31.0	Alarm and trip contact ratings of protective devices					
31.1	Rated/making/ breaking currents , Amp @ voltage for					
31.1.1	PRV for main tank					
31.1.2	PRV for OLTC					
31.1.3	Buchholz relay					
31.1.4	Oil surge relay for OLTC					
31.1.5	Sudden pressure relay					
31.1.6	OTI					
31.1.7	WTI					
31.1.8	Magnetic oil gauge					
32.0	Fittings accessories each transformer furnished as per clause No. (Bidder shall attach separate sheet giving details, make and bill of materials)					
33.0	Painting: as per clause for the transformer , cable boxes, radiator, marshalling box, etc (Yes/No)					
34.0	Over all transformer dimensions					
34.1	Length , mm	6.5 metres maximum				

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

34.2	Breadth , mm	5.0 metres maximum	
34.3	Height , mm	5.0 metres maximum	
35.0	Transformer tank dimensions		
35.1	Length , mm		
35.2	Breadth , mm		
35.3	Height , mm		
36.0	Marshalling box dimensions		
36.1	Length , mm		
36.2	Breadth , mm		
36.3	Height , mm		
37.0	Weight data		
37.1	Core, kG		
37.2	Frame parts, kG		
37.3	Core and frame, kG		
37.4	Total winding, kG		
37.5	Core and frame winding, kG		
37.6	Tank, kG		
37.7	Tank lid, kG		
37.8	Empty conservator tank , kG		
37.9	Each radiator empty , kG		
37.10	Total weight of all radiator empty , kG		
37.11	Weight of oil in tank , kG		
37.12	Weight of oil in each conservator , kG		
37.13	Weight of oil in each radiators , kG		
37.14	Total weight of oil in radiator , kG		
37.15	OLTC gear including oil , kG		
37.16	Total transport weight of the transformer , kG		
37.17	Total transport weight of the transformer with OLTC and all accessories		
38.0	Volume data		
38.1	Volume of oil in main tank , liters		
38.2	Volume of oil between highest and lowest levels of main conservator ,liters		
38.3	Volume of oil between highest and lowest levels of OLTC conservator, liters		
38.4	Volume of oil in each radiator , liters		
38.5	Total volume of oil in radiators , liters		
38.6	Volume of oil in OLTC , liters		
38.7	Transformer total oil volume , liters		
39.0	Shipping data		



BSES-TS-24-TRPU-R0

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

39.1	Weight of heaviest package, kG		
39.2	Dimensions of the largest package (L x B x H) mm		
40.0	Tests		
40.1	All in process tests confirmed as per Cl. (Yes /No)		
40.2	All types tests confirmed as per Cl. (Yes /No)		
40.3	All in routine tests confirmed as per Cl. (Yes /No)		
40.4	All in special tests confirmed as per Cl. (Yes /No)		

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

SCHEDULE – B –GUARANTEED TECHNICAL PARTICULARS OF TRANSFORMER OIL

Bidder to submit hard copy duly filled & signed along with techno commercial offer. Bidder to submit separate GTP for each type of insulating oil

S no	Item description	Specification requirement	Data by Vendor
1.0	Manufacturer Name		
1.1		Address	
1.2		Contact person	
1.3		Contact telephone no	
2.0	Function		
2.1	Viscosity		
2.1.1	Viscosity at 40 ^o C	15 mm ² /s, Max	
2.1.2	Viscosity at 0 ^o C	1800 mm ² /s, Max	
2.2	Pour Point	- 10 ^o C, Max	
2.3	Water content	30 mg/Kg, Max	
2.4	Breakdown voltage		
2.4.1	New unfiltered oil	30 kV, Min	
2.4.2	After filtration	70 kV, Min	
2.5	Density at 20 ^o C	0.895 g/ml, Max	
2.6	Dielectric dissipation factor at 90 ^o C	0.005, Max	
2.7	Particle Content	Manufacturer to specify the data	
3.0	Refining/Stability		
3.1	Appearance of oil	Clear, free from sediment and suspended matter	
3.2	Acidity	0.01 mg KOH/g, Max	
3.3	Interfacial tension at 27 ^o C	0.04 N/m, Min	
3.4	Total sulphur content	Manufacturer to specify the data	
3.5	Corrosive sulfur	Not-corrosive	
3.6	Potentially Corrosive sulfur	Not-corrosive	
3.7	DBDS	Not detectable (<5 mg/kg)	
3.8	Inhibitor	Not detectable (<0.01%)	
3.9	Metal Passivator	Not detectable (<5 mg/kg)	
3.10	Other additives	Manufacturer to specify the data	
3.11	2-furfural and related Compounds content	Not detectable (<0.05 mg/kg) for each individual compound	
4.0	Performance		

TECHNICAL SPECIFICATION OF POWER TRANSFORMER

4.1	Oxidation stability, test duration 164 h		
4.1.1	Total acidity	1.2 mg KOH/g, Max	
4.1.2	Sludge	0.8%, Max	
4.1.3	DDF at 90 ⁰ C	0.5, Max	
4.2	Gassing Tendency	Manufacturer to specify the data	
4.3	ECT	Manufacturer to specify the data	
5.0	Health,safety and Environment		
5.1	Flash point	135 ⁰ C, Min	
5.2	PCA content Max	3%, Max	
5.3	PCB content	Not detectable (<2 mg/Kg)	

TECHNICAL SPECIFICATION OF POWER TRANSFORMER**SCHEDULE – C–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			

TECHNICAL SPECIFICATION
FOR
STRUCTURAL WORK

Prepared by			Rev: 0
Reviewed by			Date:
Approved by			

Technical Specification Structural Work

1.0 GENERAL

- 1.1 The scope of specification covers design fabrication, proto assembly, supply and erection of galvanized steel structures for towers, girders, and equipment support structures, towers which shall be lattice type structures fabricated from structural steel conforming to IS: 2062(latest) The scope shall include supply and erection of all types of structures including bolts, nuts, washers, hangers, shackles, clamps, anti climbing devices, bird guards, step bolts, inserts in concrete, gusset plates equipment mounting bolts, structure earthing bolts, foundation bolts, spring and flat washers, fixing plates and any other items as required to complete the job.
- 1.2 The connection of all structures to their foundations shall be by base plates and embedded anchor/foundation bolts. All steel structures and anchor anchor/foundation bolts shall be galvanized. The weight of the zinc coating shall be at least 0.610 Kg/m² for anchor bolts/foundation bolts and for structural members. One additional nut shall be provided below the base plate which may be used for the purpose of leveling.

2.0 DESIGN REQUIREMENTS FOR STRUCTURES

- 2.1 For design of steel structures loads such as dead loads, live loads, wind loads etc. shall be based on IS: 802 Part 1 Sec 1
- 2.2 For material and permissible stresses IS: 802, Part-1, Section-2 shall be followed in general. However additional requirements given in following paragraphs shall be also considered.
- 2.3 Minimum thickness of galvanized tower member shall be as follows:
- | Member | Minimum thickness (mm) |
|---------------------------|------------------------|
| Leg members, ground wire | 5 |
| Peak members/main members | |
| Other members | 4 |
| Redundant members | 4 |
- 2.4 Maximum slenderness ratios for leg members, other stressed members and redundant members for compression force shall be as per IS-802
- 2.5 Minimum distance from hole center to edge to adjacent hole shall be minimum 1.5 X bolt diameter. Minimum distance between center to center of holes shall be 2.5 x bolt diameter.
- 2.6 The minimum bolt diameter shall be 16 mm.

Technical Specification Structural Work

2.7 Step Bolts

In order to facilitate inspection and maintenance, the structures shall be provided with climbing devices. Each tower shall be provided with step bolts not less than 16mm diameter and 175mm long spaced not more than 450mm apart, staggered on faces on one leg extending from about 0.5M above ground level to the top of the tower. The step bolt shall conform to IS: 10238

2.8 Design Criteria

- a) All structures be designed for the worst combination of dead loads, live loads, wind loads as per code IS 802 seismic forces as per code IS : 1893, importance factor of 1.5, loads due to deviation of conductor, load due to unbalanced tension in conductor, torsion load due to unbalanced vertical and horizontal forces, erection loads, short circuit forces shall be calculated considering a fault level of 31.5KA for 3 secs. IEC-865 may be followed for evaluation of short circuit forces.
- b) Switchyard girders structure shall be designed for the two conditions i.e. normal condition and short circuit condition. In both conditions the design of all structures shall be based on the assumption that stringing is done only on one side i.e. all the three (phase) conductors broken on the other side. Factor of safety of 2.0 under normal conditions and 1.5 under short circuit condition shall be considered on all external loads for the design of switchyard structures, which are of lattice type.
- c) Vertical load of half the span of conductors/string and the earth wires on either side of the beam shall be taken into account for the purpose of design. Weight of man with tools shall be considered as 150KGs for the design of structures.
- d) Terminal / line take off girders shall be designed for a minimum conductor tension of 1000Kg per sub conductor per phase for 66KV. The distance between terminal girders and the dead end tower shall be taken as per standard. The design of these terminal girders shall also be checked considering +/- 30 deg deviation of conductor in both vertical and horizontal planes. For other girders the structural layout requirements shall be adopted in design.
- e) The girders shall be connected with lattice columns be bolted joints.
- f) All support structures used for supporting equipments shall be designed for the worst combination of dead loads, erection load. Wind load/seismic forces, short circuit forces. Short circuit forces shall be calculated considering a fault level of 31.5KA for 3 seconds.
- g) Foundation bolts shall be designed for the loads for which the structures are designed

Technical Specification Structural Work

3.0 DESIGN DRAWINGS, BILL OF MATERIAL & DOCUMENTS

- 3.1 The contractor shall furnish design, drawing and BOMs to the Owner after award of the contract. However contractor shall have to prepare and submit any other drawings, bill of material additionally required during design and construction stage which the Owner feels necessary. In case Owner feels that any design drawing, BOM are to be modified even after its approval, contractor shall modify the design & drawings and resubmit the design drawing, BOM as required in the specification.
- 3.2 The fabrication drawings are to be provided and furnished by the contractor shall be based on design approved by Owner. These fabrication drawings shall be based on the design approved by the Owner. These fabrication drawings shall indicate complete details of fabrication and erection including all erection splicing details, lacing details, weld sizes and lengths. BOM in the Performa approved by the Owner shall be submitted. Bolt details and all customary details in accordance with standard structural engineering practice whether or not given by the Owner.
- 3.3 The fabrication work shall start only after the final approval to the design and drawings is accorded by the Owner. The design drawing should indicate not only profile, but section, numbers and sizes of bolts and details of typical joints.
- 3.4 Such approval shall however not relieve the contractor his responsibility for the safety of the structure and good connections and any loss or damage occurring due to defective fabrication design or workmanship shall be borne by the contractor.

4.0 FABRICATION OF STEEL MEMBERS

- 4.1 The fabrication and erection works shall be carried out generally in accordance with IS 802. A reference however may be made to IS 800 in case of non-stipulation of some particular provision in IS 802. All materials shall be completely shop fabricated and finished with proper connection material and erection marks for ready assembly in the field.

5.0 PROTO – ASSEMBLY

- 5.1 The component parts shall be assembled in such a manner that are neither twisted nor otherwise damaged and shall be so prepared that the specific camber, if any, is provided. In order to minimize distortion in member the component parts shall be positioned by using the clamps, Clips, lugs, jigs and other suitable means and fasteners (bolts and weld) shall be placed in a balanced pattern. If the individual components are to be bolted, paralleled and tapered drifts shall be used to align the part so that the bolts can be accurately positioned.
- 5.2 Sample towers, beams and lightning masts and equipment structures shall be trial assembled in the fabrication shop and shall be inspected and cleared by contractor based on the design approval accorded by the Owner before mass fabrication.

Technical Specification Structural Work

- 5.3 Pursuant to above the BOM's along with proto-corrected fabrication drawing shall be prepared and submitted by the main vendor to Owner as document for information. Such BOM, which shall be the basis for the Owner to carry out inspection.

6.0 BOLTING

- 6.1 Every bolt shall be provided with two flat and one spring washer under the nut so that no part of the threaded portion of the bolt is within the thickness of the parts bolted together. Locking nut shall be provided with each grouting bolt.
- 6.2 All steel items, bolts, nuts and washers shall be hot dip galvanized.
- 6.3 2.0% extra nuts and bolts shall be supplied for erection.

7.0 WELDING

- 7.1 The work shall be done as per approved fabrication drawings, which clearly indicate various details of joints to be welded, type of weld, length and size of weld, whether shop or site weld etc. Symbols for welding on erection and shop drawings shall be according to IS 813. Efforts shall be made to reduce site welding so as to avoid improper joints due to constructional difficulties.

8.0 FOUNDATION BOLTS

- 8.1 Foundation bolts for the towers and equipment supporting structures and elsewhere shall be embedded in first stage concrete while the foundation is cast. The contractor shall ensure the proper alignment of these bolts to match the holes in the base plate.
- 8.2 The contractor shall be responsible for the correct alignment and leveling of all steel work on site to ensure that the towers/structures are plumb.
- 8.3 All foundation bolts for lattice structures are to be supplied by the contractor.
- 8.4 All foundation bolts shall be fully galvanized so as to achieve 0.610 kg. Per Sq.m. of Zinc coating as per specifications.
- 8.5 All foundation bolts shall conform to IS 5624 but the material shall be MS conforming to IS 2062.

9.0 STABILITY OF STRUCTURES

The method of grouting the column bases shall be subject to approval of Owner and shall be such as to ensure complete uniformity of contact over the whole area of the steel base. The contractor will be fully responsible for the grouting operations.

Technical Specification Structural Work

10.0 GROUTING

The method of grouting the column bases shall be subject to approval of Owner and shall be such as to ensure complete uniformity of contact over the whole area of the steel base. The contractor will be fully responsible for the grouting operations.

11.0 GALVANISING

- 11.1 All structural steel works and support shall be galvanized after fabrication.
- 11.2 Zinc required for galvanizing shall have to be arranged by the manufacturer. Purity of zinc to be used shall be 99.95% as per IS 209.
- 11.3 The contractor shall be required to make arrangement for frequent inspection by the Owner as well as continuous inspection by a resident representative of the Owner, if so desired for fabrication work.

12.0 TOUCH UP PAINTING

The touch up primers and paint shall consist of Zinc phosphate / Zinc chromate conforming to the requirements of IS 2074 with a pigment to be specified by the Owner.

13.0 INSPECTION BEFORE DESPATCH

- 13.1 Each part of the fabricated steel work shall be inspected as per approved quality plans and certified by the Owner or his authorized representative as satisfactory before it is dispatched to the erection site.
- 13.2 Such certification shall not relieve the contractor of his responsibility regarding adequacy and completeness of fabrication.

14.0 TEST CERTIFICATE

Copies of all test certificates relating to material by the contractor for the works shall be forwarded to the Owner.

15.0 ERECTION

The contractor should arrange on his own all plant and equipment, welding set, tools and tackles, scaffolding, trestles equipments and all other accessories and ancillaries required for carrying out erection without causing any stresses in the members which may cause deformation and permanent damage.

Technical Specification Structural Work

16.0 SAFETY & PRECAUTION

The contractor shall strictly follow at all fabrication, transportation and erection of steel structures, raw m, materials and other tools and tackles, the stipulations contained in Indian standard code for safety during erection of structural steel work.

17.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION
FOR
LIGHTNING ARRESTERS

Prepared by	Hemanshi		Rev: 0
Reviewed by	Abhinav Srivastava		Date: 2.11.2013
Approved by	Vijay Panpalia		

Chapter-6b Technical Specification for Lightning Arrestor

1.0 CODES & STANDARDS:

Materials, equipment and methods used in the manufacturing of Lightning Arresters shall confirm the latest edition of following standard: -

National Standard

Standard Code	Standard Description
	Indian Electricity Rules (relevant safety regulation of CEA)
	Indian Electricity Act 2003
	CBIP manual
IS: 3070 Part-3	Lightning Arresters for Alternating Current Systems
IS : 2071 - Part I	Method of high voltage testing
IS : 2629 -1985	Recommended practice for Hot-Dip Galvanizing of Iron and Steel
IS : 5621 – 1980	Hollow insulators for use in electrical equipment
IS : 6639 - 1972	Specification for Hexagon bolts for Steel structures

International Standard

Standard Code	Standard Description
IEC 60099-4-2001	Metal-Oxide surge arresters without gaps for AC system

2.0 DESIGN FEATURES

S No	Description	Requirement / Rating
2.1	Application	To be used for protection of transformers, circuit breakers and other sub-station equipment against lightning and switching surges.
2.2	Type of Lightning Arrester	Gap-less metal oxide type (ZnO type)
2.3	Pressure relief device	Pressure relief device of class 40 KA shall be provided
2.4	Accessories	Clamps and counter
2.5	Mounting	LA mounting vertically on steel structures with insulating bases. Surge counters in weather proof enclosures suitable for mounting on structure of lightning arrester
2.6	Line-side Terminal Connectors	Suitable for ACSR Zebra/ Goat conductor / Pipe Bus
2.7	Ground Terminal Connectors	Suitable for 50x6 mm GS flat
2.8	Surge Counter	Non – resettable type

Chapter-6b Technical Specification for Lightning Arrestor

2.9	Name Plate Marking	Following minimum information must be marked – i) Name of the manufacturer ii) Type and serial No. iii) Model No. iv) Rated voltage v) Max. continuous Operating Voltage vi) Nominal discharge current vii) Pr. Relief Current viii) Identification mark on each separately housed unit to enable it to be replaced in correct position after the multiunit arrester has been dismantled.
3.0	Approved make of Components	
3.1	Insulators	JS / WSI / BHEL / Modern / Saravana
4.0	Testing & Inspection	
4.1	Internal Test	Manufacturer shall carry out comprehensive inspection and testing during manufacturing of the equipment.
4.2	Type test	The product must be of type tested quality. Type test reports shall be submitted for the type, size & rating of equipment offered along with bid. If the manufacturer's lab is accredited by Govt./ authorized body then it shall be acceptable for type testing
4.3	Routine test	As per relevant IS / IEC
4.4	Acceptance test	as per relevant IS / IEC
4.5	Test Witness	
		The buyer reserves the right to witness all tests specified on completed product
		The buyer reserve the right to inspect the product at the sellers works at any time prior to dispatch, to verify compliance with the specifications.
		In-progress and final inspection call intimation shall be given in advance to Owner.
4.6	Tests on Fitting and Accessories	As per manufacturer's standard and relevant IS / IEC

3.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.



**Specification for
Lighting High Mast
Specification no – GN101-03-SP-33-00**

Prepared by		Reviewed by		Approved by		Rev No.	Date
Name	Sign	Name	Sign	Name	Sign		
Hemanshi		Abhinav Srivastava		Vijay Panpalia		00	04.01.2012

1.0 Scope of supply

This specification covers the requirement of design, manufacture and testing of 16M high mast along with accessories and requisite hardware. The scope also includes erection, installation and associated civil work like foundation etc.

2.0 Codes & Standards

All standards, specifications, and codes of practice referred to herein shall be the latest edition including all applicable official amendments and revisions as applicable.

IS: 5	1994	Colour for ready mixed paints and enamels.
IS:694	1990	PVC insulated cables for working voltages upto and including 1100V.
IS:800	1984	Code of practice for general construction in steel.
IS:802	1978 Part-2	Code of practice for use of structural steel in Overhead transmission line towers. Part-2 Fabrication, galvanising, inspection and packing.
IS: 875	1987 Part-3	Code of practice for design loads(other than earthquake) for buildings and structures: Wind loads
IS:2062	1992	Steel for general structural purposes.
IS: 2551	1982	Danger notice plates.
IS:2629	1985	Recommended practice for hot dip galvanising on iron and steel.
IS :2633	1986	Methods for testing uniformity of coating of zinc coated articles.
IS :3961	1967 Part-2	Recommended current ratings for PVC insulated cables. Part-2: PVC insulated and PVC sheathed heavy duty cables.
IS :5133	1969 Part-1	Boxes for enclosure of electrical accessories- Part-1: steel and cast iron boxes.
IS: 5831	1984	PVC insulation and sheath of electric cables.
IS :8130	1984	Conductors for insulated electric cables and flexible cords.
IS :10810	1984	Method of tests for cables.
IS:13703	1993 Part-1	Low voltage fuses for voltages not exceeding 1000V AC or 1500V DC .Part-1:General requirements
IS:13703	1993 Part-2	Low voltage fuses for voltages not exceeding 1000V AC or 1500V DC .Part-2:Supplementary requirements for fuses for industrial applications
BS EN 10-027 (part-1)	1992	Designation systems for steel: steel names, principal symbols
BS EN 10-027 (part-2)	1992	Designation systems for steel: steel numbers
BS 5135		National Electrical Code.
BS-EN 10-027		Indian Electricity rules(relevant safety regulation of CEA) and acts

--	--	--

3.0 Service Conditions

Equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

Maximum Ambient Temperature (Degree C)	50
Maximum temperature in shade (Degree C)	45
Min. Temperature of Air in Shade (Degree C)	-10
Relative Humidity (Percent)	10 To 100
Maximum annual rain fall (mm)	1450
Maximum Wind pressure (Kg/Sq. M.)	150
Maximum altitude above mean sea level (Meters)	3000
Isoceranic level (days per year)	50
Seismic level (Horizontal Acceleration) Moderately hot and humid tropical climate conducive to rust and fungus growth	0.3g

4.0 Technical Requirement

4.1. Structure

The High mast shall be of continuously tapered, galvanised polygonal cross section, at least 20 sided, presenting a good and pleasing appearance, based on proven In-Tension design, conforming to the standards referred to above, to give an assured performance, and reliable service. The structure shall be suitable for wind loading as per IS - 875 Part -III, 1987.

4.2. Construction

The mast shall be fabricated from special steel plates, conforming to BS-EN10-027, cut and folded to form a polygonal section and telescopically jointed and welded. The welding shall be in accordance with BS-5135. The sections are joined together by slip-stressed-fit method. No site welding shall be done. Only bolted joint shall be done on the mast at the site. The minimum over lap distance shall be 1.5 times the diameter at penetration. The dimensions of the mast shall be decided based on proper design and accordingly design calculations shall be submitted for review / approval.

The mast shall be provided with fully penetrated flange, free from any lamination or incursion. The welded connection of the base flange shall be fully developed to the strength of the entire section. The base flange shall be provided with supplementary gussets between the bolt holes to ensure elimination of helical stress concentration. The entire fabricated mast shall be hot dip galvanised both internally and externally.

4.3. Door Opening

An adequate door opening shall be provided at the base of the mast and the opening shall be such that it permits clear access to equipment like winches, cables, plug and socket, etc. and also facilitate easy removal of the winch. The door opening shall be complete with a close fitting, vandal resistant, weatherproof door, provided with a heavy-duty double internal lock with special paddle key.

4.4. Dynamic Loading for the Mast

The mast structure shall designed as per TR No-7 of Institutions of lightning engineers of UK and shall be suitable to sustain maximum reaction arising from a wind speed as per IS-875 (three second gust), and is measured at a height of 10 meters above ground level.

4.5. Lantern Carriage

A fabricated Lantern Carriage shall be provided for fixing and holding the flood light fittings and control gear boxes. The lantern Carriage shall be of special design and shall be of steel tube construction, the tubes acting as conduits for wires, with holes fully protected by

grommets. (The lantern carriage tube should not be used as conduit. Separate flexible conduits are used from CG Boxes to the Flood Light Fixtures) The Lantern Carriage shall be designed and fabricated to hold the required number of flood light fittings and the control gear boxes, and also have a perfect self balance.

The Lantern Carriage shall be fabricated in two halves and joined by bolted flanges with stainless steel bolts and plastic lock type stainless steel nuts to enable easy installation or removal from the erected mast. The inner lining of the carriage shall be provided with protective PVC arrangement, so that no damage is caused to the surface of the mast during the raising and lowering operation of the carriage. The entire Lantern Carriage is hot dip galvanised after fabrication.

4.6. Junction Box

The junction box shall be cast aluminium or SS, weather proof IP67 junction box. It shall be provided on the Carriage Assembly as required, from which the inter-connections to the designed number of the flood light luminaries and associated control gears fixed on the carriage, is made.

4.7. Raising and lowering mechanism

It will be necessary to lower and raise the Lantern Carriage Assembly to install and maintain the luminaries and lamps. To enable this, a suitable Winch Arrangement shall be provided, with the winch fixed at the base of the mast and the specially designed head frame assembly at the top.

4.8. Winch

The winch shall be of completely self-sustaining type, without the need for brake, shoe, springs or clutches. Each driving spindle of the winch is positively locked when not in use. Individual drum also should be operated for the fine adjustment of lantern carriage. The capacity, operating speed, safe working load, recommended lubrication and serial number of the winch shall be clearly marked on each winch.

The gear ratio of the winch shall be 53 : 1 or as recommended by manufacturer. However, the minimum working load shall not be less than 750 kg. The winch shall be self-lubricating type by means of an oil bath and the oil shall be readily available grades of reputed manufacturers and details of the oil shall be furnished.

The winch drums shall be grooved to ensure perfect seat for stable and tidy rope lay, with no chances of rope slippage. The rope termination in the winch shall be such that distortion or twisting is eliminated and at least 5 to 6 turns of rope remains on the drum even when the

lantern carriage is fully lowered and rested on the rest pads. It should be possible to operate the winch manually by a suitable handle and/or by an external power tool. It would be possible to remove the double drum after dismantling, through the door opening provided at the base of the mast. Also, a winch gearbox for simultaneous and reversible operation of the double drum winch shall be provided as part of the contract.

The winch shall be type tested in a reputed test lab/ Institution and the test certificates shall be furnished before supply of materials. Test certificate shall be furnished by the bidder from the original equipment manufacturer, for each winch in support of the maximum load operated by the winch.

4.9. Head Frame

The head frame, which is to be designed, as a capping unit of the mast, shall be of welded steel construction, galvanised both internally and externally after assembly. The top pulley shall be of appropriate diameter, large enough to accommodate the stainless steel wire ropes and the multi-core electric cable. The pulley block shall be made of corrosion resistant material, and is of the cast Aluminium Alloy (LM-6) or SS. Pulley made of synthetic materials such as Plastic or PVC is not acceptable. Self-lubricating bearings and stainless steel shaft shall be provided to facilitate smooth and maintenance free operation for a long period. The pulley assembly shall be fully protected by a canopy galvanised internally and externally.

Close fitting guides and sleeves shall be provided to ensure that the ropes and cables do not dislodge from their respective position in the grooves. The head frame shall be provided with guides and stops with PVC buffer for docking the lantern carriage.

4.10 Stainless Steel Wire Ropes

The suspension system shall essentially be without any intermediate joint and shall consist of only non-corrodable stainless steel of AISI - 316 or better grade.

The stainless steel wire ropes shall be of 7/19 construction, the central core being of the same material. The overall diameter of the rope shall be more than 6 mm keeping in mind contingency. The breaking load of each rope shall not be less than 2350 kg. The design shall have a factor of safety over 5 for the system at full load. The end constructions of ropes to the winch drum shall be fitted with talurit.

The thimbles are secured on ropes by compression splices. Two continuous lengths of stainless steel wire ropes are used in the system and no intermediate joints are acceptable in view of the required safety. No intermediate joints, either bolted or else, shall be provided on the wire ropes between winch and lantern carriage.

4.11 Electrical System, Cable and Cable Connections

A suitable terminal box shall be provided as part of the supply at the base compartment of the high mast for terminating the incoming cable. The electrical connections from the bottom to the top shall be made by special trailing cable. The cable is EPR insulated and PCP sheathed to get flexibility and endurance. Size of the cable is minimum 5 core 2.5 sq mm copper, in case of failure of any core 2 spare cores shall be available. The cable shall be of reputed make. At the top necessary weatherproof junction box to terminate the trailing cable shall be provided. Connections from the top junction box to the individual luminaries is made by using 3 core 1.5 sq mm flexible PVC cables of reputed make. The system shall have in built facilities for testing the luminaries while in lowered position.

Also, suitable provision shall be made at the base compartment of the mast to facilitate the operation of externally mounted, electrically operated power tool for raising and lowering of the lantern carriage assembly. The trailing cables of the lantern carriage rings shall be terminated by means of specially designed, metal clad, multi pin plug and socket provided in the base compartment to enable easy disconnection when required.

4.12 Power Tool for the Winch

A suitable, high-powered, electrically driven, externally mounted power tool, with manual over ride, together with an operating stand shall be supplied for the raising and lowering of the lantern carriage for maintenance purposes. The speed of the power tool may preferably of slow speed, of 1.5 to 1.8 m/minute, so that vibrations associated with high speed operation are avoided. The power tool shall be single speed, provided with a motor of the required rating, suitable for hand/stand operation. The power tool shall be supplied complete with push button type remote control switch, together with 6 (six) meters of power cable, so that the operations can be carried out from a safe distance of 5 (five) meters. The capacity and speed of the electric motor used in the power tool shall be suitable for the lifting of the design load installed on the lantern carriage.

The power tool stand shall be so designed that it will not only be self-supporting but also aligns the power tool perfectly with respect to the winch spindle during the operations. Also, a handle for the manual operation of the winches in case of problems with the electrically operated tool shall be provided and shall incorporate a torque-limiting device.

A separate torque-limiting device to protect the wire ropes from over stretching shall be provided. It shall be mechanical with suitable load adjusting device. The torque limiter is a requirement as per the relevant standards in view of the overall safety of the system.

4.13 Lightning Finial

One number heavy-duty hot dip galvanised lightning finial shall be provided for each mast. The lightning finial shall be minimum 1.2 m in length and shall be provided at the centre of the head frame. It shall be bolted solidly to the head frame to get a direct conducting path to the earth through the mast. The lightning finial shall not be provided on the lantern carriage under any circumstances in view of safety of the system.

4.14 Aviation Obstruction Lights:

Based on site and project specific requirements, 2 nos. Low Intensity Type-B (as per Table 6.3 of Volume-1, Annexure-14 of ICAO Guideline for Aerodrome Design & Operations) LED type aviation obstruction lights of reliable design and reputed manufacturer shall be provided on top of each mast.

4.15 Earthing Terminals:

Suitable earth terminal pad using twin 12 mm diameter stainless steel bolts shall be provided at a convenient location on the base of the Mast, for lighting and electrical earthing of the mast.

4.16 Luminaries:

The non-integral floodlight luminaries with LED Lamp shall be provided with each mast. Optical compartment of the luminary shall be IP 66 and control gear compartment shall be IP 54 or better. Bajaj, Crompton and Philips make luminaries are approved. Detailed technical brochure shall be provided along with the bid.

4.17 Feeder Pillar:

Feeder pillar required for feeding power to the Lighting mast shall also be supplied along with the mast and its accessories. The feeder pillar is fed from the main switchgear / main lighting distribution board. The outgoing of this feeder pillar are connected to the MCBs in the mast. The feeder pillar shall be FLP or WP IP 54 with rain protection canopy in galvanised CRCA sheet or cast Aluminium body (for FLP) and finished with two coats of epoxy primer and grey enamel paint of shade 631 of IS-5. The feeder Pillar shall comprise of incoming 32 Amp TPN switch, HRC fuses, outgoing 25 Amp SP MCB, Time switch and contactor for automatic on & off of circuit with manual override, TP MCB for power tool contactors for reversing the motor and overload Protection of motor. Feeder pillar shall be mounted on suitable foundation near to the mast.

5.0 Tests

All type test certificates for the tests listed in the relevant standards, conducted on identical masts shall be submitted to BSES for approval. Routine tests & acceptance tests as per relevant IS shall be conducted as per approved Quality Plan.

6.0 Marking / Name Plate

The high mast shall be provided with “BSES” insignia with anodized aluminium plate. Anodized plate showing 24X7 customer care number shall also be provided. Name plate shall include manufacturer name, date of manufacturing, warranty period and other details as per standards.

Annexure A: Guaranteed Technical Parameters

Sl. No.	Particulars	Data by purchaser			Data by seller
1	Name and address of manufacturer				
2	Overall height of high mast	12 mtrs	16 mtrs	20 mtrs	
2.1	Make				
2.2	Material of construction of shaft	Grade S355 J O as per BSEN 10025 or equivalent			
2.2	Cross section of mast	20 sided, regular continuously tapered polygonal			
2.3	Number of sections	One	Two	Two	
2.3	Minimum thickness of shaft (mm)	4 mm	Bottom section: 5 mm Top section: 4mm	Bottom section: 5 mm Top section: 4mm	
2.4	Length of individual section (mm)	12000 mm	10900mm / 5850mm	10375mm / 10375mm	
2.5	Minimum Base and top diameter	340mm (A/F) and 150 mm (A/F)	450mm (A/F) and 150 mm (A/F)	500mm (A/F) and 150 mm (A/F)	
2.6	Type of joints	No site joints, mast should be delivered in a single section	Telescopic slip joint, stress fitted	Telescopic slip joint, stress fitted	
2.7	Length of overlap	N/A	750mm	750mm	
2.8	Metal protection treatment of fabricated mast section	Hot dip galvanization through single dipping process			
2.9	Thickness of	Minimum 85 microns as per IS:2629			

Sl. No.	Particulars	Data by purchaser			Data by seller
	galvanizations				
2.10	Size of opening door at base	Approx. 250 X 1200 mm			
2.11	Type of locking arrangement and door construction	Anti vandal type			
2.12	Details of struck board inside	Insulated base board			
2.13	Size , material and thickness of cable termination box				
2.14	Minimum size of base plate diameter	540 mm (min.)	650 mm (min.)	680 mm (min.)	
2.15	Minimum size of base plate thickness	25 mm thick			
2.16	Minimum size of anchor plate thickness	8 mm			
2.17	Details of template	Same as anchor plate but 2 mm thick			
3	Dynamic loading as prevailing at site				
3.1	maximum wind pressure (basic wind speed)	47m/s as per IS:875, p-3			
3.2	Maximum gust speed time	3 seconds			
3.3	Height above ground level at which wind speed is consider	10 mtrs			
3.4	Factor of safety for wind load	1.25			
3.5	Factor of safety for other load	1.15			
3.6	Application standard for mast design	Technical report #7:2000 by ILE, UK			
4	Foundation details				
4.1	Type of foundation	Open raft shallow footing or pile as applicable			
4.2	Size of foundation	as per design conforming to IS:456			
4.3	Design safety factor	2			
4.4	Considered wind speed	180 m /s			
4.5	Depth of foundation	As per requirement of design			
4.6	Average soil bearing capacity	As per site condition			
4.7	Numbers of foundation bolts	6 nos	8 nos		
4.8	PCD of foundation bolts	440 mm (min.)	550 mm (min.)	600 mm (min.)	
4.9	Type of foundation bolt	Tor steel			
4.10	Bolt diameter / length	25mm dia / 750 mm	32mm dia / 1325 mm	40mm dia / 1375 mm	
5	Lantern Carriage				

Sl. No.	Particulars	Data by purchaser			Data by seller
5.1	Diameter of Carriage Ring	Suitable to carry up to 4 nos. floodlights	1200 mm	1200 mm	
5.2	Construction	MS Channels / Tube, Hot dip galvanized	Channels 75X40X4mm thick	Channels 75X40X4mm thick	
5.3	Number of joints	As per manufacturer's standard design (2 segments as per CI no.4.5)	3 segments (2 segments as per CI no.4.5)	3 segments (2 segments as per CI no.4.5)	
5.4	Buffer arrangement between carriage and mast	Rubber padded guide ring provided			
5.5	Load carrying capacity	500 kg	750 kg	750 kg	
5.6	Total weight of assembly with fitting	as per design			
6	Winch				
6.1	Make of winch				
6.2	Number of drums/ winch	Double drum			
6.5	Gear Ratio				
6.3	Capacity	SWL 500 kg	SWL 750 kg		
6.4	Method of operation	Manual and Inbuilt power tool			
6.6	Operating speed				
6.7	Lubricant Arrangement	Permanent oil bath			
6.8	Type of lubricant				
6.9	Material of construction of gear	Phosphorus Bronze / EN 19			
6.10	Tested load per drum	500 kg	750 kg		
6.11	SWL of winch at 410 rpm	500 kg SWL	750 kg SWL		
7	Wire rope				
7.1	Make				
7.2	Grade	AISI 316			
7.3	Number of ropes	3 nos / 5mm (three wire rope)	3 nos / 6 mm (three wire rope)		
7.4	Construction	7./19			
7.5	Diameter of Wire rope	5mm	6mm		
7.6	Factor of safety	Not less than 5	Not less than 6		
7.7	Breaking capacity	Minimum 2350Kgs. X 2			
8	Cable				

Sl. No.	Particulars	Data by purchaser		Data by seller
8.1	Type	EPR coated PCP sheathed		
8.2	Material	Multicore copper conductor		
8.3	Make	Finolex, torrent, Polycab, KEI, Havells		
8.4	Current carrying capacity	As per IS 9968 (Part - 1), 1998		
8.5	conductor size	5CX2.5 sqmm.		
9	Torque limiter			
9.1	Lifting capacity	Upto 500 kg	Upto 750 kg	
9.2	Adjustable / non adjustable	Adjustable		
10	Lantern and Fixture			
10.1	Type Of Lamp	LED, Asymetrical IP65 fitting		
10.1.1	Wattage	400W		
10.1.2	Make			
10.1.3	Model Number			
10.2	Housing	Single piece gravity die-cast		
10.2.1	Material	Aluminium alloy: LM6		
10.2.2	Ingress protection			
10.2.3	For optical compartment	IP:65/IP:66		
10.2.4	For control gear compartment	IP:54 or better		
10.2.5	Dimensions of lantern	As per design standard		
10.2.6	Weight of lantern with control gear	As per design standard		
10.3	Lamp Cover	Perspex/Toughened glass		
10.3.1	Toughened glass			
10.3.2	Class of glass	AA/SSQ		
10.3.3	Nominal thickness	5mm		
10.3.4	Perspex thickness	2.5mm+/-0.4 mm		
10.4	Material of gasket	Slicon Rubber/ Neoprene		
10.5	Lamp holder	Screw type/three pin type		
10.5.1	Material	Porcelain		
10.6	Ballast	Conventional/Open type/ VI/VPI		
10.6.1	Ballast voltage	240V AC		
10.6.2	Minimum open circuit voltage	198V		
10.6.3	Frequency	50 Hz		
10.6.4	Current output(A), at rated voltage			
10.6.5	Voltage to current ratio () +/-0.5%			
10.6.6	Watt loss (W)	To be specified		
10.7	Power factor of lantern	More than 0.95 lag		
10.7.1	Value of capacitor	To be specified		
10.8	Igniter	Three wire		
10.9	Reflector	Anodised/POT		

Sl. No.	Particulars	Data by purchaser			Data by seller
10.9.1	Angle of tilt of lamp	To be specified			
10.9.2	Downward light output ratio	More than 70%			
10.9.3	Angle of throw	As per clause 5.12.5			
10.9.4	Angle of spread	As per clause 5.12.6			
10.9.5	Luminous intensity in C = 0° plane at $\gamma = 90^\circ$	Less than 10 Cd/klm			
10.9.6	Luminous intensity in C = 0° plane at $\gamma = 80^\circ$	Less than 30 Cd/klm			
10.10	Make of fixture	Bajaj, GE, Philips and CGL			
10.10.1	Nos of fixture provided with high mast	4	5	6	
10.10.2	Type of fixture	Weather proof			
11	Others				
11.1	Make of 24 hour Differential Timer Switch	Legrand/ GE/ Schnider/ L&T			
11.2	Make of 32A TPN MCB	GE/ Hager/ Legrand/ Schnider			
11.3	Make of 32A Contactor	L&T/ Schnider/ GE			
11.4	Earth pit	Two numbers of treated earth pit with each mast			
12	GTP and Drawing Submitted	Yes/No			
13	Type Tests Submitted	Yes/ No			
14	Technical Brochure of luminaries submitted	YES / NO			
15	Operation and maintenance manual submitted	YES / NO			

TECHNICAL SPECIFICATION
FOR
OUTDOOR SWITCHYARD MATERIAL

Prepared by				Rev: 1
Reviewed by				Date:
Approved by				

Technical Specification Outdoor Switchyard Material

1.0 INTENT OF SPECIFICATION

- 1.1 This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport F.O.R site of 66KV Outdoor Switchyard Material and Hardware complete with all accessories for efficient and trouble free operation.
- 1.2 In the event of any discrepancy between listed documents, the stipulation of this specification shall govern.
- 1.3 The specification shall be read and constructed in conjunction with other sections of bidding document.

2.0 SCOPE OF WORK

2.1 Scope of Supply

Type, rating, connections etc. of the materials shall be as detailed in the drawings and annexure. The materials shall be furnished in strict compliance with the same.

2.2 Following materials and hardware's are to be furnished:

- a) ACSR ZEBRA Conductor
- b) Disc Insulator & Post Insulators
- c) Conductor Spacers, Clamps, Connectors.

Any material or accessory, which may not have been specifically mentioned but which is usual and / or necessary shall be supplied free of cost to the Owner.

PG Clamps for ACSR Conductors shall not be acceptable. However, C-Wedge Connector can be offered in place of PG Clamp.

3.0 GENERAL REQUIREMENTS

3.1 Codes and Standards

- i) All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) & IEC Standard except where modified and / or supplemented by this specification.
- ii) Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted. In such cases, copies of the English version of the standard adopted shall be submitted along with the bid.

Technical Specification Outdoor Switchyard Material

- iii) The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Codes of Practice. In addition other rules or regulations applicable to the work followed. In case of any discrepancy, the more restrictive rule shall be binding.

4.0 DESIGN CRITERIA

- 4.1 All the ACSR conductors, disc and string insulators, clamps & connectors, hardware's etc. will be used in extra high voltage system having characteristics as listed in the annexure.
- 4.2 All equipments, conductors, hardware's, insulators & clamps etc. will be installed outdoor in a hot, humid & tropical atmosphere.
- 4.3 The maximum temperature in any part of the clamps, connectors, conductors etc at specified rating shall not exceed the permissible limit as stipulated in the relevant standards.
- 4.4 All equipments, conductors, clamps, connectors, insulators etc shall be capable of withstanding the dynamic & thermal stresses of maximum short circuit current without any damages or deterioration.
- 4.5 In order to avoid concentration of stresses, all sharp edges of clamps, connectors etc. shall be rounded off.
- 4.6 Bi-metallic connectors shall be used for any connection between dissimilar materials.

5.0 SPECIFIC REQUIREMENT

5.1 Equipment & Materials

- i) Equipment & material shall comply with description, rating etc. as detailed in this specification and annexure.
- ii) All accessories, fittings, supports, bolts etc. which form part of the equipment or which are necessary for safe and satisfactory installation and operation of the equipment shall be furnished.
- iii) All parts shall be made accurately to standard gauges so as to facilitate replacement and repair. All corresponding parts of similar equipment shall be interchangeable.
- iv) After the treatment of steel surfaces damaged during transit sufficient quantity of anti-corrosive paint shall be applied and subsequently finished with two coats of final paint of approved shade.

Technical Specification Outdoor Switchyard Material

5.2 ACSR Conductor

- i) The Aluminum Standard conductor and steel reinforced shall have the technical parameters matching with the requirements given in Annexure. ACSR conductors shall conform to the latest revision of IS-398.
- ii) The material for ACSR conductor shall conform to the following:

Aluminum

The Aluminum strands shall be hard drawn from electrolytic Aluminium rods having purity not less than 99.5% and a copper content not exceeding 0.04%.

Steel

The steel wire strands shall be drawn from high carbon steel wire rods and shall conform to the following chemical composition:

Element -% Composition

Carbon - 0.50 to 0.85 Manganese - 0.50 to 1.10 Phosphorous -not more than 0.035
Sulphur -not more than 0.045 Silicon - 0.10 to 0.35

Zinc

The zinc used for galvanizing shall be electrolytic High Grade Zinc of 99.95% purity. It shall conform to and satisfy all the requirements of IS: 209-1979.

5.3 Clamps and connectors

- i) All clamps, connectors and hardware's shall be designed manufactured and tested as per relevant standards.
- ii) All clamps & connectors for connection with ACSR conductors shall have high tensile Aluminum alloy grade A6 body. U- Bolt and nut for the clamp shall be made of non-magnetic material e.g. chromium steel.
- iii) Bolt, nut, washer, shackle etc. required for other purpose shall be of forged steel with adequate strength and the surface shall be so protected as to offer maximum resistance to corrosion. Malleable iron wherever used for any part shall be of best quality and shall correspond to latest amendments of relevant IS.
- iv) Various fittings & accessories of the clamps & connectors shall be so designed as to eliminate sharp edges & maintain bright smooth surface. All bolts, nuts, rivets etc. shall have round profiles.

5.4 Disc Insulator

- i) All disc insulators shall be dimensioned appropriately so as to have the required Electro- Mechanical strength for EHV outdoor duties.

Technical Specification Outdoor Switchyard Material

- ii) Suspension and tension insulators shall be wet process porcelain with ball and socket connection. Glazing of the porcelain shall be uniform brown colour, free from blisters, burrs and other similar defects. Insulators shall be interchangeable and shall be suitable for forming either suspension or strain strings. Each insulator shall have rated strength markings on porcelain printed and applied before firing.
- iii) When operating at normal rated voltage there shall be no electric discharge between conductor and insulator which would cause corrosion or injury to conductors or insulators by the formation of substances due to chemical action. No radio interference shall be caused when operating at normal rated voltage.
- iv) Insulating shall be co-ordinated with basis impulse level of the system. The creepage distance shall correspond to very heavily polluted atmosphere (31mm/KV)
- v) Porcelain used in insulator manufacture shall be homogeneous, free from lamination, cavities and other flaws or imperfection that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.
- vi) The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. All ferrous parts shall be hot dip galvanized in accordance with the latest edition of IS: 209. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfection such as flux, ash, rust stains bulky white deposits and blisters.
- vii) Bidder shall make available data on the essential features of design including the method of assembly of discs and metal parts, number of discs per insulators, the manner in which mechanical stresses are transmitted through discs to adjacent parts, provision for meeting expansion stresses, results of corona and thermal shock tests, recommended working strength and any special design or arrangement employed to increase life under service conditions.
- viii) Insulator hardware shall be of forged steel. Malleable cast iron shall not be accepted except for insulator disc cap. The surface of hardware must be clean, smooth, without cuts, abrasion or projections. No part shall be subjected to excessive localized pressure. The metal parts shall not produce any noise generating corona under operating conditions.
- ix) The insulator hardware assembly and clamps shall be designed for 120KN Tensile load. The clamps shall be designed for 700 Kg tensile load. Earth wire tension clamp shall be designed for 1000 Kg tensile load with a factor of safety of two (2).
- x) The tension string assemblies shall be supplied along with suitable turn buckle.

Technical Specification Outdoor Switchyard Material

6.0 TESTS

6.1 Routine Tests

- i) During manufacture and on completion of all equipment, conductors, insulators, clamps, connectors and accessories shall be routine tested as per applicable standards at manufacture's works.
- ii) The suspension and tension strings, insulator discs and hardware shall be subjected to the following, acceptance tests and routine tests:
 - a) Visual examination
 - b) Verification of Dimensions as per CI no. 10.5 of IS: 731
 - c) Temperature cycle test as per CI no. 10.6 of IS: 731
 - d) Puncture test as per CI no. 10.10 of IS: 731
 - e) Galvanizing test as per CI no. 10.12 of IS: 731
 - f) Mechanical performance test as per IEC-575 Cl. 4
 - g) Test on locking device for ball & socket coupling as per IEC-372 (2)
 - h) Porosity test as per CI no. 10.11 of IS: 731

Acceptance Tests

- a) Visual examination as per Cl. 5.10 Of IS: 2468 (Part-1)
- b) Verification of Dimensions as per Cl. 5.8 Of IS: 2468 (Part-1)
- c) Galvanizing / Electroplating test as per Cl. 5.9 Of IS: 2468 (Part-1)
- d) Slip strength test as per Cl. 5.4 Of IS: 2468 (Part-1)
- e) Shore hardness test for the Elastomer (if applicable as per the value guaranteed by the Bidder)
- f) Mechanical strength test for each component (including grading rings and arcing horns).
- g) Test on locking devices for ball and socket coupling as per IEC: 372 (2)

Routine Tests on Disc Insulator / Long rod Insulator

- a) Visual Inspection as per CI No. 10.13 of IS: 731
- b) Mechanical Routine Test as per CI No. 10.14 of IS: 731
- c) Electrical Routine Test as per CI No. 10.15 of IS: 731

Routine Tests on Hardware Fittings

- a) Visual examination as per Cl. 5.10 Of IS: 2468 (Part-1)
- b) Mechanical strength Test as per Cl. 5.11 Of IS: 2468 (Part-1)

Test during manufacture on all components as applicable on Disc Insulator

Technical Specification Outdoor Switchyard Material

- a) Chemical analysis of zinc used for galvanizing:

Samples taken from the zinc ingot shall be chemically analyzed as per IS: 209. The purity of zinc shall not be less than 99.95%.

- b) Chemical analysis, mechanical hardness tests and magnetic particle inspection for malleable casting:

The chemical analysis, hardness tests and magnetic particle inspection for malleable casting will be as per the internationally recognized procedure for these tests. The sampling will be based on heat number and heat treatment batch

Test during manufacture on all components as applicable on hardware fittings

- a) Chemical analysis of zinc used for galvanizing

Samples taken from the zinc ingot shall be chemically analyzed as per IS: 209. The purity of zinc shall not be less than 99.95%.

- b) Chemical analysis, mechanical hardness tests and magnetic particle inspection for malleable casting:

The chemical analysis, hardness tests and magnetic particle inspection for malleable casting will be as per the internationally recognized procedure for these tests. The sampling will be based on heat number and heat treatment batch

- c) Chemical analysis, mechanical hardness tests and magnetic particle inspection for fabricated hardware.

The chemical analysis, hardness tests and magnetic particle inspection for fabricated hardware will be as per the internationally recognized procedure for these tests. The sampling will be based on heat number and heat treatment batch.

- iii) The following, acceptance & routine tests and tests during manufacturing shall be carried out on the conductor.

Acceptance Tests

a)	Visual check for joints, scratches etc. and length of conductor	
b)	Dimensional check on steel and Aluminum strands	
c)	Check for lay ratio of various layers	
d)	Galvanizing test on steel strands	

Technical Specification Outdoor Switchyard Material

e)	Torsion and Elongation test on steel strands	
f)	Breaking load test on steel and Aluminum strands	
g)	Wrap test on steel and Aluminum strands	IS: 398(Part-V) 1982 Clauses 12.5.2, 12.7 & 12.8
h)	DC resistance test on Aluminum strands	
i)	UTS test on welded joint of Aluminum strands	

NOTE: All the above tests except test mentioned at (i) shall be carried out on Aluminum and steel strands after stranding only

Routine Tests

- a) Check to ensure that the joints are as per specification
 - b) Check that there are no cuts, fins etc. on the strands
- iv) The following type, routine & acceptance tests and tests during manufacturing shall be carried out on the earth wire.

Acceptance Tests

- a) Visual check for joints, scratches etc. and length of Earth wire
- b) Dimensional check
- c) Galvanizing test
- d) Lay length check
- e) Torsion test
- f) Elongation test
- g) Wrap test
- h) DC resistance test : IS: 398 (Part III) 1976
- i) Breaking load test
- j) Chemical Analysis of steel

Routine Tests

- a) Check that there are no cuts, fins etc. on the strands.
- b) Check for correctness of stranding

Technical Specification Outdoor Switchyard Material

6.2 Type Test

Test certificates for type tests shall be from CPRI/ERDA/NABL approved lab, as stipulated in Indian Standards carried out on similar equipment shall be furnished. If test certificate for any of the type test is not available, the same shall be carried out free of cost from CPRI/ERDA/NABL.

6.3 Test Witness

Tests shall be performed in presence of Owner's representative if so desired by the Owner. The contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

6.4 Test Certificates

- i) Certified copies of all tests carried out at works shall be furnished in requisite no. of copies as stated in the condition of contract for approval of the Owner. The certificates shall furnish complete identification, date including serial number of each material and accessory.
- ii) Equipment shall be dispatched from works only after receipt of Owner's written approval of shop test reports.
- iii) Type test certificate on any equipment, if so desired by the Owner, shall be furnished. Otherwise, the equipment shall have to be type tested, free of charge, to prove the design.

7.0 SPARES

The Bidder shall submit a list of recommended spare parts for three (3) years of satisfactory and trouble free operation, indicating itemized price of each item of the spares.

Technical Specification Outdoor Switchyard Material

8.0 DRAWING & DOCUMENTS TO BE FURNISHED

8.1 To be submitted with each copy of the Bid

- i) Typical general arrangement drawing of the equipment / items.
- ii) Technical leaflets on equipment / items expending constructional features.
- iii) Type test certificates on similar equipment / items.

8.2 To be submitted for Approval and Distribution

- i) Dimensional general arrangement drawing showing disposition of various fittings for equipment, accessories, components etc.
- ii) Assembly drawing for erection at site with part numbers and schedule of materials.
- iii) Type & Routine test certificates
- iv) Technical leaflets on equipment / items
- v) Back-up calculation for:
 - a) Selection of equipment / material ratings.
 - b) Sag-Tension of ACSR.
 - c) Lighting protection system
 - d) Selection of rigid bus support spacing.
- vi) Any other relevant drawing, documents, calculations and data necessary for satisfactory installation, operation and maintenance.

9.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

Technical Specification Outdoor Switchyard Material

RATINGS & REQUIREMENTS

1.0	CONDUCTORS	
1.1	ACSR Conductor	
1.1.1	Reference standard :	IS 398
1.1.2	Code Name :	ZEBRA
1.1.3	Type :	ACSR
1.1.4	Overall diameter	28.62mm
1.1.5	Stranding no. of wire and diameter :	54/3.18 (Al) 7/3.18 (St)
	Number of strands Core	1
	1st Layer	6
	2nd Layer	12
	3rd Layer	18
	4th Layer	24
1.1.6	Sectional area of Aluminum :	428.9 sq.mm
1.1.7	Total Sectional area :	484.5 sq.mm
1.1.9	Ultimate Strength (min) :	130.32 KN
1.1.10	Calculated DC resistance at 20 Deg C :	0.06868 ohm/Km

NOTE – The 66KV Main Bus Shall be with TWIN ZEBRA. The equipment bay shall be Single Zebra.

2.0	GALVANISED STEEL SHIELD WIRE	
2.1	Reference standard :	IS 398
2.2.	Number of strands	Steel core-1, outer Steel layer-6
2.3	Total sectional area	54.55 sq.mm
2.4	Overall diameter	9.45 mm
2.5	Approximate weight	428 kg/km
2.6	Calculated DC. resistance at 200C	3.37 ohms/km
2.7	Minimum ultimate tensile strength	56 KN
2.8	Direction of lay of outer layer	Right hand
2.9	Minimum tensile strength	110 Kgf/mm ²
3.0	CONNECTORS / CLAMP ASSEMBLY / SPACER	
3.1	Reference standard :	
3.1.1	Clamp / Connector	IS 5561
3.1.2	Spacer	IS 10162
3.2	Material	Aluminum Alloy A6
3.3	Continuous current carrying capacity (r.m.s) at 50deg C ambient temp.	2000A (min)
3.4	Short time current carrying capacity	31.5KA for 3 sec
3.5	Maximum temperature rise over Ambient of 50	35 deg C

Technical Specification Outdoor Switchyard Material

	deg C	
4.0	INSULATORS	
4.1	Reference standard	
4.1.1	String Insulators/Insulator fittings	IS 731/ IS 2486
4.1.2	Post Insulators	IS 2544
4.2	Type	Post Insulator-
	Cylindrical solid	
	Core type,	
	Suspension &	
	Tension Insulator	
4.3	Service	Outdoor
4.4	System details	
4.4.1	Voltage	66/72.5KV (Nom/Max)
4.4.2	Nos. of phases	3
4.4.3	Frequency	50Hz
4.4.4	System neutral earthing	Effectively earthed
4.5	Insulation Level	
4.5.1	Dry power frequency withstand	140KV r.m.s
4.5.2	Wet power frequency withstands	140KV r.m.s
4.6	Impulse withstand	325KV
4.7	Creepage	31mm/KV

Bus Post Insulators shall have minimum cantilever strength of 800Kg and minimum torsion moment of 500 Kg.

FITTINGS AND ACCESSORIES OF INSULATORS

Each insulator shall be furnished complete with the fittings and accessories as listed below according to requirement

1. Suspension top fitting
2. Suspension clamp fitting
3. Conductor suspension clamp
4. Tension end fitting
5. Tension (anchor) clamp adopter
6. Conductor tension (anchor) clamp
7. Top metal fitting
8. Bottom metal fitting
9. Nuts, Cotter pin, security clips etc.
10. Forged pin, studs etc.

Other standard accessories which are not specifically mentioned but usually provided with insulator of such type and rating for efficient and trouble free operation.

TECHNICAL SPECIFICATION OF IT DEVICES FOR GRID COMMUNICATION

DOCUMENT NO.: BRPL-IT-SCADA-0001

Rev.: 00



BSES RAJDHANI POWER LIMITED
BSES Bhawan, Nehru Place,
New Delhi - 1100049

DOCUMENT CONTROL SHEET

DOCUMENT : TECHNICAL SPECIFICATION OF IT DEVICES FOR GRID COMMUNICATION

DOCUMENT NO. : BRPL-IT-SCADA-001

REV. NO. : 00

ENDORSEMENT

00	05.02.2019	First issue	Suman Kumar	Mrityunjay Kumar
Rev No.	Date	Description	GM - IT	HOD - IT
			Prepared by	Approved By
			BSES Rajdhani Power Limited	

(This document is a property of BSES Rajdhani Power Limited. This is not transferable and shall not be used for any purpose other than for which it is issued)

BRPL-IT-SCADA-0001, Rev. 00	Technical Specification	Page 2 of 8
-----------------------------	-------------------------	-------------

Contents

Sr. No.	Clause No.	Description	Page no.
1.	1.0	INTENT OF SPECIFICATION	4
2.	2.0	SCOPE OF SUPPLY AND SERVICES	5
3.	2.1	IT RACK ROOM REQUIREMENT	5
4.	2.2	POWER SUPPLY REQUIREMENTS	5
5.	2.3	EARTHING REQUIREMENTS	5
6.	2.4	IT RACK SPECIFICATION	6
7.	2.5	IT devices	7
8.	3.0	Terminal Points	7
9.	4.0	Exclusions	7
10.	5.0	Bill of Quantity and vendor list of each item per rack for each grid	7

POINTS TO BE CONSIDERED DURING DESIGNING OF NEW GRID**1.0 INTENT OF SPECIFICATION**

1.1 Tender Specification is intended to cover design, engineering, manufacture, assembly, inspection, shop testing, supply, packing, forwarding to site, unloading, storage and preservation, handling at site, insurance, erection & supervision of erection, pre-commissioning, testing & commissioning, completion of facilities, conducting reliability run tests and performance guarantee tests and handing over the complete IT system to IT department of BSES Rajdhani power limited.

The scope shall also cover the following activities and services in respect of all the equipment and works specified in various sections of this specification.

- a) Basic engineering of all equipment and equipment systems.
- b) Detailed design of all the equipment and equipment system(s).
- c) Providing engineering drawings, data, instruction manuals, as built drawings and other information for owner's review, approval and records.
- d) Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required.
- e) Complete manufacturing including shop testing.
- f) Packing and transportation from the manufacturer's works to the site including customs clearance, port charges, if any.
- g) Receipt, movement to proper storage, storage, preservation and conservation of equipment at the site, movement from storage area to interim/ final foundation location.
- h) Supply of spares as per specified list.
- i) All items and equipment though not specifically mentioned in the specification, but needed to complete the system to meet the intent of the specification shall be deemed to be included in the scope of the bidder.

It is not the intent to completely specify all details of design and construction, but only to lay down broad sizing and quality criteria for the major equipment and systems and it is expected that the equipments shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation up to the contractor's guarantee in a specified manner acceptable to the owner.

2.0 SCOPE OF SUPPLY AND SERVICES

The scope of supply and services shall be complete but not limited to the following:

2.1 IT RACK ROOM REQUIREMENT

- 2.1.1 Air conditioned room shall be provided for proper functioning of all IT devices. The temperature shall be maintained to 22⁰ to 24⁰ C
- 2.1.2 Room size shall be minimum as –
- a) Length – 3.5 mtrs
 - b) Width – 2.5 mtrs.
 - c) Height – 3 mtrs.
- 2.1.3 Cable trench/ duct – 200mm wide cable trench/ duct shall be provided below the finished floor for proper routing of cables up to IT rack. 100mm size conduit shall be provided for cable entry from outside of the building to inside cable trench/ duct. The cable trench / duct shall be connected to nearest DCDB for proper power cable routing up to IT rack.
- 2.1.4 Room door width shall be minimum 4 ft. for ease of rack entry and height shall be as per standard norms. Door shall have locking arrangement.
- 2.1.5 Room's front side shall be provided with glass partition to have the clear view of IT rack from outside the room.
- 2.1.6 Towers (2nos.) for communication link shall be installed at the roof the building. The area required for base of the tower shall be 5 ft X 5 ft and the tower load shall be maximum 250 kg. Link shall be delivered by RCOM/ Airtel/ Sify ISPs. These links delivery shall be directly taken care by owner. Bidder to provide the suitable platform as motioned in the clause for tower erection.

2.2 POWER SUPPLY REQUIREMENTS

- 2.2.1 Required power supply for communication devices inside the IT rack shall be provided. Two numbers 48V DC power through suitable MCB shall be provided for owner's use in the IT rack this power supply shall be used for communication link's POE devices.
- 2.2.2 All internal wiring of rack for various ratings of power supply required by other devices i.e switch, routers, cooling fan, light etc shall be provided.
- 2.2.2 All communication equipments/ devices inside the IT rack shall be on DC supply .

2.3 EARTHING REQUIREMENTS

- 2.3.1 Dedicated electronic earthing shall be provided for IT rack and their devices. The earth pit resistance should be between 0.6 ohm to 1 ohm.

- 2.3.2 Electronic Earthing cable from earth pit to IT rack shall be of minimum 16 sq.mm multi stranded copper cable PVC insulated and internal devices shall be done with minimum of 06 sq.mm multi stranded copper cable PVC insulated.

2.4 IT RACK SPECIFICATION

- 2.4.1 The design of IT rack and layout of all equipment, terminal blocks etc. shall be based on human engineering considerations, fully keeping in view the convenience of operation and maintenance personnel and shall be subject to Owner's approval during detailed engineering.
- 2.4.2 Rack shall be free standing type and have bottom/ top entry for cables to be decided application wise during detailed engineering. The bottom of rack shall be sealed with bottom plate, double compression cable glands and fire proof sealing material to prevent ingress of dust and propagation of fire.
- 2.4.3 Rack size shall be 12U and made of CRCA sheet with 1.6 mm thickness. The rack shall be of front and back opening with 2 mm thick door frame. Front and back door shall have full length of 3 mm thick glass panel for clear view of inside equipments. Cable gland plate shall be detachable type and of 2mm thickness. Door hinges and locks shall be as per manufacturer standards. Special key type locks are not acceptable. Rack colour shade shall be powder coated RAL 7035.
- 2.4.4 Two nos. adjustable height tray shall be provided in the rack for routers and ISP devices.
- 2.4.5 Following are the minimum equipment/ accessories shall be provided in the rack however same shall be decided during detail engineering –
1. DC Power supply converter -
 - i) Input source – 48V DC – 1 no.
 - ii) Output – 12V DC - 4 nos., 5VDC – 2 nos.
 - iii) Input and output connection shall be of terminal type.
 - iv) Input terminals - suitable for 4 sq.mm cable
 - v) Output terminals - suitable for 2.5 sq.mm cable
 2. AC power supply extension board -
 - i) Input source – 230V AC – 1 no.
 - ii) Output sockets with individual switch – 230V AC – 5 nos.
 3. Rack Fan and filter – size 6"
 4. MCB and Terminal blocks – MCB DP type and terminals shall be mounted on DIN rail. Minimum four nos. MCB shall be provided in the rack. One no. for 48 V DC (20A), one no.

for 230V AC (10A) and one no. of each rating shall be kept as spare. Terminal blocks shall be fused type and suitable to respective voltage rating and intended cable size mentioned elsewhere in the specification.

2.4.6 All inter panel wiring shall be with FRLS type wires with proper routing inside the cable alley. Cross ferruling shall be provided for easy identification of wires. Cable shall have proper cable tagging.

2.4.7 Panel name plate shall be provided at top portion of front and back doors. It shall be engraved type and made of acrylic plate.

2.5 IT devices

2.5.1 Router – Router shall have minimum 2 nos. WAN ports and 8 nos. LAN port. Router shall also support the 3G/ 4G dongle connectivity.

2.5.2 Switch – Switch shall have minimum 12 LAN ports. Switch shall be provided with all mounting accessories.

3.0 Terminal Points

3.1 Power supply – From PDB to IT rack including cable supply, erection and termination at both end (PDB and IT rack). PDB details shall be part of Electrical section of technical specification

3.2 LAN cabling – From RTU to IT rack router/ switch including CAT 6 cable (armour type) supply, erection and termination at both end (RTU and IT rack).

3.3 Communication link – Shall be provided by respective ISP upto router WAN ports.

4.0 Exclusions –

4.1 Communication tower and link.

5.0 Bill of Quantity and vendor list of each item per rack for each grid –

Sr. No.	Item Description	Make / Model No.	Quantity (in nos.)
1	Rack – 12U	Rittal / Pyrotech	01
2	Router	Fortigate / CISCO	01
3	Switch	CISCO	01
4	Power Supply converter	Meanwell/ Phoenix	01
5	MCB	Havells / Legrand	04
6	Terminal blocks	Wago/ phoenix	1 lot

7	AC extension board	Havells / Anchor	1
8	Wires for Internal wiring	RR cable, Finolex, Havells	1 lot
9	Spare Terminal blocks with fuses (mounted in the rack)	Wago/ phoenix	20%
10	Terminal fuses of each rating (loose supply)		20%

Technical Specification of Three Phase Four Wire CT operated Static Tri-vector ABT Meter

Document number: BR/18-19/M/ABT_V2

January 2019

Prepared By	Reviewed by	Approved By
<i>Md. Akhtar Ansari</i> 07.01.19	<i>Rishi Goyal</i> 07/01/19	<i>See</i>
Md. Akhtar Ansari	Rishi Goyal	Sheshadri Krishnapura

VERSION CONTROL

SN	Date	Previous Version No.	Current Version No.	Author
1	28.05.18	NA	BR/18-19/M/ABT_V1	Md. Akhtar Ansari, Rishi Goyal
2	07.01.19	BR/18-19/M/ABT_V1	BR/18-19/M/ABT_V2	Md. Akhtar Ansari, Rishi Goyal

CHANGE MANAGEMENT

SN	Date	Version No.	Major Changes
1	07.01.19	BR/18-19/M/ABT_V2	- Display parameters (SN 7) - Load Survey parameters (SN 16) - Other Salient Features added (SN 20)

CONTENTS

1.	SCOPE	4
2.	STANDARDS	4
3.	TECHNICAL SPECIFICATION	4
4.	CONSTRUCTIONAL SPECIFICATION	5
5.	COMMUNICATION PORT	7
6.	DATA DOWNLOADING CAPABILITY	7
7.	DISPLAY OF MEASURED VALUE	7
8.	ELECTROMAGNETIC COMPATIBILITY	9
9.	STARTING CURRENT	9
10.	RUNNING WITH NO LOAD	9
11.	POWER CONSUMPTION	9
12.	CALIBRATION & TEST OUTPUT	10
13.	CONNECTION DIAGRAM	10
14.	QUANTITIES TO BE MEASURED	10
15.	ABNORMALITY EVENTS DETECTION	10
16.	LOAD SURVEY	11
17.	MID NIGHT ENERGY PARAMETER	11
18.	MD RESET	12
19.	SELF DIAGNOSTIC FEATURE	12
20.	OTHER SALIENT FEATURES OF METER	12
21.	TEST AND TEST CONDITIONS	13

1. SCOPE

This specification shall cover design, engineering, manufacture, assembly, inspection, testing at manufacturers works before dispatch, supply and delivery to BRPL, Class 0.2s accuracy class static 3 phase-4 wire CT operated three-vector energy meter. The meter shall be suitable for measurement of energy and power, demand requirement in an AC balanced/unbalanced system over a power factor range of zero lag to unity. These meters should have communication port to interface for remote meter reading.

2. STANDARDS

The meter shall be ISI marked (vendor shall be BIS certified) and conform to CEA Metering (Installation and Operation of Meters) Regulation 2006 and latest amendments, Indian Electricity Acts and Indian Electricity Rules.

The CT operated energy meter shall be of accuracy Class 0.2 for active/ reactive / apparent energy and conform to relevant clauses of following standards or report: -

IS 14697: 1999	Specification for A.C Static Transformer operated Watt Hour & VAR – Hour meters, class 0.2s
CBIP Technical Report No. 304 with	Specification for A.C. Static Electrical Energy Meters.
IS 15959 (Companion specification)	DLMS Indian Companion Standard – Category 'B' for Ring fencing/Boundary/ABT Metering

Unless otherwise specified elsewhere in this specification the static meters shall conform to the latest version available of the standard as specified above.

3. TECHNICAL SPECIFICATION

SN	Parameters	Technical Requirements
1	Rated Secondary Voltage	63.5 V (Phase to Neutral)
2	Rated secondary Current (I Basic)	1A or 5 A
3	Maximum Current	200% of Ib
4	Rated Frequency	50 Hz
5	Accuracy class	<ul style="list-style-type: none"> • 0.2s (the meter should meet the same class of accuracy for reactive energy also) • The reactive accuracy class of the meter shall be same as the active accuracy class
6	Power Factor	Unity to Zero (all power factor lag / or lead)
7	Temperature	The standard reference temperature for performance shall be 27 °C. The mean temperature co-efficient shall not exceed 0.03%.

The meter shall start and continue to register on application of 0.1% of basic current at Unity P.F., as per relevant standards and shall work satisfactorily up to maximum continuous current of 2 times rated basic current with the following supply system variation:

Voltage: $V_{ref} \pm 30\%$
Frequency: $50 \text{ Hz} \pm 5\%$

4. CONSTRUCTIONAL SPECIFICATION

The case, winding, voltage circuit, sealing arrangements, registers, terminal block, terminal cover & name plate etc, shall be in accordance with the relevant standards. The meter should be compact & reliable in design, easy to transport & immune to vibration & shock involved in the transportation & handling. The construction of the meter should ensure consistence performance under all conditions especially during storms/heavy rains/very hot weathers. The insulating materials used in the meter should be non-hygroscopic, non-ageing & have tested quality. The meter should be sealed in such a way that the internal parts of the meter become inaccessible.

The meter should employ latest technology such as Application Specific Integrated Circuit (ASIC) to ensure reliable performance. The mounting of the components on the PCB should be Surface Mounted Technology (SMT) type except some power supply related component. The electronic components used in the meter should be of high quality.

4.1 GENERAL MECHANICAL REQUIREMENT

The construction of the meter shall be rigid & suitable to withstand shock & vibration involved in transportation & handling, as specified in IS14697. Meter shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially personal safety against electric shock, safety against effect of excessive temperature, protection against spread of fire, protection against penetration of solid objects, dust and water. The design of meter shall conform to IP51 class degree of protection against dust and moisture as per relevant standards.

4.2 TROPICAL TREATMENT

All parts, which are subject to corrosion under normal working conditions, shall be protected effectively. Any protective coating shall not be liable to damage by ordinary handling or damage due to exposure to air, under normal working conditions. Meters shall withstand solar radiation. The meters shall be suitably designed and treated for normal life & satisfactory operation under the hot and hazardous tropical climatic conditions as specified in clause no. 2. The meter shall work from -10°C to $+55^{\circ}\text{C}$ and RH 95% non-condensing type.

4.3 METER CASE

The housing of the meter shall be safe high-grade Engineering plastic or any other high quality insulating material and shall be very compact in design. All the insulation materials used in the construction of meter shall be non-hygroscopic, non ageing & of tested quality, capable of withstanding resistant to heat & fire. The construction of the meter offered shall be such that it can be sealed independently and the cover cannot be removed with the use of a

tool, without breaking the seal. The case of offered meters shall be so constructed that any non-permanent deformation shall not prevent the satisfactory operation of the meter.

4.4 TERMINALS - TERMINAL BLOCK

- a. The base of the meter shall have a terminal block at the bottom made out of high grade engineering plastic so as to facilitate bottom connection and houses solid nickel plated brass terminals having capability to carry maximum value of current.
- b. The material of the terminal block shall be capable of passing the tests given in IS14697: 1999.
- c. The terminal holes in the insulating material shall be of sufficient size to accommodate the insulation of the conductors. The diameter of the terminal hole for current terminals shall not be less than 5.0 mm & shall be of adequate length in order to have proper grip of conductors / crimping pins with the help of two screws.
- d. The terminal block shall satisfy all the conditions such as clearance & creepage distance between terminals & surrounding part of the meter as specified in relevant clause of IS 14697: 1999.
- e. The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there shall have no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixing which may be loosened and tightened several times during the life of the meter shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Electrical connections shall be so designed that contact pressure shall not be transmitted through insulating material.

4.5 TERMINAL BLOCK COVER

The terminals block cover for the energy meters shall be extended transparent type, which can be sealed independently of the meter cover. The ETBC shall have a clear space of min 40 ± 5 mm, thus allowing sufficient clearance space for inserting cables. The terminals, their fixing screws and the insulated compartment housing them shall be enclosed by extended terminal cover in such a way that no part of meter or accessories at terminal block shall be accessible from the front of the meter. There shall be provision of fixing of seals so that screws cannot be loosened without breaking the seals.

The terminals shall not be accessible without removing the seal(s) of terminal cover when energy meter is mounted on the meter board.

4.6 WINDOW

The energy meter cover shall be made of high-grade engineering plastic with one window. The window shall be of transparent material ultrasonically welded with the meter cover such that it cannot be removed undamaged without breaking the meter cover seals.

4.7 QUALITY

Overall the quality of the meter should be good and the service life of the meter shall be more than the guarantee period. The material, components used for manufacturing the meter shall be of premium quality. The LCD display shall not fade with time and the display annunciators should be visible. Functionality of the meter shall not be affected by the harsh environmental conditions. Quality meters shall be given preference and the performance of previous installed meters shall be analyzed before awarding the tender. Aesthetically, the meter shall be of premium quality.

5. COMMUNICATION PORT

5.1 LOCAL COMMUNICATION PORT

The energy meter shall have a galvanically isolated optical communication port located in front of the meter for data transfer to or from a hand held Data Collection Device. The sealing provision should be available for optical port.

5.2 REMOTE COMMUNICATION PORT

Meter shall have an additional communication port (RS 232) in the form of RJ11 port to interface external modem for remote data collection. RS232 port should have sealing provision. It should facilitate to read meter remotely via GSM/GPRS/3G/4G modem.

6. DATA DOWNLOADING CAPABILITY

Meter shall support a minimum baud rate of 9600 on optical port as well as RS 232 remote communication port. It shall be possible to read selective data from the meter using base computer software.

7. DISPLAY OF MEASURED VALUE

The measured value(s) shall be displayed on seven segments, six digit Liquid Crystal Display (LCD) display unit/register, having minimum character height of 10 mm.

The data should be stored in non-volatile memory. The non-volatile memory should retain data for a period of not less than 10 years under unpowered condition. Battery back-up memory will not be considered as NVM.

It should be possible to easily identify the single or multiple displayed parameters through symbols/legend on the meter display itself or through display annunciators.

The register shall be able to record and display starting from zero, for a minimum of 1500 hours, the energy corresponding to rated maximum current at reference voltage and unity power factor. The register should not roll over in between this duration.

The principle unit for the measured values shall be Wh/kWh for active energy, VARh/kVARh for reactive energy & VAh/kVAh for apparent energy based on secondary current. Bidder shall mention the scale in which the meter displays the energy values.

Following parameters should be made available on display:

1. Real Time
2. Date
3. Line currents
4. Phase to Neutral Voltages
5. Phase wise Power Factor
6. Frequency
7. Active, Reactive and Apparent Power
8. Cumulative tamper count
9. Cumulative MD reset Count
10. Cumulative active import energy
11. Cumulative active export energy
12. Cumulative reactive lag While active import
13. Cumulative reactive lead While active import
14. Cumulative reactive lag While active Export
15. Cumulative reactive lead While active Export
16. Cumulative apparent import energy
17. Cumulative apparent export energy
18. Active net energy(Imp – exp)
19. Reactive net energy(Imp – exp)
20. Reactive high energy(V>103 percent)
21. Reactive low energy (V<97 percent)
22. THD in % for Voltage R Phase
23. THD in % for Voltage Y Phase
24. THD in % for Voltage B Phase
25. THD in % for Current R Phase
26. THD in % for Current Y Phase
27. THD in % for Current B Phase
28. THD in % for Power R Phase
29. THD in % for Power Y Phase
30. THD in % for Power B Phase
31. Present PT status
32. Present CT status
33. High resolution active import energy
34. High resolution active export energy
35. High resolution reactive lag While active import
36. High resolution reactive lead while active import
37. High resolution reactive lag While active Export
38. High resolution reactive lead While active Export
39. High resolution apparent forwarded energy
40. High resolution apparent import energy
41. High resolution apparent export energy

The meter should have visual quadrant representation on the LCD for energy measurement. Relevant quadrant in which metering is taking place should be in on state for ease of understanding.

8. ELECTROMAGNETIC COMPATIBILITY

The static energy meters shall conform to requirements listed in relevant standards and shall also be protected against radiated interference from either magnetic or radio-frequency source.

8.1 IMMUNITY TO ELECTROMAGNETIC DISTURBANCE

The meter shall be designed in such a way that conducted or radiated electromagnetic disturbance as well as electrostatic discharge do not damage or substantially influence the meter and meter shall work satisfactorily under these conditions as per relevant standards

NOTE: the disturbances to be considered are: -

- (a) Harmonics
- (b) Voltage dips and short interruptions
- (c) Conducted transients
- (d) D.C. and A.C. magnetic fields
- (e) Electromagnetic fields
- (f) Electrostatic discharges

8.2 RADIO INTERFERENCE SUPPRESSIONS

The meter shall not generate noise, which could interfere with other equipment, and meter shall work satisfactorily as per relevant standards

8.3 INFLUENCE OF HIGH MAGNETIC FIELD

The meters shall be provided appropriate magnetic shielding so that any external magnetic field (AC/DC electromagnet) as per CBIP Technical Report no. 304 applied on meter would not affect the proper functioning of the meter and meter shall work satisfactorily as per relevant standards.

9. STARTING CURRENT

The meter shall start and continue to register at the current 0.1% of Ib.

10. RUNNING WITH NO LOAD

When the 115% of rated voltage is applied with no current flowing in the current circuit, the meters shall not register any energy and test output of the meter shall not be more than one pulse/count on "no load".

11. POWER CONSUMPTION

11.1 The active and apparent power consumption in each voltage circuit of the CT Operated meters at reference voltage; temperature and frequency shall not exceed 1.0 W and 4 VA per phase respectively.

11.2 The apparent power consumption in each current circuit for the CT Operated meters at basic current, reference frequency and reference temperature shall not exceed 1.0 VA per phase.

12. CALIBRATION & TEST OUTPUT

All the meters shall be tested, calibrated and sealed at works before dispatch. Further, no modification of calibration shall be possible at site by any means.

However, it shall be possible to check the accuracy of kWh and kVAh energy measurement of the meter in the field by means of LED/LCD output on meter for accuracy. Resolution of the test output shall be sufficient to enable the starting current test in less than 10 minutes

13. CONNECTION DIAGRAM

The connection diagram of the meter shall be clearly shown for 3 phase 4 wire system, on the terminal cover. The meter terminals shall also be marked and this marking should appear in the above diagram.

14. QUANTITIES TO BE MEASURED

The meter shall be able to provide the following data:

- a. Instantaneous Parameters (Phase wise THD in % for Voltage and Phase wise THD in % for Current).
- b. Block Profile / Load Survey data
- c. Daily load profile/Mid night data
- d. Abstract quantities
 - Name Plate Details
 - Programmable parameters
- e. Event Conditions.(Parameter snapshot of Phase wise THD% in Current and Voltage along with other parameters & kWh (total & fundamental), kVAh, Phase wise Current and Voltage for 3rd, 5th, 7th and 9th Harmonics).

Meter should store previous 12 month billing data into meter memory.

15. ABNORMALITY EVENTS DETECTION

The meter should have features to detect the occurrence and restoration of, at least, the following common abnormal events:

- a. **Missing Potential:** The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of Potential failure (one phase or two phases). All potential missing cases shall be considered as power failure.
- b. **Current imbalance:** The meter shall be capable of detecting and recording occurrence and restoration with date and time of Current unbalance (for more than a defined persistence time).
- c. **Current Reversal:** The meter shall be capable of detecting and recording occurrence and restoration with date and time if the current is flowing in reverse direction in one or more phases.
- d. **Power on/off:** The meter shall be capable to record power on /off events in the meter memory. All potential failure should record as power off event.

- e. **Voltage unbalance** – Meter shall detect voltage unbalance if there is unbalance in voltages.
- f. **Over Current** – When load condition at any phase i.e. Line current at any phase goes more than defined limit, this will be detected as Over current condition.
- g. **CT Open** – The meter should detect phase wise current circuit open when the circuit is opened from meter side.
- h. **CT Bypass** – The condition should be detected whenever the current terminal is bypassed in the meter
- i. **High and Low Voltage**: The meter should detect under and over voltage events respectively if voltage falls / rise from defined limits.
- j. Phase wise voltage THD% more than 5% for 5 min
- k. Phase wise current THD% more than 8% for 5 min.

The meter shall keep records for the minimum last 250 events (occurrence + restoration) for above abnormal conditions. Each event shall be logged with date and time of occurrence/restoration. It shall be possible to retrieve the abnormal event data locally using a hand held unit (HHU) through the meter's optical port & same can be viewed / analyzed at base computer end in simple and easily understandable format.

16. LOAD SURVEY

Following parameters shall be made available for last 60 days with integration period of 15 min.

- i. Frequency
- ii. Three Phase Average Voltage
- iii. R Phase Voltage
- iv. Y Phase Voltage
- v. B phase Voltage
- vi. Phase R Current
- vii. Phase Y Current
- viii. Phase B Current
- ix. Energy Active Import (with & without harmonics)
- x. Energy Active Export (with & without harmonics)
- xi. Energy Apparent Import (with & without harmonics)
- xii. Energy Apparent Export (with & without harmonics)
- xiii. Energy Reactive Import with voltage as per ABT requirement
- xiv. Energy Reactive Export with voltage as per ABT requirement
- xv. Energy Net Active Energy
- xvi. THD for phase wise voltage, current, power
- xvii. Average and phase wise power factor

These load survey and history data can be retrieved with the help of Meter Reading Instrument on local interrogation or remotely using the remote communication interface.

17. MID NIGHT ENERGY PARAMETER

The parameters shall be logged at midnight (00:00 hrs). The meter should store these parameters for 35 days.

- i. Real time clock , date and time
- ii. Cumulative Energy , kWh Import
- iii. Cumulative Energy , kWh Export
- iv. Reactive energy high (V>103 percent)
- v. Reactive energy low (V<97 percent)

18. MD RESET

The meter shall have provision to store two Maximum Demand occurred during the integration period selected for kW / kVA parameters during a month. The meter shall monitor the demand during the period set and record for each of the TOD zones the maximum registered values during the particular month. Default demand integration period shall be 15 min.

The meter shall have any of the following MD resetting options:

- a. Automatic reset at the end of a certain predefined period (say, end of the month)
- b. Manual resetting arrangement (MD reset button) with sealing facility.
- c. MD reset through authenticated transaction

19. SELF DIAGNOSTIC FEATURE

The meter shall be capable of performing complete self-diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data memory location at all time. The meter shall have indication for unsatisfactory/non-functioning/malfunctioning of the following:

- a. Time and date on meter display
- b. All display segments on meter display
- c. Self diagnostic (RTC, NVM information) on display

20. OTHER SALIENT FEATURES OF METER

- a. It should be possible to check the healthiness of phase voltages by phase indicator available on meter display.
- b. The meter shall have provision for TOD tariff as per latest DERC regulations. The following features.
 - Programmable upto 8 energy and 2 Demand registers.
 - Programmable upto 4 seasons per year.
- c. The meter should work accurately irrespective of phase sequence of the supply.
- d. The meter shall compute the reactive power on 3-phase, 4-wire principle, with an accuracy as per relevant IS/ IEC standards, and integrate the reactive energy algebraically into two separate reactive energy registers, one for the period for which the average RMS voltage is greater than 103% (Reactive High), and the other for the period for which the average RMS voltage is below 97.0% (Reactive Low). When lagging reactive power is being sent out from substations bus bars, reactive registers shall move forward. When reactive power flow is in the reverse direction, reactive registers shall move backwards.
- e. The meter shall continuously compute the average of the RMS values of the three line-to-neutral VT secondary voltages as a percentage of 63.51 V, and display the same on demand.

21. TEST AND TEST CONDITIONS

- a. Acceptance test: All acceptance tests as per relevant standards shall be carried out in the presence of utility representatives.
- b. Routine Test: All the routine tests as per – IS 14697 shall be carried out and routine tests certificates shall be submitted for approval of purchaser.

--End of Doc--



Specification for
66KV OUTDOOR
CAPACITIVE VOLTAGE TRANSFORMER
(CVT)

Specification no. SP-CVT-01-R0

Prepared by:		Checked by :		Approved by:		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
Tanu		Meenakshi		K.K.Alla		02	16-July-14

Volume – I Technical Specification for 66KV Outdoor CVT

1.0 CODES & STANDARDS:

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

National Standard

Standard Code	Standard Description
IS-3156 (Part I to IV)	Specification for Voltage transformer.
IS-4146	Application guide for voltage transformer.
IS-2099	High voltage porcelain bushings
IS-731	Insulator for O/H power line
IS-335	New insulating oil for transformer and switchgear.
IS-9676	Reference ambient temperature of electrical equipment
IS-5561	Specification of electric power connectors
IS-5621	Hollow insulator for use in electrical equipments
IS-3156 (Part I to IV)	Specification for Voltage transformer.
IS-4146	Application guide for voltage transformer.
IS-2099	High voltage porcelain bushings
IS-731	Insulator for O/H power line
	Indian Electricity Rules (relevant safety regulation of CEA)
	Indian electricity act
	CBIP manual

2.0 MAJOR DESIGN CRITERIA & PARAMETERS OF THE CVT

	Description	Requirement / Rating
2.1.0	Rated Voltage	66KV
2.1.1	Highest System Voltage	72.5kV
2.1.2	Frequency	50HZ ± 5%
2.1.3	Fault level	31.5KA for 3secs.
2.1.4	Earthing	Solidly grounded
2.2.1	Type	Single phase, outdoor, dead tank type, oil immersed, self cooled type.
2.2.2	Construction feature	Oil immersed CVT shall be hermetically sealed to eliminate breathing and to prevent ingress of air and moisture.

Volume – I Technical Specification for 66KV Outdoor CVT

2.3.0	Features	<p>a) Shall comprise a capacitor divider unit and an electromagnetic unit such that secondary voltage of electromagnetic unit is substantially proportional to and in phase with the primary voltage applied to capacitor divider units.</p> <p>b) Capacitors shall be oil impregnated type enclosed in inert gas atmosphere, hermetically sealed.</p> <p>c) The material and construction and assembly of CVT shall be such that the capacitance does not change with time and the effect of temperature is minimum.</p> <p>d) Provided with an over voltage suppressor</p> <p>e) No radio interference when operated at maximum service voltage</p> <p>f) Reactance to be provided to minimize draining of carrier signal in electromagnetic unit</p> <p>g) No radio interference when operated at maximum service voltage</p> <p>h) The CVT shall be designed to cover its rated output range without any adjustment of its electromagnetic unit.</p> <p>i) Material used in insulation and assembly of the winding shall be insoluble, non catalytic and chemically inactive in hot transformer oil and shall not be subjected to a shrinking and seasoning process</p> <p>j) CVT shall provide designed transient response requirement as per IEC / IS i.e. during transient oscillations following a short circuit on primary side, the secondary side output voltage shall not fall to a value less than 10% of peak value before short circuit within 20 milliseconds</p> <p>k) The secondary terminal box shall include necessary HRC fuses for protection of secondary circuits and both the sides of fuse shall be terminated on terminal block for fuse supervision.</p>
2.4.0	Major Parts	
2.4.1	Tank	
2.4.2	Material of Construction	Tank shall be of high quality steel and shall be Hot Dip Galvanized with galvanizing thickness of 610gm/sq mm minimum.
2.4.3	Tank Feature	The tank shall be provided with oil draining plug, Oil level gauge glass.
2.4.4	Oil Expansion	Stainless steel bellow or diaphragm shall be provided to take care of oil expansion
2.4.5	Core	High grade, non ageing, low loss, high

Volume – I Technical Specification for 66KV Outdoor CVT

		permeability, cold rolled grain oriented silicon steel lamination.
2.5.0	Winding	
2.5.1	Material	Electrolytic Copper
2.5.2	Winding Insulating material	Class A, non catalytic, inert to transformer oil, free from compounds liable to ooze out, shrink or collapse.
2.5.3	Winding Insulation	Uniform
2.5.4	Design features	Winding shall be capable of desired output as per specified limits without exceeding permissible temperature rise.
2.6.0	Insulating oil	
2.6.1	Type	Class 1 new mineral insulating oil as per IS 335, shall be certified not to contain PCBs. Anti oxidant inhibitor if recommended shall be subject to Owner's approval.
2.7.0	Bushings and Terminations	
2.7.1	Type	Porcelain bushing
2.7.2	Termination on HV side bushing	The HV Terminal shall be of copper. Termination shall be by bimetallic of Aluminum alloy grade A6 suitable for Twin Zebra ACSR conductor/ 3inch Pipe Bus.
2.7.3	Termination of LV side	The secondary terminals shall be provided in IP55 Box with Brass/copper stud type terminals accessible from front with removable cover.
2.7.4	Termination of Earth terminal of HV winding	The earth terminal of HV winding shall be bought out in secondary Terminal box by bushing. This shall be connected with body earth terminal with flexible copper lead through a link.
2.7.5	Terminal marking	Terminals shall be marked as per IS 3156
2.8.1	Minimum creepage distance of bushing	31 mm/KV
2.8.1	Protected creepage distance	At least 50 % of total creepage distance
2.9.1	Over Voltage factor	1.2 times for continuous rating and 1.5 times for 30 seconds.
2.10.1	Atmospheric protection for clamp and fitting of iron and steel	Hot dip galvanizing as per IS 2633
2.10.2	Gland Plate	Min. 3 mm thick detachable with three knockout holes of 3/4 inch.
2.10.3	Cable entry	Bottom for all cables
2.11.1	Earthing	The CVT assembly comprising of the chassis, frame work and fixed parts of metal casing shall be provided with two separate body earthing terminals.
2.12.1	External finish	Shall be Hot Dip galvanized

Volume – I Technical Specification for 66KV Outdoor CVT

3.0 FITTINGS & ACCESSORIES ON POTENTIAL TRANSFORMER

3.1.0	Rating and Diagram Plate	Required
3.1.1	Material	Anodized Aluminum 16SWG
3.1.2	Background	SATIN SILVER
3.1.3	Letters, diagram & border	Black
3.1.4	Process	Etching
3.2.5	Name plate details	Required
3.3.6	Terminal marking of Primary and secondary terminals.	Required
3.4.0	Drain Plug on tank Base	Required

4.0 APPROVED MAKE OF COMPONENTS

4.1.0	Insulator	CJI/JSI/WSI/Modern/Saravana/BHEL/ABIL
-------	-----------	---------------------------------------

5.0 TESTING & INSPECTION

5.1.0	Inspection and Testing during manufacture	
5.2.0	Tank	i) Checking of dimensions as per approved drawing. ii) Checking for leakage by pressure testing. iii) Thickness of Paint or Galvanization, as applicable
5.3.0	Porcelain	i) Check dimension. ii) Check finish of sealing surface. iii) Check creepage distance. iv) Check for routine electrical test. v) Check for porosity and temperature cycle test.
5.4.0	Insulating Materials	i) Sample check for physical properties of materials. ii) Check for dielectric strength. iii) Visual and dimensional checks.
5.5.0	Copper conductor	i) Check for dimension. ii) Check for elongation. iii) Check for unidirectional scrap. iv) Check for heat shock.
5.6.0	Oil	i) Check for break down voltage. ii) Check for density. iii) Check for flash point. iv) Check for moisture content. v) Check for neutralization value. vi) Check for inter facial tension at 27 Deg c. vii) Check for sludge content. viii) Check for specific resistance. ix) Check for pour point.
5.7.0	Secondary terminals	i) Check for one min AC Test
5.8.0	Routine tests	Tests shall be carried out in accordance with IS 3156
5.9.0	Type Tests	a) On one CVT of each rating and type (In CPRI/ERDA) b) All the test as per IS 3156

Volume – I Technical Specification for 66KV Outdoor CVT

		b) In case the product is never type tested earlier, seller has to conduct the type tests from CPRI/ERDA test labs on BSES order at their own cost, before commencement of supply.
5.10.0	Acceptance test	<p>To be performed in presence of Owner at manufacturer works:-</p> <ul style="list-style-type: none"> i) Physical inspection of dimensions and BOM. ii) Verification of terminal marking and polarity. iii) Power frequency dry withstand tests on primary winding. iv) Power frequency dry withstand tests on <ul style="list-style-type: none"> • <i>secondary winding</i> • <i>Capacitor voltage divider</i> • <i>Low-voltage terminal of the capacitor voltage divider.</i> • <i>Electromagnetic unit</i> v) Partial discharge test (this shall be only for future reference) vi) Determination of ratio and phase angle errors according to the appropriate designation or accuracy class.

6.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

Volume – I Technical Specification for 66KV Outdoor CVT

Annexure –A Scope of supply

1.0 The scope of supply shall include following

1.1 Design, manufacture, assembly, testing at storages of manufacturing as per C I. 12 of this specification, final testing at manufacturer works on completely assembled transformer before dispatch, packing delivery and submission of all documentation for the Power transformer with all accessories as below

Sr. No.	Description	Scope of Supply
1.0	Fully assembled PT with all major parts like Tank, bushing, Primary terminal with connector and secondary terminal box.	YES
1.1	Galvanised steel structure for PT	NO
1.2	Fixing Bolts for PT	YES
1.3	Routine testing as per this specification	YES
1.4	Type testing as per this specification	YES
1.5	Submission of Documentation as detailed below	YES

1.2 Supervision of testing & commissioning of PT as site

1.3 BOQ as following-

Sr. No.	Purchaser Equipment Tag No. / SAP code	Location / Substation name	Unit	Quantity
1		e.g. Santacruz	No	e.g. 1
2		e.g. Alaknanda	No	e.g. 1
3				
4				
5				

2.0 Submission of documents

Submission of drawing, calculations, manual, catalogues, test report shall be as follows

	Along with offer	For Approval after award of contract	Final after approval	Remarks
Drawing	3 copies (Typical drgs)	4 copies	6 copies + 1 soft copy in CD	See clause 5.0 for various drawing required
Calculations	3 copies (Typical)	4 copies	6 copies + 1 soft copy in CD	See clause 5.0 for details
Catalogues	1 copy		6 copies + 1 soft copy in CD	
Instruction manual for the transformer	1 copy		6 copies + 1 soft copy in CD	

Volume – I Technical Specification for 66KV Outdoor CVT

Test Report	2 copy		6 copies + 1 soft copy in CD	Type test and sample routine test reports
-------------	--------	--	------------------------------	---

3.0 Delivery Schedule

- 3.1 Delivery Period start date - from data of purchase order
- 3.2 Delivery Period end date - as agreed with supplier
- 3.3 Material dispatch clearance - after inspection by purchaser and written dispatch clearance for purchaser

Volume – I Technical Specification for 66KV Outdoor CVT

Annexure – B SERVICE CONDITIONS

1.0.0	Mumbai Atmospheric conditions	
a)	Average grade atmosphere	Heavy polluted , salt Laden, dusty, humid with possibility of condensation
	Maximum altitude above see level	1000 M
b)	Ambient Air temperature	Highest 45 deg C, Average 35 deg C
	Maximum ambient air temperature	20 deg C
c)	Relative Humidity	100 % Max
d)	Thermal Resistivity of Soil	150 deg. C cm/W
e)	Seismic Zone	3 as per IS 1893
f)	Rainfall	3000 mm concentrated in four months

2.0.0	Delhi Atmospheric conditions	
a)	Average grade atmosphere	Heavy polluted , dry
	Maximum altitude above see level	1000 M
b)	Ambient Air temperature	Highest 50 deg C, Average 40 deg C
	Maximum ambient air temperature	0 deg C
c)	Relative Humidity	100 % Max
d)	Thermal Resistivity of Soil	150 deg. C cm/W
e)	Seismic Zone	4 as per IS 1893
f)	Rainfall	750 mm concentrated in four months
g)	Wind Pressure	195 Kg/m ² up to 90 M elevation as per IS 875-1975

Volume – I Technical Specification for 66KV Outdoor CVT

**Annexure – C: Guaranteed Technical Particulars 66 KV OUT DOOR CAPACITIVE
VOLTAGE TRANSFORMER**

	Description	Data By Purchaser	Data By Supplier
1.0	Location of Equipment	Project specific to be filled up	
2.0	Name of Manufacturer		
3.0	Address & Contact details		
4.0	Type	Single phase, outdoor, dead tank type, oil immersed, self-cooled, hermetically sealed type	
5.0	Manufacturer Model No		
6.0	Reference design ambient temperature	50 Deg C	
7.0	Reference Standard	IS: 3156 (Part1 to 4)	
8.0	Nominal system voltage	66KV	
9.0	Highest system voltage	72.5KV	
10.0	Basic Insulation level	325KVp	
11.0	Power frequency voltage	140KV	
12.0	Type of cooling	ONAN	
13.0	Rated frequency (Hz)	50 Hz	
14.0	Insulation Class	A	
15.0	Rated Primary voltage	66KV / $\sqrt{3}$	
16.0	Rated secondary voltage	110V / $\sqrt{3}$	
17.0	Number of secondary cores	Two	
18.0	CORE Specifications		
18.1	Core - 1		
18.2	Purpose	Metering	
18.3	Rated Output	50 VA	
18.4	Class of accuracy	0.2	
18.5	Ratio error	As per IS	
18.6	Phase angle error	As per IS	
19.0	Core - 2		
19.1	Purpose	Protection	
19.2	Rated Output	50 VA	
19.3	Class of accuracy	3P	
19.4	Total Simultaneous Burden		
19.5	Total Thermal Burden		
19.4	Ratio error	As per IS	
19.5	Phase angle error	As per IS	
20.0	Rated over voltage factor		
20.1	- Continuous	1.2 times	
20.2	- 30 Seconds	1.5 times	
21.0	Capacitor Divider		
21.1	High voltage Capacitor	C1(pf)	
21.2	Intermediate Voltage Capacitor	C2(pf)	

Volume – I Technical Specification for 66KV Outdoor CVT

21.3	Total Equivalent Capacitance	Pf	
21.4	Rated temperature at which above values are indicated.	Deg C	
21.5	Capacitance temperature coefficient		
21.6	Tan delta value of capacitance		
21.7	Carrier frequency coupling	Pf	
21.8	Rated Intermediate Voltage		
22.0	Natural frequency of coupling	kHz	
23.0	Band Width	kHz	
24.0	Series reactance/choke rated Voltage & power frequency withstand voltage		
24.0	Temperature rise above an ambient of 50Deg C at 1.2 times voltage factor for 30 seconds rating		
24.1	- For Winding	Deg C	
24.2	- For Oil	Deg C	
25.0	Temperature rise above an ambient of 50Deg C at 1.5 times voltage factor for 30 seconds rating		
25.1	- For Winding	Deg C	
25.2	- For Oil	Deg C	
26.0	One minute power frequency dry& wet withstand voltage of capacitor	140kVrms	
27.0	One minute power frequency withstand voltage of H.F terminal		
28.0	1.2/50 microsecond impulse withstand test voltage	325 KVp	
29.0	One minute Power frequency withstand voltage on secondary winding	3KV	
30.0	Corona extinction voltage	kV	
31.0	Max Radio Interference voltage at $1.1 \times U_m / \sqrt{3}$	V	
32.0	Minimum creepage distance in mm	2250 mm	
33.0	Protective creepage distance in mm	1125 mm	
34.0	Partial discharge test, whether will be carried out Yes / No		
35.0	Weight of core		

Volume – I Technical Specification for 66KV Outdoor CVT

36.0	Weight of oil		
37.0	Total weight		
38.0	Mounting details		
39.0	Overall dimensions		

Annexure –D RECOMMENDED SPARES (DATA BY SUPPLIER)

List of recommended spares as following –

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

BSES

Technical Specification

For

Outdoor Potential Transformers

(33 kV and 66 kV)

Specification no – BSES-TS-89-OPT-R0

Rev:		0
Date:		06 Jun 2022
Prepared by	Abhishek Harsh	
	Amar Singh	
Reviewed by	Srinivas Gopu	
	Abhinav Srivastava	
Approved by	Gaurav Sharma	 
	Gopal Nariya	

INDEX

1	SCOPE OF SUPPLY.....	3
2	CODES & STANDARDS.....	3
3	MAJOR DESIGN CRITERIA & PARAMETERS.....	3
4	RATING PLATE.....	6
5	APPROVED MAKE OF COMPONENTS.....	7
6	DRAWING, DATA & MANUALS.....	7
7	QUALITY ASSURANCE, TESTING & INSPECTION.....	8
8	PACKING, SHIPPING, HANDLING AND STORAGE.....	10
9	DEVIATIONS.....	12
10	DRAWINGS & DATA SUBMISSION MATRIX.....	12
11	ANNEXURE - A (SERVICE CONDITIONS).....	13
12	ANNEXURE - B (GUARANTEED TECHNICAL PARTICULARS 66KV PT/VT).....	14
13	ANNEXURE - C (GUARANTEED TECHNICAL PARTICULARS 33KV PT/CVT).....	17
14	ANNEXURE – D (RECOMENDED SPARES-DATA BY SUPPLIER).....	20

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER**1 SCOPE OF SUPPLY**

Design, manufacture, assembly, testing at stages of manufacture as per this specification, final testing at manufacturer works on completely assembled Potential Transformer (PT) / CVT before dispatch, packing and delivery of PT/CVT Transformer as per the tender requirement.

2 CODES & STANDARDS

Materials, equipment and methods used in the manufacture of Potential Transformer (PT)/ CVT shall conform to the latest edition of following

IS-3156 (Part I to IV)	Specification for Voltage transformer
IS-4146	Application guide for voltage transformer.
IS-2099	High voltage porcelain bushings
IS-731	Insulator for O/H power line
IS-335	New insulating oil for transformer and switchgear.
IS-9676	Reference ambient temperature of electrical equipment
IS-5561	Specification of electric power connectors
IS-5621	Hollow insulator for use in electrical equipments
	Indian Electricity Rules
	Indian electricity act
	CBIP manual

3 MAJOR DESIGN CRITERIA & PARAMETERS

3.1	System	66KV	33KV
3.2	Voltage	66KV \pm 10%	33KV \pm 10%
3.3	Frequency	50HZ \pm 5%	50HZ \pm 5%
3.4	Fault level	31.5KA for 3secs.	26.3KA for 3secs.
3.5	Earthing	Solidly grounded	Solidly grounded
3.6	Type	Single phase, dead tank, oil immersed, self-cooled outdoor type.	
3.7	Construction feature	Oil immersed PT/CVT shall be hermetically sealed to eliminate breathing and to prevent ingress of air and	

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

		moisture.
3.8	Tank	
3.8.1	Material of Construction	Tank shall be of MS with polyurethane paint or shall be Galvanised Steel with galvanizing thickness 610gm/sqmm.
3.8.2	Tank Feature	The tank shall be provided with oil draining plug, Oil level gauge glass.
3.8.3	Oil Expansion	Stainless steel bellow or diaphragm shall be provided to take care of oil expansion
3.8.4	Core	High grade, non ageing, low loss, high permeability, cold rolled grain oriented silicon steel lamination.
3.9	Winding	
3.9.1	Material	Electrolytic Copper
3.9.2	Winding Insulating material	Class A, non catalytic, inert to transformer oil, free from compounds liable to ooze out, shrink or collapse.
3.9.3	Winding Insulation	Uniform
3.9.4	Design features	Winding shall be capable of desired output as per specified limits without exceeding permissible temperature rise.
3.10	Insulating oil	
3.10.1	Type	Class 1 new mineral insulating oil as per IS 335, shall be certified not to contain PCBs. Anti oxidant inhibitor if recommended shall be subject to Purchaser's approval.
3.11	Terminals	
3.11.1	Primary terminals	The HV Terminal shall be of copper. Single Zebra ACSR conductor. Termination shall be by bimetallic Aluminum alloy grade A6 suitable for
3.11.2	Primary Terminal connector	Universal type, Suitable for termination of Single Zebra ACSR conductor. Connector should be of Aluminium alloy A6. Bimetallic sleeve of 1mm thickness should be provided for primary connection.

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

3.11.3	Secondary terminals	The secondary terminals shall be provided in IP55 Box with Brass/copper stud type terminals accessible from front with removable cover.
3.11.4	Earth terminal of primary winding	The earth terminal of HV winding shall be brought out in secondary Terminal box by bushing. This shall be connected with body earth terminal with flexible copper lead through a link.
3.11.5	Terminal marking	Terminals shall be marked as per IS 3156
3.12	Bushing	
3.12.1	Type	Polymeric bushing
3.12.2	Minimum creepage distance of bushing	31 mm/KV
3.12.3	Protected creepage distance	At least 50 % of total creepage distance
3.13	Over Voltage factor	1.2 times for continuous rating and 1.5 times for 30 seconds.
3.14	Atmospheric protection for clamp and fitting of iron and steel	Hot dip galvanizing as per IS 2633. The Minimum thickness of galvanization should be 610 g/ sq mm.
3.15	Gland Plate	Min. 3 mm thick detachable with three knockout holes of 3/4 inch.
3.16	Cable entry	Bottom for all cables
3.17	Earthing	The PT/CVT assembly comprising of the chasis, frame work and fixed parts of metal casing shall be provided with two separate body earthing terminals.
3.18	Drain Plug on tank Base	Required
3.19	Painting surface preparation	Shot blasting or chemical 7 tank process.
3.20	Painting external finish	692 as per IS 5
3.21	Fixing bolts	Fixing bolts and other accessories as per this specification.
3.22	Terminal Blocks	Terminal Blocks shall be
3.23	Additional details of CVT	i) Shall comprise a capacitor divider unit and an electromagnetic unit such that secondary voltage

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

		<p>of electromagnetic unit is substantially proportional to and in phase with the primary voltage applied to capacitor divider units.</p> <p>ii) Capacitors shall be oil impregnated type enclosed in inert gas atmosphere, hermetically sealed.</p> <p>iii) The material and construction and assembly of CVT shall be such that the capacitance does not change with time and the effect of temperature is minimum.</p> <p>iv) Provided with an over voltage suppressor</p> <p>v) No radio interference when operated at maximum service voltage</p> <p>vi) Reactance to be provided to minimize draining of carrier signal in electromagnetic unit</p> <p>vii) No radio interference when operated at maximum service voltage</p> <p>viii) The CVT shall be designed to cover its rated output range without any adjustment of its electromagnetic unit.</p> <p>ix) Material used in insulation and assembly of the winding shall be insoluble, non catalytic and chemically inactive in hot transformer oil and shall not be subjected to a shrinking and seasoning process</p> <p>x) CVT shall provide designed transient response requirement as per IEC / IS i.e. during transient oscillations following a short circuit on primary side, the secondary side output voltage shall not fall to a value less than 10% of peak value before short circuit within 20 milliseconds</p> <p>xi) The secondary terminal box shall include necessary HRC fuses for protection of secondary circuits and both the sides of fuse shall be terminated on terminal block for fuse supervision.</p>
--	--	---

4 RATING PLATE

4.1	Material	Anodized aluminum 16SWG
4.2	Background	SATIN SILVER
4.3	Letters, diagram & border	Black
4.4	Process	Etching
4.5	Rating plate details	As per IS3156
4.6	Other details required on rating plate	BSES PO No. and Date
		Warranty Period
		Connection Diagram

5 APPROVED MAKE OF COMPONENTS

5.1	Insulator	ABIL, WSI, Modern, Saravana, BHEL, CJI
5.2	Primary Terminal Connector	Exault, Tyco, Rashtraudyog, Burma
5.3	Note	Any other make of component to be approved by Owner

6 DRAWING, DATA & MANUALS

6.1	To be submitted along with bid	<p>Seller has to submit:</p> <ul style="list-style-type: none">i) Tentative GA / cross sectional drawing of product showing all the views / sectionsii) Detailed reference list of customers already using the offered product during the last 5 years with particular emphasis on units of similar design and ratingiii) Completely filled GTPiv) Deviations from this specification. Only deviations approved in writing before award of contract shall be acceptedv) Details of manufacturer's quality assurance standards and programme and ISO 9000 series or equivalent national certificationvi) Type test reports shall be submitted for the type, size & rating of product / equipment offered along with bid. In case the type test report for identical product is not available then type test report of nearby size /rating shall be submitted for review. They shall be considered valid for 5 years from date of test performed on product /equipment.vii) Complete product catalogue and Manual along with the bid.viii) Recommended spare parts and consumable items for five years of operation with prices and spare parts catalogue with price list for future requirements
-----	--------------------------------	--

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

6.2	After award of contract, seller has to submit mentioned drawings for buyer's Approval (A) / Reference (R)	<ul style="list-style-type: none"> i) Program for production and testing (A) ii) Guaranteed Technical Particulars (A) iii) Calculations to substantiate choice of electrical, structural, mechanical component size / ratings (A) iv) Detailed dimensional drawing for all components, general arrangement drawing showing detailed component layout and detailed schematic and wiring drawings for all components (like marshalling box) v) Terminal arrangement & cable box details etc (as applicable) (A) vi) Drawing of major components (A) vii) Rating and diagram plate (A) viii) Detailed loading drawing to enable the buyer to design and construct foundations (as applicable) (R) ix) Transport / Shipping dimensions with weights, wheel base details, untanking height etc (As applicable) (R) x) List of makes of all fittings and accessories (A) xi) detailed installation and commissioning instructions (R) xii) quality plan
6.3	Submittals required prior to dispatch	<ul style="list-style-type: none"> i) Inspection and test reports, carried out in manufacturer's works (R) ii) Test certificates of all bought out items iii) Operation and maintenance Instruction as well as trouble shooting charts/ manuals
6.4	Drawing and document sizes	Standard size paper A0, A1, A2, A3, A4
6.5	Drgs/Documents required at different stages	Both hard copy and Soft copy in Pendrive

7 QUALITY ASSURANCE, TESTING & INSPECTION

7.1	Vendor Quality Plan	To be submitted for purchaser approval
7.2	Inspection points	To be mutually identified & agreed in quality plan
7.3	Type Tests	i) On one CVT/PT of each rating and type (In Govt.

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

		recognized independent test laboratory), all the test as per IS 3156
		ii) In case the product is never type tested earlier, seller has to conduct the type tests from govt. recognized / internationally accredited test labs at their own cost, before commencement of supply.
		iii) If the manufacturer's lab is accredited by govt. / authorized body then it shall be acceptable for type testing.
7.4	Inspection and testing during manufacture	
7.4.1	Tank	i) Checking of dimensions as per approved drawing. ii) Checking for leakage by pressure testing. iii) Thickness of Paint or Galvanisation, as applicable
7.4.2	Porcelain	i) Check dimension. ii) Check finish of sealing surface. iii) Check creepage distance. iv) Check for routine electrical test. v) Check for porosity and temperature cycle test.
7.4.3	Insulating Materials	i) Sample check for physical properties of materials. ii) Check for dielectric strength. iii) Visual and dimensional checks.
7.4.4	Copper conductor	i) Check for dimension. ii) Check for elongation. iii) Check for unidirectional scrap. iv) Heat shock.
7.4.5	Oil	i) Check for break down voltage. ii) Check for density. iii) Check for flash point. iv) Check for moisture content. v) Check for neutralization value. vi) Check for inter facial tension at 27 Deg c. vii) Check for sludge content.

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

		viii) Check for specific resistance. ix) Check for pour point.
7.4.6	Secondary terminals	i) Check for one min AC Test
7.5	Routine tests	Tests shall be carried out in accordance with IS 3156
7.6	Acceptance test	To be performed in presence of Owner's representative at manufacturer works:- i) Routine tests as per IS ii) Physical inspection of dimensions and BOM. iii) Pressure test on tank iv) IP55 test on secondary compartment v) Creepage distance of bushing vi) Test on accessories as per manufacturer's standard
7.7	Inspection and Testing	i) The buyer reserves the right to witness all tests specified on completed product ii) The buyer reserves the right to inspect the product at the sellers works at any time prior to dispatch, to verify compliance with the specifications. iii) In-process and final inspection call intimation shall be given atleast 15 days in advance.

8 PACKING, SHIPPING, HANDLING AND STORAGE

8.1.1		Packing	
8.1.2		Packing protection	Against corrosion, dampness, heavy rains, breakage and vibration
8.1.3		Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection and identification labels.
8.1.4		Packing identification label	In each packing case, following details are required : i) Individual serial number ii) Purchaser's name

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

			<p>iii) PO number(along with SAP item code, if any) & date</p> <p>iv) Equipment Tag no. (if any)</p> <p>v) Destination</p> <p>vi) Manufacturer/Supplier's name</p> <p>vii) Address of manufacturer/supplier's / its agent</p> <p>viii) Description and quantity</p> <p>ix) Country of origin</p> <p>x) Month and year of manufacturing</p> <p>xi) Case measurements</p> <p>xii) Gross and net weights in kilograms</p> <p>xiii) All necessary slinging and stacking instructions.</p>
8.1.5		Shipping	<p>i) The bidder shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, overhead lines, free access etc. from the manufacturing plant to the project site; and furnish to the Purchaser confirmation that the proposed packages can be safely transported, as normal or oversize packages, upto the plant site. Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice of the Purchaser.</p> <p>ii) the seller shall be responsible for all transit damage due to improper packing.</p>
8.1.6		Handling and Storage	<p>Manufacturer instruction shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.</p>

9 DEVIATIONS

9.1	Deviations from this Specification shall be provided in excel sheet 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. No deviation will be acceptable post order.
-----	---

10 DRAWINGS & DATA SUBMISSION MATRIX

Drawing submission shall be as per the matrix given below. All documents/ drawing shall be provided on A3/A4 sheet (based on legibility) in box file with separators for each section. PDF shall also be provided of all documents. Deviation sheet and GTP shall be provided in excel sheet. Language of the documents shall be English only. Deficient/ improper document/ drawing submission shall be liable for rejection.

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
10.1	Contact Person Name, Email ID and Mobile Number	Required			
10.2	Consolidated Deviation Sheet	Required	Required		
10.3	GTP	Required	Required		
10.4	Relevant Type Test as per IS/IEC	Required			
10.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
10.6	Sizing Calculation of Associated Equipment		Required		
10.7	Recommended Spares Apart from spares stated in Spec(for five years of operation)		Required		
10.8	CT/PT drawing				
10.8.1	General Arrangement	Required	Required		
10.8.2	Sectional Layout		Required		

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

10.8.3	SLD	Required	Required		
10.8.4	Schematic Circuit diagram		Required		
10.8.5	QAP		Required		
10.8.6	BOQ		Required		
10.8.7	Plan		Required		
10.8.8	TB Details		Required		
10.8.9	Make of all Component as per specification		Required		
10.9	Installation, erection and commissioning manual		Required		
10.10	Inspection Reports			Required	
10.11	As manufacturing Drawings			Required	
10.12	Operation and Maintenance Manual			Required	Required
10.13	Trouble shooting manual			Required	Required
10.14	As built Drawings				Required
10.15	Test Report				Required

11 ANNEXURE - A (SERVICE CONDITIONS)

S No.	ENVIRONMENTAL CONDITION	REQUIREMENT
11.1	Average grade atmosphere	Heavily polluted, dry
11.2	Maximum altitude above sea Level	1000 M
11.3	Ambient air temperature	Highest 50Deg C Average 40Deg C
11.4	Minimum ambient air temperature	0 Deg C
11.5	Relative Humidity	100%
11.6	Seismic Zone	4
11.7	Rainfall	750 mm concentrated in four months

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER**12 ANNEXURE - B (GUARANTEED TECHNICAL PARTICULARS 66KV PT/VT)**

S No.	Description	Data by purchaser	Data by Supplier
12.1	Location of equipment	Project specific to be filled up	
12.2	Name of manufacturer		
12.3	Address & contact details		
12.4	Type	Single phase outdoor, dead tank type oil immersed, self cooled	
12.5	Manufacturer model no.		
12.6	Reference design ambient temperature	50 Deg. C	
12.7	Reference standard	IS:3156	
12.8	Nominal system voltage	66 KV	
12.9	Highest system voltage	72.5KV	
12.10	Basic insulation level	325KVp	
12.11	Power frequency voltage	140 KV	
12.12	Type of cooling	ONAN	
12.13	Rated frequency	50 Hz	
12.14	Insulation class	A	
12.15	Rated primary voltage	$66kV/\sqrt{3}$	
12.16	Rated secondary voltage	$110V / \sqrt{3}$	
12.17	Number of secondary cores	Two	
12.18	Core specifications		
12.18.1	Core -1		

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

S No.	Description	Data by purchaser	Data by Supplier
12.18.1.1	Purpose	Metering	
12.18.1.2	Rated output	50 VA	
12.18.1.3	class of accuracy	0.2	
12.18.1.4	Ratio error	As per IS	
12.18.1.5	Phase angle error	As per IS	
12.18.2	Core -2		
12.18.2.1	Purpose	Protection	
12.18.2.2	Rated output	50 VA	
12.18.2.3	class of accuracy	3P	
12.18.2.4	Ratio error	As per IS	
12.18.2.5	Phase angle error	As per IS	
12.19	Rated over voltage factor		
12.19.1	Continuous	1.2 times	
12.19.2	30 seconds	1.5 times	
12.20	For CVT, Capacitor Divider		
12.20.1	High voltage Capacitor	C1 (pf)	
12.20.2	Intermediate Voltage Capacitor	C2 (pf)	
12.20.3	Total Equivalent Capacitance	Pf	
12.20.4	Rated temperature at which above values are indicated.	Deg C	
12.20.5	Capacitance emperature coefficient		
12.20.6	Tan delta value of capacitance		
12.20.7	Carrier frequency coupling	Pf	
12.20.8	Rated Intermediate Voltage		
12.20.9	Natural frequency of coupling	kHZ	
12.20.10	Band Width	kHZ	
12.20.11	Series reactance/choke rated Voltage & power frequency		

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

S No.	Description	Data by purchaser	Data by Supplier
	withstand voltage		
12.21	Temperature rise above the ambient 50 deg.C at 1.2 times voltage factor for continues rating		
12.21.1	For winding	50 Deg. C	
12.21.2	For Oil	40 Deg C	
12.22	Temperature rise above the ambient 50 deg.C at 1.5 times voltage factor for 30 seconds rating		
12.22.1	For winding	50 Deg. C	
12.22.2	For Oil	40 Deg C	
12.23	One minute power frequency dry withstand voltage for 66 KV (KV rms)		
12.24	One minute power frequency wet withstand voltage for 66 KV (KV rms)		
12.25	1.2/50 micro seconds impulse withstand test voltage KV peak for 66KV PT/ CVT	325 KVp	
12.26	One minute power frequency withstand voltage for secondary winding	3 KV	
12.27	Minimum creepage distance in mm	2250 mm	
12.28	Protective creepage distance in mm	50 % of creepage	

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

S No.	Description	Data by purchaser	Data by Supplier
12.29	Partial discharge test, whether will be carried out Yes / No		
12.30	Weight of core		
12.31	Weight of oil		
12.32	Total weight		
12.33	Mounting details		
12.34	Overall dimensions		
12.35	Terminal connector	Aluminium alloy A6 universal type (horizontal & vertical take-off) terminal connector suitable for single zebra conductor shall be provided with bimetallic sleeve of minimum 1 mm thickness	

13 ANNEXURE - C (GUARANTEED TECHNICAL PARTICULARS 33KV PT/CVT)

S No.	Description	Data by purchaser	Data by Supplier
13.1	Location of equipment	Project specific to be filled up	
13.2	Name of manufacturer		
13.3	Address & contact details		
13.4	Type	Single phase outdoor, dead tank type oil immersed, self cooled	
13.5	Manufacturer model no.		
13.6	Reference design ambient temperature	50 Deg. C	
13.7	Reference standard	IS:3156	
13.8	Nominal system voltage	33 KV	
13.9	Highest system voltage	36 KV	
13.10	Basic insulation level	170 KVp	

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

S No.	Description	Data by purchaser	Data by Supplier
13.11	Power frequency voltage	70 KV	
13.12	Type of cooling	ONAN	
13.13	Rated frequency	50 Hz	
13.14	Insulation class	A	
13.15	Rated primary voltage	33kV/ $\sqrt{3}$	
13.16	Rated secondary voltage	110V / $\sqrt{3}$	
13.17	Number of secondary cores	Two	
13.18	Core specifications		
13.18.1	Core -1		
13.18.1.1	Purpose	Metering	
13.18.1.2	Rated output	50 VA	
13.18.1.3	class of accuracy	0.2	
13.18.1.4	Ratio error	As per IS	
13.18.1.5	Phase angle error	As per IS	
13.18.2	Core -2		
13.18.2.1	Purpose	Protection	
13.18.2.2	Rated output	50 VA	
13.18.2.3	class of accuracy	3P	
13.18.2.4	Ratio error	As per IS	
13.18.2.5	Phase angle error	As per IS	
13.19	Rated over voltage factor		
13.19.1	Continuous	1.2 times	
13.19.2	30 seconds	1.5 times	
13.20	For CVT, Capacitor Divider		
13.20.1	High voltage Capacitor	C1 (pf)	
13.20.2	Intermediate Voltage Capacitor	C2 (pf)	
13.20.3	Total Equivalent Capacitance	Pf	
13.20.4	Rated temperature at which above values are indicated.	Deg C	
13.20.5	Capacitance Temperature coefficient		

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

S No.	Description	Data by purchaser	Data by Supplier
13.20.6	Tan delta value of capacitance		
13.20.7	Carrier frequency coupling	Pf	
13.20.8	Rated Intermediate Voltage		
13.20.9	Natural frequency of coupling	kHZ	
13.20.10	Band Width	kHZ	
13.21	Temperature rise above the ambient 50 deg.C at 1.2 times voltage factor for continuous rating		
13.21.1	For winding	50 Deg. C	
13.21.2	For Oil	40 Deg C	
13.22	Temperature rise above the ambient 50 deg.C at 1.5 times voltage factor for 30 seconds rating		
13.22.1	For winding	50 Deg. C	
13.22.2	For Oil	40 Deg C	
13.23	One minute power frequency dry withstand voltage for 33 KV		
13.24	One minute power frequency wet withstand voltage for 33 KV		
13.25	1.2/50 micro seconds impulse withstand test voltage KV peak for 33KV PT/CVT	170 KVp	
13.26	One minute power frequency withstand voltage for secondary winding	3 KV	
13.27	Minimum creepage distance in mm	1116	
13.28	Protective creepage	50 % of creepage	

TECHNICAL SPECIFICATION FOR OUTDOOR POTENTIAL TRANSFORMER

S No.	Description	Data by purchaser	Data by Supplier
	distance in mm		
13.29	Partial discharge test, whether will be carried out Yes / No		
13.30	Weight of core		
13.31	Weight of oil		
13.32	Total weight		
13.33	Mounting details		
13.34	Overall dimensions	For 33 Kv CVT, Dimension shall be – a. Overall Height- 600 mm (Tank) + 540 mm (Bushing) b. Tank Dimension in mm- 640 X 650x600 (LXBXH)	
13.35	Terminal connector	Aluminium alloy A6 universal type (horizontal & vertical take-off) terminal connector suitable for single zebra conductor shall be provided with bimetallic sleeve of minimum 1 mm thickness	

14 ANNEXURE – D (RECOMENDED SPARES-DATA BY SUPPLIER)

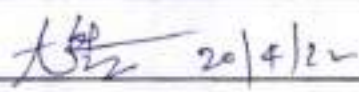


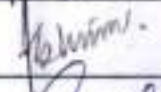
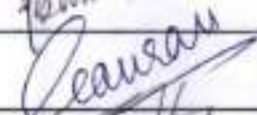
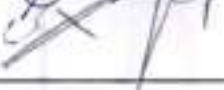
List of recommended spares as following –

Sr No	Description of spare part	Unit	Quantity
14.1		No	
14.2		No	

BSES

Technical Specification of Outdoor Current Transformer

Specification no – BSES-TS-31-ODCT-R0

Rev.	0	
Date:	18 Apr 2022	
Pages:	40	
Prepared by	Abhishek Harsh	 20/4/22
	Amar Singh	
Reviewed by	Srinivas Gopu	
	Abhinav Srivastava	
Approved by	Gaurav Sharma	
	Gopal Nariya	

INDEX

RECORD OF REVISION.....	3
1.0 SCOPE OF SUPPLY	4
2.0 CODES & STANDARDS	4
3.0 CURRENT TRANSFORMER DESIGN FEATURES	4
4.0 APPROVED MAKE OF COMPONENTS	6
5.0 NAME PLATE & TERMINAL MARKING	6
6.0 QUALITY ASSURANCE, TESTING & INSPECTION.....	7
7.0 PACKING, SHIPPING, HANDLING & STORAGE	8
8.0 PROGRESS REPORTING	9
9.0 DEVIATIONS.....	10
10.0 DOCUMENT SUBMISSION	10
ANNEXURE – A SCOPE OF SUPPLY	12
ANNEXURE – B SERVICE CONDITIONS.....	13
ANNEXURE- C1 GUARANTEED TECHNICAL PARTICULARS (66KV, 2000-1000/1/1/1/1A).....	14
ANNEXURE- C2 GUARANTEED TECHNICAL PARTICULARS (66KV, 1000-500/1/1/1/1A).....	16
ANNEXURE- C3 GUARANTEED TECHNICAL PARTICULARS (66KV, 800-400/1/1/1/1A)	18
ANNEXURE- C4 GUARANTEED TECHNICAL PARTICULARS (66KV, 400-200/1/1/1/1A)	20
ANNEXURE- C5 GUARANTEED TECHNICAL PARTICULARS (33KV, 2000-1000/1/1/1/1A).....	22
ANNEXURE- C6 GUARANTEED TECHNICAL PARTICULARS (33KV, 1000-500/1/1/1/1A).....	24
ANNEXURE- C7 GUARANTEED TECHNICAL PARTICULARS (33KV, 800-400/1/1/1/1A)	26
ANNEXURE- C8 GUARANTEED TECHNICAL PARTICULARS (66KV, NCT 2000-1000/1-1A)	28
ANNEXURE- C9 GUARANTEED TECHNICAL PARTICULARS (33KV, NCT 2000-1000/1/1A)	30
ANNEXURE- C10 GUARANTEED TECHNICAL PARTICULARS (33KV, NCT 10/1-1A)	32
ANNEXURE- C11 GUARANTEED TECHNICAL PARTICULARS (11KV, NCT 1600/1-1A)	34
ANNEXURE- C12 GUARANTEED TECHNICAL PARTICULARS (11KV, NCT 1200/1-1A)	36
ANNEXURE- C13 GUARANTEED TECHNICAL PARTICULARS (11KV, NCT 1200/0.578-0.578A).....	38
ANNEXURE - D RECOMENDED SPARES (DATA BY SUPPLIER).....	40

RECORD OF REVISION

Clause No.	Change in Specification	Approved by	Rev

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER**1.0 SCOPE OF SUPPLY**

For scope of supply, refer Annexure A

2.0 CODES & STANDARDS

The manufacturing, rating & performance of the Outdoor Current Transformer shall conform to the latest edition of following standards:-

IS-2705 part 1	Specification for current transformer.
IS 16227/IEC 61869	Specification for current transformer.
IS 4201	Application guide for current transformer.
IS/IEC 60137	High voltage porcelain bushings
IS 731	Insulator for O/H power line
IS 335	New insulating oil Specification
IS 9676	Reference ambient temperature of electrical equipment
IS 5561	Specification of electric power connectors
IS 6949	Summation current transformer
IS/IEC 60529	Ingress protection
IS-5621	Hollow insulator for use in electrical equipment
IEC: 439	Specification for Terminal box / Marshalling box
	Indian Electricity Rules
	Indian electricity act
	CBIP manual

3.0 CURRENT TRANSFORMER DESIGN FEATURES

3.1.0	Type	Shall be dead tank type, oil immersed, self-cooled outdoor type
3.2.0	Construction	<ul style="list-style-type: none"> i) Oil immersed CT shall be hermetically sealed to eliminate breathing and to prevent air and moisture ingress. The core and winding shall be provided in porcelain bushing. Provision for oil expansion without breathing (bellow as per manufacturer design). ii) All ferrous parts, CT tank and other metallic parts exposed to atmosphere shall be hot dip galvanized. iii) Galvanising thickness shall be 610gm/sqmm minimum
3.3.0	Core	The core shall be of high-grade non-ageing, electrical

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

		silicon laminated steel of low hysteresis loss and high permeability to ensure high accuracy at both normal and over current conditions. The saturation factor of the core shall be low enough not to cause any damage to measuring instruments in the event of maximum short circuit current.
3.4.0	Winding	The winding shall be suitable for simultaneous 100% full load continuous rating. The winding shall be capable of desired output as per specified limit.
3.5.0	Insulation	i) Class of Insulation should be Class A ii) The current transformer shall withstand satisfactorily the dielectric test voltage corresponding to basic insulation level specified.
3.6.0	Insulation Oil	The quantity of insulating oil in each current transformer shall be best available and the complete specification of the oil shall be furnished with the tender. The current transformer offered shall be hermetically sealed completely filled with insulating oil with provision to replace the oil. Oil level indication shall be provided.
3.7.0	Bushing	Porcelain used in bushing manufacture shall be homogenous, free from laminations, cavities and other flaws or imperfections that might effect the mechanical or dielectric quality. Glazing of the porcelain shall be uniform brown color free blisters, burns and similar defects. The bushing shall be designated to have ample insulation, mechanical strength and rigidity.
3.7.1	Creepage distance	Not less than 31mm /KV
3.7.2	Protected creepage distance	At least 50 % of total creepage distance
3.8.0	Terminals	
3.8.1	Primary terminals	Primary terminal should be tinned copper
3.8.2	Primary Terminal connectors	Universal type (Horizontal and vertical takeoff), Suitable for termination of Twin Zebra ACSR conductor. Connector should be of Aluminium alloy A6. Bimetallic sleeve of 1mm thickness should be provided for primary connection.
3.8.3	Secondary terminals	i) Provide Epoxy terminal block for separation of secondary terminals with main oil tank and further it is connected to secondary termination. ii) All the secondary terminals shall be bought in IP55 box with brass/ copper stud type terminals. iii) The secondary terminals shall be shorted by brass/copper links before dispatch. Terminal box to be provided with earthing stud.
3.8.4	Terminal Marking	Terminal marking shall be as per IS 2705

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

3.9.0	Atmospheric protection for clamp and fitting of iron and steel	Hot dip galvanizing as per IS 2633. The Minimum thickness of galvanization should be 610 g/ sq mm.
3.10.0	Gland Plate	Min. 3 mm thick detachable undrilled gland plate.
3.11.0	Cable entry	Bottom for all cables
3.12.0	Earthing	The CT assembly comprising of the chasis, frame work and fixed parts of metal casing shall be provided with two separate body earthing terminals.
3.13.0	Drain Plug on tank Base	Required
3.14.0	Painting surface preparation	Shot blasting or chemical 7 tank process
3.15.0	Painting	Polyurethane based paints shall be used. The color for the finishing paint shall be light gray as per shade No. 692 as per IS-5

4.0 APPROVED MAKE OF COMPONENTS

4.1.0	Insulator	ABIL, WSI, Modern, Saravana, BHEL, CJI, IEC
4.2.0	Primary Terminal Connector	Exalt, Tyco, Rashtraudyog, Burma
4.3.0	Secondary terminals	Connectwell / Elmex
4.4.0	Note	Any other make of component to be approved by Owner

5.0 NAME PLATE & TERMINAL MARKING

5.1.0	Material	Anodized aluminum 16SWG
5.1.1	Background	SATIN SILVER
5.1.2	Letters, diagram & border	Black
5.1.3	Process	Etching
5.2.0	Rating plate details	As per IS 2705 & IS 16227
5.2.1	Other details required on rating plate	Manufacturer name and address
		Customer name: BSES Yamuna Power Limited/ BSES Rajdhani Power Limited
		PO No. and Date
		Serial number and a type designation
		Rated Primary current & secondary current
		Rated frequency
		Rated output
		Connection Diagram
		Accuracy class, burden, knee point voltage, Magnetizing current
	Secondary resistance	

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

		Highest system voltage,
		Rated short time thermal current or short time factor with rated time
		Rated dynamic current
		Rated Insulation level
		Class of Insulation
		Temperature class
		Caution/Instructions
		Minimum functional pressure
		Rated filling pressure
		Quantity of oil
		Total weight
		Warranty Period
		Reference standard

6.0 QUALITY ASSURANCE, TESTING & INSPECTION

6.1.0	Vendor quality plan	To be submitted for purchaser approval
6.2.0	Inspection points	To be mutually identified & agreed in quality plan
6.3.0	Inspection and testing during manufacture	
6.3.1	Tank	<ul style="list-style-type: none"> i) Checking of dimensions as per approved drawing. ii) Checking for leakage by pressure testing. iii) Thickness of Paint or Galvanisation, as applicable
6.3.2	Porcelain	<ul style="list-style-type: none"> i) Check dimension. ii) Check finish of sealing surface. iii) Check creepage distance. iv) Check for routine electrical test. v) Check for porosity and temperature cycle test.
6.3.3	Insulating Materials	<ul style="list-style-type: none"> i) Sample check for physical properties of materials. ii) Check for dielectric strength. iii) Visual and dimensional checks.
6.3.4	Copper conductor	<ul style="list-style-type: none"> i) Check for dimension. ii) Check for elongation. iii) Check for unidirectional scrap. iv) Heat shock.
6.3.5	Oil	<ul style="list-style-type: none"> i) Check for break down voltage. ii) Check for density. iii) Check for flash point. iv) Check for moisture content. v) Check for neutralization value. vi) Check for inter facial tension at 27 Deg c. vii) Check for sludge content. viii) Check for specific resistance.

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

		ix) Check for pour point.
6.3.6	Secondary terminals	Check for one min AC Test
6.4.0	Tests	Test shall be carried out in accordance with IS 2705/ IS 16227
6.6.1	Type test	i) Following type test shall be carried out on current transformer <ul style="list-style-type: none"> a. Short-time current test b. Temperature-rise test c. Lightning impulse test d. HV power frequency wet withstand voltage test on CT e. Determination of errors
		ii) Current transformer must be of type tested from CPRI/ERDA as per the IS 2707/ IS 16227 and reports shall be submitted
		iii) In case the product is never type tested earlier, seller has to conduct the type tests from CPRI/ERDA / internationally accredited test labs at their own cost, before commencement of supply.
6.6.2	Routine Test	Test shall be carried out in accordance with IS 2705/ IS 16227
6.6.3	Acceptance test	To be performed in presence of Owner's representative at manufacturer works:- <ul style="list-style-type: none"> i) Routine tests as per IS 2705/ IS 16227 ii) Physical inspection of dimensions and BOM. iii) Pressure test on tank iv) IP55 test on secondary compartment v) Creepage distance of bushing vi) Test on accessories as per manufacturer's standard
6.7.0	Inspection and Testing	<ul style="list-style-type: none"> i) The buyer reserves the right to witness all tests specified on completed product ii) The buyer reserves the right to inspect the product at the sellers works at any time prior to dispatch, to verify compliance with the specifications. iii) In-process and final inspection call intimation shall be given atleast 15 days in advance.

7.0 PACKING, SHIPPING, HANDLING & STORAGE

7.1.0	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration
7.1.1	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

7.1.2	Packing Identification Label	In 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 and Quantity
		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		
7.2.0	Shipping	i) Bidder shall furnish the confirmation that the proposed packages can be delivered safely upto the site.
		ii) The seller shall be responsible for all transit damage due to improper packing.
7.3.0	Handling & Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.

8.0 PROGRESS REPORTING

8.1.0	Outline Document	To be submitted for purchaser approval for outline of production, inspection, testing, packing, dispatch, documentation program
8.2.0	Detailed Progress report	To be submitted to Purchaser once a month containing i) Progress on material procurement ii) Progress on fabrication (As applicable) iii) Progress on assembly (As applicable) iv) Progress on internal stage inspection v) Reason for any delay in total program vi) Details of test failures if any in manufacturing stages vii) Progress on final box up

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

viii) Constraints / forward path

9.0 DEVIATIONS

9.1.0	Deviation from the Specification	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 by the Buyer that the Seller complies fully with this specification.
-------	----------------------------------	--

10.0 DOCUMENT SUBMISSION

Document submission shall be as per the matrix given below. All documents/drawing shall be provided in soft copy (in pen drive) for each section. Language of the documents shall be English only. Deficient/improper drawing submission may liable for rejection.

S.No.	Detail of Document	For Tender	For Approval/Review	For Prior to Dispatch
1	Type test report shall be submitted for the type, size & rating of product / equipment offered along with bid.	Required		
2	Type test report shall be submitted for the type, size & rating of product / equipment offered along with bid. They shall be considered valid for 5 years from date of test performed on product / equipment.	Required		
3	Recommended spare parts and consumable items for 5 years of operation with prices and spare parts catalogue with list for future requirements.	Required		
4	Details of manufacturer's quality assurance standards and program and ISO 9000 series or equivalent national	Required		
5	Complete product catalogue and manual along with the bid.	Required		
6	Guaranteed Technical Particulars (GTP)	Required	Required	
9	Deviation Sheet, if any	Required	Required	
10	Complete assembly, GA drawing outdoor current transformer showing plan	Required	Required	
12	General arrangement drawing	Required	Required	

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

	secondary terminal box			
13	Structural drawing for CT mounting arrangement	Required	Required	
14	Rating plate diagram	Required	Required	
15	Drawings of terminal connectors	Required	Required	
16	Calculations to substantiate choice of electrical , mechanical component size / ratings	Required	Required	
17	Typical connection diagram and winding connection of current Transformer	Required	Required	
18	Quality plan	Required	Required	
19	Detailed installation and commissioning instructions	Required	Required	
20	Inspection and test reports, carried out in manufacturer's work			Required
21	Test certificates of all bought out items			Required
22	Operation and maintenance instruction as well as trouble shooting charts / manuals.			Required

ANNEXURE – A SCOPE OF SUPPLY**1.0 The scope of supply shall include following**

- a. Design, manufacture, assembly, testing at stages of manufacture as per this specification, final testing at manufacturer works on completely assembled Current Transformer before dispatch, packing and delivery of Current Transformer
- b. Primary terminal connectors (Universal type)
- c. Fixing bolts and other accessories as per this specification.
- d. Submission of all documentation for the Current transformer and all accessories as mentioned below

2.0 Submission of documents

	Along with offer	For Approval after award of contract	Final after approval	Remarks
Drawings	3 copies (Typical drgs)	4 copies	6 copies + 1 soft copy in CD	See Clause 11.0 for various drawings required
Calculations	3 copies (Typical)	3 copies (Typical)	6 copies + 1 soft copy in CD	See Clause 11.0 for details
Catalogues	1 copy		6 copies + 1 soft copy in CD	
Instruction manual for the current transformer	1 copy		6 copies + 1 soft copy in CD	
Test Report	2 copies		6 copies + 1 soft copy in CD	Type test and sample routine test reports

ANNEXURE – B SERVICE CONDITIONS

S No.	ENVIRONMENTAL CONDITION	REQUIREMENT
1	Average grade atmosphere	Heavily polluted, dry
2	Maximum altitude above sea level	1000 M
3	Ambient air temperature	Highest 50Deg C Average 40Deg C
4	Minimum ambient air temperature	0 Deg C
5	Relative Humidity	100%
6	Seismic Zone	4
7	Rainfall	750 mm concentrated in four months

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C1 GUARANTEED TECHNICAL PARTICULARS (66KV, 2000-1000/1/1/1/1A)

S No.	Description	Data By Purchaser				Data By Supplier			
1	Name of Manufacturer								
2	Address and contact details								
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank CT							
4	Rated nominal voltage	66kV							
5	Highest system voltage	72.5kV							
6	Rated frequency	50 Hz							
7	Rated primary current	2000-1000 A							
8	Rated secondary current	1A							
9	Number of core	Four							
10.0		Core-1	Core-2	Core-3	Core-4				
10.1	Secondary current (A)	1	1	1	1				
10.2	Application	Metering	Protection (O/C & E/F)	Protection (Bus Bar)	Protection (Spare)				
10.3	Rated Output (VA)	30	30						
10.4	Class of accuracy	0.2s	5P	PS	PS				
10.5	Instruments security factor	≤5	-	-	-				
10.6	Accuracy limit factor	-	20	-	-				
10.7	Knee point voltage and corresponding excitation current	-	-	≥40(Rct+8)	≥40(Rct+8)				
10.8	Magnetizing current at Vk/2 (mA)	-	-	≤30	≤30				
10.9	Resistance at secondary winding at 75 Deg. C (ohms)								
10.10	Secondary limiting voltage								
11	Short time thermal rating of primary								
11.1	One second								

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
11.2	Three seconds	31.5 KA	
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage	140kV (rms)	
16	One minute power frequency wet withstand voltage	140kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	325 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C2 GUARANTEED TECHNICAL PARTICULARS (66KV, 1000-500/1/1/1/1A)

S No.	Description	Data By Purchaser				Data By Supplier			
1	Name of Manufacturer								
2	Address and contact details								
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank CT							
4	Rated nominal voltage	66kV							
5	Highest system voltage	72.5kV							
6	Rated frequency	50 Hz							
7	Rated primary current	1000-500 A							
8	Rated secondary current	1A							
9	Number of core	Four							
10.0		Core-1	Core-2	Core-3	Core-4				
10.1	Secondary current (A)	1	1	1	1				
10.2	Application	Metering	Protection (O/C & E/F)	Protection (Bus Bar)	Protection (Spare)				
10.3	Rated Output (VA)	30	30						
10.4	Class of accuracy	0.2s	5P	PS	PS				
10.5	Instruments security factor	≤5	-	-	-				
10.6	Accuracy limit factor	-	20	-	-				
10.7	Knee point voltage and corresponding excitation current	-	-	≥40(Rct+ 8)	≥40(Rct+ 8)				
10.8	Magnetizing current at Vk/2 (mA)	-	-	≤30	≤30				
10.9	Resistance at secondary winding at 75 Deg. C (ohms)								
10.10	Secondary limiting voltage								
11	Short time thermal rating of primary								
11.1	One second								

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
11.2	Three seconds	31.5 KA	
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage	140kV (rms)	
16	One minute power frequency wet withstand voltage	140kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	325 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C3 GUARANTEED TECHNICAL PARTICULARS (66KV, 800-400/1/1/1/1A)

S No.	Description	Data By Purchaser				Data By Supplier			
1	Name of Manufacturer								
2	Address and contact details								
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank CT							
4	Rated nominal voltage	66kV							
5	Highest system voltage	72.5kV							
6	Rated frequency	50 Hz							
7	Rated primary current	800-400 A							
8	Rated secondary current	1A							
9	Number of core	Four							
10.0		Core-1	Core-2	Core-3	Core-4				
10.1	Secondary current (A)	1	1	1	1				
10.2	Application	Metering	Protection (O/C & E/F)	Protection (Bus Bar)	Protection (Spare)				
10.3	Rated Output (VA)	30	30						
10.4	Class of accuracy	0.2s	5P	PS	PS				
10.5	Instruments security factor	≤5	-	-	-				
10.6	Accuracy limit factor	-	20	-	-				
10.7	Knee point voltage and corresponding excitation current	-	-	≥40(Rct+8)	≥40(Rct+8)				
10.8	Magnetizing current at Vk/2 (mA)	-	-	≤30	≤30				
10.9	Resistance at secondary winding at 75 Deg. C (ohms)								
10.10	Secondary limiting voltage								
11	Short time thermal rating of primary								
11.1	One second								

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
11.2	Three seconds	31.5 KA	
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage	140kV (rms)	
16	One minute power frequency wet withstand voltage	140kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	325 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C4 GUARANTEED TECHNICAL PARTICULARS (66KV, 400-200/1/1/1/1A)

S No.	Description	Data By Purchaser				Data By Supplier			
1	Name of Manufacturer								
2	Address and contact details								
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank CT							
4	Rated nominal voltage	66kV							
5	Highest system voltage	72.5kV							
6	Rated frequency	50 Hz							
7	Rated primary current	400-200 A							
8	Rated secondary current	1A							
9	Number of core	Four							
10.0		Core-1	Core-2	Core-3	Core-4				
10.1	Secondary current (A)	1	1	1	1				
10.2	Application	Metering	Protection (O/C & E/F)	Protection (Bus Bar)	Protection (Spare)				
10.3	Rated Output (VA)	30	30						
10.4	Class of accuracy	0.2s	5P	PS	PS				
10.5	Instruments security factor	≤ 5	-	-	-				
10.6	Accuracy limit factor	-	20	-	-				
10.7	Knee point voltage and corresponding excitation current	-	-	$\geq 40(R_{ct+8})$	$\geq 40(R_{ct+8})$				
10.8	Magnetizing current at $V_k/2$ (mA)	-	-	≤ 30	≤ 30				
10.9	Resistance at secondary winding at 75 Deg. C (ohms)								
10.10	Secondary limiting voltage								
11	Short time thermal rating of primary								
11.1	One second								

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
11.2	Three seconds	31.5 KA	
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage	140kV (rms)	
16	One minute power frequency wet withstand voltage	140kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	325 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C5 GUARANTEED TECHNICAL PARTICULARS (33KV, 2000-1000/1/1/1/1A)

S No.	Description	Data By Purchaser				Data By Supplier			
1	Name of Manufacturer								
2	Address and contact details								
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank CT							
4	Rated nominal voltage	33kV							
5	Highest system voltage	36kV							
6	Rated frequency	50 Hz							
7	Rated primary current	2000-1000 A							
8	Rated secondary current	1A							
9	Number of core	Four							
10.0		Core-1	Core-2	Core-3	Core-4				
10.1	Secondary current (A)	1	1	1	1				
10.2	Application	Metering	Protection (O/C & E/F)	Protection (Bus Bar)	Protection (Spare)				
10.3	Rated Output (VA)	30	30						
10.4	Class of accuracy	0.2s	5P	PS	PS				
10.5	Instruments security factor	≤ 5	-	-	-				
10.6	Accuracy limit factor	-	20	-	-				
10.7	Knee point voltage and corresponding excitation current	-	-	$\geq 40(R_{ct} + 8)$	$\geq 40(R_{ct} + 8)$				
10.8	Magnetizing current at $V_k/2$ (mA)	-	-	≤ 30	≤ 30				
10.9	Resistance at secondary winding at 75 Deg. C (ohms)								
10.10	Secondary limiting voltage								
11	Short time thermal rating of primary								
11.1	One second								
11.2	Three seconds	26.3 KA							

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage	70 kV (rms)	
16	One minute power frequency wet withstand voltage	70 kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	170 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C6 GUARANTEED TECHNICAL PARTICULARS (33KV, 1000-500/1/1/1/1A)

S No.	Description	Data By Purchaser				Data By Supplier			
1	Name of Manufacturer								
2	Address and contact details								
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank CT							
4	Rated nominal voltage	33kV							
5	Highest system voltage	36kV							
6	Rated frequency	50 Hz							
7	Rated primary current	1000-500 A							
8	Rated secondary current	1A							
9	Number of core	Four							
10.0		Core-1	Core-2	Core-3	Core-4				
10.1	Secondary current (A)	1	1	1	1				
10.2	Application	Metering	Protection (O/C & E/F)	Protection (Bus Bar)	Protection (Spare)				
10.3	Rated Output (VA)	30	30						
10.4	Class of accuracy	0.2s	5P	PS	PS				
10.5	Instruments security factor	≤ 5	-	-	-				
10.6	Accuracy limit factor	-	20	-	-				
10.7	Knee point voltage and corresponding excitation current	-	-	$\geq 40(R_{ct} + 8)$	$\geq 40(R_{ct} + 8)$				
10.8	Magnetizing current at $V_k/2$ (mA)	-	-	≤ 30	≤ 30				
10.9	Resistance at secondary winding at 75 Deg. C (ohms)								
10.10	Secondary limiting voltage								
11	Short time thermal rating of primary								
11.1	One second								
11.2	Three seconds	26.3 KA							

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage	70 kV (rms)	
16	One minute power frequency wet withstand voltage	70 kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	170 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C7 GUARANTEED TECHNICAL PARTICULARS (33KV, 800-400/1/1/1/1A)

S No.	Description	Data By Purchaser				Data By Supplier			
1	Name of Manufacturer								
2	Address and contact details								
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank CT							
4	Rated nominal voltage	33kV							
5	Highest system voltage	36kV							
6	Rated frequency	50 Hz							
7	Rated primary current	800-400 A							
8	Rated secondary current	1A							
9	Number of core	Four							
10.0		Core-1	Core-2	Core-3	Core-4				
10.1	Secondary current (A)	1	1	1	1				
10.2	Application	Metering	Protection (O/C & E/F)	Protection (Bus Bar)	Protection (Spare)				
10.3	Rated Output (VA)	30	30						
10.4	Class of accuracy	0.2s	5P	PS	PS				
10.5	Instruments security factor	≤ 5	-	-	-				
10.6	Accuracy limit factor	-	20	-	-				
10.7	Knee point voltage and corresponding excitation current	-	-	$\geq 40(R_{ct} + 8)$	$\geq 40(R_{ct} + 8)$				
10.8	Magnetizing current at $V_k/2$ (mA)	-	-	≤ 30	≤ 30				
10.9	Resistance at secondary winding at 75 Deg. C (ohms)								
10.10	Secondary limiting voltage								
11	Short time thermal rating of primary								
11.1	One second								
11.2	Three seconds	26.3 KA							

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage	70 kV (rms)	
16	One minute power frequency wet withstand voltage	70 kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	170 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C8 GUARANTEED TECHNICAL PARTICULARS (66KV, NCT 2000-1000/1-1A)

S No.	Description	Data By Purchaser		Data By Supplier	
1	Name of Manufacturer				
2	Address and contact details				
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank CT			
4	Rated nominal voltage	66kV			
5	Highest system voltage	72.5kV			
6	Rated frequency	50 Hz			
7	Rated primary current	2000-1000 A			
8	Rated secondary current	1A			
9	Number of core	2			
10.0		Core-1	Core-2		
10.1	Secondary current (A)	1	1		
10.2	Application	Protection (O/C & E/F)	Protection		
10.3	Rated Output (VA)	30			
10.4	Class of accuracy	5P	PS		
10.5	Instruments security factor	-	-		
10.6	Accuracy limit factor	20			
10.7	Knee point voltage and corresponding excitation current	-	$\geq 40(R_{ct} + 8)$		
10.8	Magnetizing current at $V_k/2$ (mA)	-	$\leq 30\text{mA}$		
10.9	Resistance at secondary winding at 75 Deg. C (ohms)				
10.10	Secondary limiting voltage				
11	Short time thermal rating of primary				
11.1	One second				
11.2	Three seconds	31.5 kA			

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage	140kV (rms)	
16	One minute power frequency wet withstand voltage	140kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	325 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C9 GUARANTEED TECHNICAL PARTICULARS (33KV, NCT 2000-1000/1/1A)

S No.	Description	Data By Purchaser		Data By Supplier	
1	Name of Manufacturer				
2	Address and contact details				
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank NCT			
4	Rated nominal voltage	33kV			
5	Highest system voltage	36kV			
6	Rated frequency	50 Hz			
7	Rated primary current	2000-1000 A			
8	Rated secondary current	1A			
9	Number of core	2			
10.0		Core-1	Core-2		
10.1	Secondary current (A)	1	1		
10.2	Application	Protection (O/C & E/F)	Protection		
10.3	Rated Output (VA)	30			
10.4	Class of accuracy	5P	PS		
10.5	Instruments security factor	-	-		
10.6	Accuracy limit factor	20			
10.7	Knee point voltage and corresponding excitation current	-	$\geq 40(R_{ct} + 8)$		
10.8	Magnetizing current at $V_k/2$ (mA)	-	$\leq 30\text{mA}$		
10.9	Resistance at secondary winding at 75 Deg. C (ohms)				
10.10	Secondary limiting voltage				
11	Short time thermal rating of primary				
11.1	One second				

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
11.2	Three seconds	26.3 KA	
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage	70kV (rms)	
16	One minute power frequency wet withstand voltage	70kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	170 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C10 GUARANTEED TECHNICAL PARTICULARS (33KV, NCT 10/1-1A)

S No.	Description	Data By Purchaser		Data By Supplier	
1	Name of Manufacturer				
2	Address and contact details				
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank NCT			
4	Rated nominal voltage	33kV			
5	Highest system voltage	36kV			
6	Rated frequency	50 Hz			
7	Rated primary current	10 A			
8	Rated secondary current	1A			
9	Number of core	2			
10.0		Core-1	Core-2		
10.1	Secondary current (A)	1	1		
10.2	Application	Protection (O/C & E/F)	Protection (REF)		
10.3	Rated Output (VA)	30			
10.4	Class of accuracy	5P	PS		
10.5	Instruments security factor	-	-		
10.6	Accuracy limit factor	20			
10.7	Knee point voltage and corresponding excitation current	-	$\geq 40(R_{ct} + 8)$		
10.8	Magnetizing current at $V_k/2$ (mA)	-	$\leq 30\text{mA}$		
10.9	Resistance at secondary winding at 75 Deg. C (ohms)				
10.10	Secondary limiting voltage				
11	Short time thermal rating of primary				
11.1	One second				
11.2	Three seconds	100 times of rated primary			

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
		current	
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage	70kV (rms)	
16	One minute power frequency wet withstand voltage	70kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	170 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C11 GUARANTEED TECHNICAL PARTICULARS (11KV, NCT 1600/1-1A)

S No.	Description	Data By Purchaser		Data By Supplier	
1	Name of Manufacturer				
2	Address and contact details				
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank NCT			
4	Rated nominal voltage	11kV			
5	Highest system voltage	12kV			
6	Rated frequency	50 Hz			
7	Rated primary current	1600A			
8	Rated secondary current	1A			
9	Number of core	2			
10.0		Core-1	Core-2		
10.1	Secondary current (A)	1	1		
10.2	Application	Protection (O/C & E/F)	Protection (Busbar)		
10.3	Rated Output (VA)	30			
10.4	Class of accuracy	5P	PS		
10.5	Instruments security factor	-	-		
10.6	Accuracy limit factor	20			
10.7	Knee point voltage and corresponding excitation current	-	$\geq 40(R_{ct}+8)$		
10.8	Magnetizing current at $V_k/2$ (mA)	-	$\leq 30mA$		
10.9	Resistance at secondary winding at 75 Deg. C (ohms)				
10.10	Secondary limiting voltage				
11	Short time thermal rating of primary				
11.1	One second				
11.2	Three seconds	26.3 KA			

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage		
16	One minute power frequency wet withstand voltage	28kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	75 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C12 GUARANTEED TECHNICAL PARTICULARS (11KV, NCT 1200/1-1A)

S No.	Description	Data By Purchaser		Data By Supplier	
1	Name of Manufacturer				
2	Address and contact details				
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank NCT			
4	Rated nominal voltage	11kV			
5	Highest system voltage	12kV			
6	Rated frequency	50 Hz			
7	Rated primary current	1200A			
8	Rated secondary current	1A			
9	Number of core	2			
10.0		Core-1	Core-2		
10.1	Secondary current (A)	1	1		
10.2	Application	Protection (O/C & E/F)	Protection (Busbar)		
10.3	Rated Output (VA)	30			
10.4	Class of accuracy	5P	PS		
10.5	Instruments security factor	-	-		
10.6	Accuracy limit factor	20			
10.7	Knee point voltage and corresponding excitation current	-	$\geq 40(R_{ct} + 8)$		
10.8	Magnetizing current at $V_k/2$ (mA)	-	$\leq 30\text{mA}$		
10.9	Resistance at secondary winding at 75 Deg. C (ohms)				
10.10	Secondary limiting voltage				
11	Short time thermal rating of primary				
11.1	One second				

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
11.2	Three seconds	26.3 KA	
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage		
16	One minute power frequency wet withstand voltage	28kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	75 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER
ANNEXURE- C13 GUARANTEED TECHNICAL PARTICULARS (11KV, NCT 1200/0.578-0.578A)

S No.	Description	Data By Purchaser		Data By Supplier	
1	Name of Manufacturer				
2	Address and contact details				
3	Type	Outdoor, Oil cooled, Hermetically sealed, Single phase, Dead tank NCT			
4	Rated nominal voltage	11kV			
5	Highest system voltage	12kV			
6	Rated frequency	50 Hz			
7	Rated primary current	1200A			
8	Rated secondary current	0.578A			
9	Number of core	2			
10.0		Core-1	Core-2		
10.1	Secondary current (A)	0.578	0.578		
10.2	Application	Protection (O/C & E/F)	Protection (Busbar)		
10.3	Rated Output (VA)	30			
10.4	Class of accuracy	5P	PS		
10.5	Instruments security factor	-	-		
10.6	Accuracy limit factor	20			
10.7	Knee point voltage and corresponding excitation current	-	$\geq 40(R_{ct} + 8)$		
10.8	Magnetizing current at $V_k/2$ (mA)	-	$\leq 30\text{mA}$		
10.9	Resistance at secondary winding at 75 Deg. C (ohms)				
10.10	Secondary limiting voltage				
11	Short time thermal rating of primary				
11.1	One second				

TECHNICAL SPECIFICATION OF OUTDOOR CURRENT TRANSFORMER

S No.	Description	Data By Purchaser	Data By Supplier
11.2	Three seconds	26.3 KA	
12	Rated dynamic current of primary		
13	Rated continuous thermal current		
14	Temperature rise at ambient temp 50 deg. C		
14.1	Winding		
14.2	Oil at top		
14.3	Exposed current carrying parts		
15	One minute power frequency dry withstand voltage		
16	One minute power frequency wet withstand voltage	28kV (rms)	
17	1.2/50 microsecond impulse withstand test voltage	75 KV (peak)	
18	Minimum creepage distance in mm	31KV / mm	
19	Protective creepage distance in mm		
20	Magnetization curve of CT core		
21	Variation in ratio and phase angle error due to variation in		
21.1	Voltage by 1 volts		
21.2	Frequency by 1 Hz		
22	Current density in primary winding (A/sqmm)		
23	Weight of oil		
24	Total weight		
25	Mounting details		
26	Overall dimensions		
27	Terminal connector		

ANNEXURE - D RECOMENDED 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			

CONTROLLED COPY



Specifications

Outdoor Disconnecting Switch

(66 & 33 KV)

Specification no. : SP-ISLU-01-R0

Prepared By		Reviewed By		Approved By		Revision	Date
Name	Sign.	Name	Sign.	Name	Sign.		
AAG		HPB		DG		0	29-Jan-2005

Index

1.0	General Specification.....	03-11
2.0	Annexure – A : Scope & Documentation.....	12-13
3.0	Annexure – B : Ambient Conditions.....	14-14
4.0	Annexure – C1 : Guaranteed Tech. Particulars for 66KV Disconnecting Switch...	15-17
5.0	Annexure – C2 : Guaranteed Tech. Particulars for 33KV Disconnecting Switch...	18-20
6.0	Annexure – D : Recommended spares (Data by supplier).....	21-21

General Specification

1.0.0 Codes & Standards

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

National Standards

Standard Code	Standard Description
	Indian Electricity Rules
	Indian electricity act
	CBIP manual
IS : 9921 - Part I to V	Specification for Alternating Current Disconnectors (Isolators) and Earthing Switches
IS : 0996 -1979	Single phase small AC and Universal Electric Motors.
IS : 7572 -1974	Guide for testing single phase AC and Universal motors.
IS : 4237 -1967	General Requirement for switchgear for voltage not exceeding 1.1 kV.
IS : 2147 -1962	Degree of protection provided by enclosure for low-voltage switchgear control gear
IS : 2544	Porcelain Post Insulator
IS : 2629 -1985	Recommended Practice for Hot-Dip Galvanizing of Iron and Steel
IS : 6639 - 1972	Specification for Hexagon Bolts for Steel Structures

Important Note :

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

- i. Specification including applicable codes, standards
- ii. Guaranteed Technical Particulars (GTP)
- iii. Approved Vendor Drawings

Sr. No.	Description	Requirement / Rating
2.0.0	Design Features	Common for both 66KV and 33 KV equipment
2.1.0	Disconnect Switch Type & Mechanism	Motor operated, central rotating double break with turn and twist mechanism, triple pole, outdoor type for installation and operation in horizontal plane for 66KV & in vertical plane for 33 kv with or without earth switches, as required complete in all respects.
i)	Motor assembly	Suitable for 3 phase 415V, 50 Hz. Provided with a quick electro-mechanical brake on high speed shaft for rapid braking.
2.2.0	Earth Switch Mechanism	Manually operated
2.3.0	Disconnect Switch Controls	
i)	Remote electrical control	Required
ii)	Local Manual control	Required
iii)	Local electrical control	Required from integral Local Control Cabinet
2.4.0	Interlock with circuit breakers	Electrical interlock suitable for 220 V / 50 V DC
2.5.0	Interlock with Earth Switch	Mechanical & Electrical interlock
2.6.0	Padlock for Earth Switch	Padlock & keys for both positions i.e. when earth switch is grounded and when earth switch is un-grounded
2.7.0	Fixed Contacts	
i)	Type of contacts	Spring loaded with smooth surface, silver plated
ii)	Current carrying castings	Non corrodible, non ferrous material
iii)	Current carrying Springs	Made of non aging, non magnetic stainless steel with life long spring action strength
2.8.0	Insulators	
i)	Construction	Comprising of cylindrical solid core post insulators. The porcelain used in the insulators shall be homogeneous, free from laminations, cavities or any other defect which may affect its mechanical and dielectric qualities and shall be thoroughly vitrified, tough and impervious to moisture. The glazing of the porcelain shall be of uniform brown colour, free from blisters, burrs and other defects.
ii)	Fasteners	All metal caps, jointing flanges, bolts and nuts shall be made of high grade cast iron or malleable steel casting, machine faced and hot-dip galvanised.

Sr. No.	Description	Requirement / Rating
2.9.0	Moving Contacts	
i)	Type of contacts	High pressure relieving copper contacts, silver plated
ii)	Wiping Action	Required during opening & closing. Shall be adequate to remove any oxide film formed without causing scouring or abrasion on the contact surfaces.
2.10.0	Current carrying Springs	Made of non aging, non magnetic stainless steel with life long spring action strength
2.11.0	Fault Current rating	Earth switch shall be able to carry same Fault Current as assigned to the disconnecting switch.
2.12.0	Disconnecting Switch contacts movement	90 deg from full open to full close in order to ensure a distinct break and clear visibility.
2.13.0	Corona Effect	Shall be free from visible corona discharge in both open & close positions at visible discharge test voltages.
2.14.0	Control cabinet	
i)	Enclosure	Weather-proof, water-shedding, corrosion-proof IP-55 steel cabinet
ii)	Cabinet Door	Gasketed, hinged access door shall have a mechanical indicator fitted to clearly indicate fully opened and fully closed positions of the disconnection switch.
iii)	Wiring	Control wiring shall be done using 1.1KV grade 2.5 sq.mm stranded copper conductor, PVC insulated, cables laid in GI conduits.
iv)	Locking arrangement	Padlocking arrangement to be provided.
v)	Incomer	A local TPN MCB to be provided in cabinet at power supply incoming point.
vi)	Outgoing Control Wiring	All outgoing control wiring shall terminate on terminal blocks, inside the cabinet so as to have maximum access to all conductor terminals.
vii)	Aux. Contacts	All auxiliary contacts of the disconnection switch and earthing switches shall be supplied duly wired up to the terminal blocks.
viii)	Terminals	Stud type terminals with at least twenty (20) percent spare terminals shall be provided over and above the number actually required.
ix)	Paint Shade	Polyurethane Paint Shade no. 692 of IS-5.
x)	Local Controls	A local/ remote changeover switch shall be fitted inside the cabinet together with open/ close push buttons for local control.

Sr. No.	Description	Requirement / Rating
xi)	Cabinet accessories	Cabinet illumination incandescent lamp with ON/OFF switch, 5/15A single phase 3 pin socket with switch & fuse, 240V AC space heater with switch & thermostat etc.
2.15.0	Manual Operation	Manual operation of disconnection switch by means of crank handle disconnecting power supply to the 3-pole operating mechanism on insertion into its socket. The height of socket shall be about 1.2 metre above the finished ground level of the substation.
2.16.0	Disconnection switches with Earth switch	Switch shall have three (3) grounding blades forming integral part of the isolator. These blades shall be capable of being fitted on either side of the brakes. Flexible heavily tinned copper braids of adequate cross-sectional area with connector suitable for the specified short circuit current shall be provided on the hinged end of the grounding blade for connection to the station grounding grid.
2.17.0	Grounding Blades Operation	Manually operated and interlocked with disconnection switch so that the grounding blades can be closed only when the disconnection switch is open.
2.18.0	Pivot bearings	Shall be maintenance-free and corrosion resistant. Double tapered-roller bearings located 150 mm apart suitable for ensuring smooth and dependable operation of the disconnection switch shall be located at the base of the supporting insulators. The earthing switch shaft shall also be provided with necessary bearings. The bearings shall be suitable for effective operation of disconnection switch and earthing switches even after long periods of their remaining in closed/ open position.
2.19.0	Disconnection Switch Poles & base	<p>Each pole of the disconnection switch shall be provided with a complete galvanized steel base designed for mounting on a supporting structure/ gantry.</p> <p>The base shall be rigid and self-supporting and shall require no guying or cross bracing between phases. The group operated isolators shall have a common supporting structure for all the three (3) poles.</p>
2.20.0	Grounding Pads	Each pole of disconnection switch shall be provided with two (2) grounding pads of non-corrodible material brazed to the channel base at opposite ends. Flexible tinned copper (15-25 microns) connectors shall be provided for a) Connection of earthing pad of each pole, b) Operating handle, c) Earthing switches.

Sr. No.	Description	Requirement / Rating
2.21.0	Counter-Balancing Springs/ Weights	Springs/ weights of non-rusting alloy composition shall be provided for counter-balancing the earthing switch blades to prevent impact at the end of travel both on opening and closing of the earthing switch.
2.22.0	Name Plates	Corrosion-proof nameplates giving all the relevant mandatory as well as optional information as stipulated in IS shall be provided on disconnection switches, earthing switches and operating devices as per the Purchaser's/ Consulting Engineer's approval.
3.0.0	Approved Make of Components	Common for both 66KV and 33 KV outdoor disconnecting switch
3.1.0	Motors	ABB / Siemens / Crompton
3.2.0	Insulators	JSI / WSI / Modern / Saravana / BHEL
3.3.0	Switch	Kaycee / L&T (Salzer)
3.4.0	HRC Fuse Links	Alstom / Siemens / L&T
3.5.0	AC Contactors & O/L Relay	L&T / Siemens / Schneider
3.6.0	Terminals	Connectwell / Elmex
3.7.0	Push buttons / Actuator	L&T / Teknic / Siemens
3.8.0	MCB	Merlin Gerin / Siemens / Schneider

Sr. No.	Description	Requirement / Rating
4.0.0	Testing & Inspection	
4.1.0	Internal Test	Manufacturer shall carry out comprehensive inspection and testing during manufacture of the equipment.
4.2.0	Type test	The product must be of type tested quality. Type test reports shall be submitted for the type, size & rating of equipment offered along with bid. If the manufacturer's lab is accredited by govt./ authorised body then it shall be acceptable for type testing.
4.3.0	Routine test	As per relevant IS / IEC.
4.4.0	Acceptance test	As per relevant IS / IEC.
4.5.0	Test Witness	
4.5.1		The Buyer reserves the right to witness all tests specified on completed product.
4.5.2		The Buyer reserves the right to inspect the product at the Sellers works at any time prior to dispatch, to verify compliance with the specifications.
4.4.3		In-process and final inspection call intimation shall be given in advance to purchaser.
4.6.0	Tests on fitting and Accessories	As per Manufacturer's Standards and relevant IS / IEC.
5.0.0	Drawing, Data & Manuals	
5.1.0	To be submitted along with bid	The seller has to submit :
	i)	Tentative GA / cross sectional drawing of product showing all the views / sections.
	ii)	Detailed reference list of customers already using the offered product during the last 5 years with particular emphasis on units of similar design and rating.
	iii)	Completely filled GTP
	iv)	Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted.
	v)	Details of manufacturer's quality assurance standards and program and ISO 9000 series or equivalent national certification.

Sr. No.	Description	Requirement / Rating
	vi)	Type test reports shall be submitted for the type, size & rating of product / equipment offered along with bid. In case the type test report for identical product is not available then type test report of nearby size/ rating shall be submitted for review. They shall be considered valid for 5 years from date of test performed on product /equipment.
	vii)	Complete product catalogue and Manual along with the bid.
	viii)	Recommended spare parts and consumable items for five years of operation with prices and spare parts catalogue with price list for future requirements.
	ix)	Bill of material with make, model & quantity of items.
5.2.0	To be submitted after award of contract	The seller has to submit : for buyer's Approval (A) / Reference (R)
	i)	Program for production and testing (A)
	ii)	Guaranteed Technical Particulars (A)
	iii)	Calculations to substantiate choice of electrical, structural, mechanical component size / ratings (A)
	iv)	a) Detailed dimension drawing for all components, general b) Drawings of major components (A) c) Rating and diagram plate (R)
	v)	Detailed loading drawing to enable the buyer to design and construct foundations (as applicable) (R)
	vi)	Transport / Shipping dimensions with weights (R)
	vii)	Detailed Bill of Materials for all fittings and accessories with their make, model & tag no. etc. (A)
	viii)	Detailed installation and commissioning instructions (R)
	ix)	Quality plan (A)
5.3.0	Submittals required prior to dispatch	The seller has to submit :
	i)	Inspection and test reports, carried out in manufacturer's works (R)
	ii)	Test certificates of all bought out items
	iii)	Operation and maintenance Instruction as well as trouble shooting charts/ manuals
5.4.0	Drawing and document sizes	Standard size paper A0, A1, A2, A3, A4
5.5.0	No of drgs. / Documents required at different stages	As per Annexure- A

Sr. No.	Description	Requirement / Rating
6.0.0	Packing	
6.1.0	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration
6.2.0	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
6.3.0	Packing Identification Label	In 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 and Quantity
	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
7.0.0	Shipping, Handling & Storage	
7.1.0	Shipping Information	The seller shall give complete shipping information concerning weight, size etc. of each package.
7.2.0	Shipping Constraints	The seller shall ascertain at an early date before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, overhead lines, free access etc. from the manufacturing plant to the project site. Bidder shall furnish the confirmation that the proposed packages can be safely transported, as normal or oversize packages, upto the site. Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice of the Purchaser.
7.3.0	Transit Damage	The seller shall be responsible for any transit damage due to improper packing.
7.4.0	Handling & Storage	Manufacturer's instructions shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.

Sr. No.	Description	Requirement / Rating
8.0.0	Quality Assurance	
8.1.0	Vendor quality plan	To be submitted for purchaser approval
8.2.0	Inspection points	To be mutually identified & agreed in quality plan
9.0.0	Progress Reporting	
9.1.0	Outline Document	To be submitted for purchaser approval for outline of production, inspection, testing, inspection, packing, dispatch, documentation program
9.2.0	Detailed Progress report	To be submitted to Purchaser once a month containing
	i)	Progress on material procurement
	ii)	Progress on fabrication (As applicable)
	iii)	Progress on assembly (As applicable)
	iv)	Progress on internal stage inspection
	v)	Reason for any delay in total program
	vi)	Details of test failures if any in manufacturing stages
	vii)	Progress on final box up
	viii)	Constraints / Forward path
10.0.0	Deviations	
	i)	Deviations from this Specification are only acceptable where the Seller has listed in his quotation the requirements he can't or does not wish to comply with and the buyer has accepted in writing the deviations before the order is placed.
	ii)	In the absence of a list of deviations, it will be assumed by the Buyer that the Seller complies fully with this specification.

Annexure – A
1.0 Scope

Sr. No.	Description	Requirement / Rating				
1.0.0	Scope					
1.1.0	Main Equipment	Design, manufacture, assembly & testing at manufacturer's works before dispatch, packing & delivery of outdoor disconnecting switch rated up to 66 kV.				
1.2.0	Accessories					
		i)	Clamps & terminal connectors.			
		ii)	Stainless steel hardware like nut bolts/ washers etc. for fixing of all equipment / accessories in the scope of the bidder with supporting structure.			
		iii)	Any other item necessary or usual for efficient performance and satisfactory maintenance under the various operating and atmospheric conditions			
1.3.0	Documentation	Submission of all drawings & documents pertaining to the equipment.				
1.4.0	Site Supervision	Supervision of testing & commissioning of equipment at site.				
1.5.0	Bill of Materials	Complete bill of materials shall be submitted in the following format.				
	Sr. No.	Purchaser Equipment Tag No. / Sap Code	Equipment Description	Location / Substation Name	Unit	Quantity
				e.g. Santacruz	Nos.	e.g. 1
				e.g. Alaknanda	Nos.	e.g. 6

2.0.0 Document Submission

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

	Along with offer	For Approval after award of contract	Final after approval	Remarks
Drawings	3 copies (Typical drgs)	4 copies + 1 Soft Copy	6 copies + 1 soft copy in CD	See Clause 5.0.0 for various drawings required
Calculations	3 copies (Typical)	4 copies + 1 Soft Copy	6 copies + 1 soft copy in CD	See Clause 5.0.0 for details
Catalogues	1 copy		6 copies + 1 soft copy in CD	
Instruction manual	1 copy		6 copies + 1 soft copy in CD	
Test Report	2 copies		6 copies + 1 soft copy in CD	Type test and routine test reports

3.0.0 Delivery Schedule

Sr. No.	Description	Requirement / Rating
i)	Delivery period start date	From date of purchase order
ii)	Delivery period end date	As agreed with supplier
iii)	Material dispatch clearance	After inspection by purchaser

A _____

Ambient Conditions :
A) Mumbai

a)	Average grade atmosphere	Heavily polluted , salt Laden, dusty, humid with possibility of condensation
b)	Maximum altitude above sea level	1000 M
c)	Ambient Air temperature	Highest 45 deg C, Average 35 deg C
d)	Minimum ambient air temperature	20 deg C
e)	Relative Humidity	100 % Max
f)	Thermal Resistivity of Soil	150 Deg. C cm/W
g)	Seismic Zone	3
h)	Rainfall	3000 mm concentrated in four months

B) Delhi

a)	Average grade atmosphere	Heavily polluted, dry
b)	Maximum altitude above sea level	1000 M
c)	Ambient Air temperature	Highest 50 deg C, Average 40 deg C
d)	Minimum ambient air temperature	0 Deg C
e)	Relative Humidity	100 % Max
f)	Thermal Resistivity of Soil	150 Deg. C cm/W
g)	Seismic Zone	4
h)	Rainfall	750 mm concentrated in four months

TECHNICAL SPECIFICATION
APPROVED MAKES & VENDERS

Prepared by	Abhinav Srivastava		Rev: 1
Reviewed by	k.Sheshadri		Date: 22.07.2018
Approved by	k.Sheshadri		

Technical Specification for Approved Makes & Vendors

1.0 APPROVED MAKES & VENDORS

S NO.	Vendors
1.0	Power Transformer
1.1	BHARAT BIJLEE LIMITED
1.2	ABB LIMITED
1.3	SCHNEIDER ELECTRIC LIMITED.
1.4	BHEL
1.5	CGL
1.6	Toshiba
2.0	Station Transformers
2.1	SCHNEIDER ELECTRIC LIMITED.
2.2	TOSHIBA
2.3	DANISH
2.4	CGPISL
3.0	LT Control, Communication and special cables
3.1	POLYCAB
3.2	PARAMOUNT COMMUNICATIONS LIMITED
3.3	TARUNA METALS PVT. LIMITED.
3.4	ALPHA COMMUNICATION
3.5	KEI INDUSTRIES LIMITED.
4.0	LT(1.1 KV grade) XLPE Insulated Power Cables
4.1	PARAMOUNT COMMUNICATIONS LIMITED
4.2	KEI INDUSTRIES LIMITED.
4.3	HINDUSTAN VIDYUT PRODUCTS LIMITED
4.4	GEMSCAB INDUSTRIES LIMITED
4.5	KRISHNA ELECTRICAL INDUSTRIES LIMITED
4.6	POLYCAB WIRES PRIVATE LIMITED
4.8	KEC INTERNATIONAL LIMITED (RPG CABLES LIMITED)
4.9	HAVELLS
5.0	11KV 500MVA Indoor Switchboard
5.1	SIEMENS LIMITED
5.2	ABB LIMITED
5.3	SCHNEIDER ELECTRIC LIMITED.
5.4	Stelmec
5.5	L&T
6.0	66KV Outdoor Circuit Breakers
6.1	ABB LIMITED
6.2	SIEMENS LIMITED
6.3	GE
6.4	CGPISL

Technical Specification for Approved Makes & Vendors

7.0	66KV & 11KV Outdoor CT/PT
7.1	CROMPTON GREAVES LIMITED
7.2	KAPCO ELECTRIC PVT. LIMITED.
7.3	GE
7.4	MEHRU ELECTRICAL & MECHANICAL ENGINEERS P LIMITED.
7.5	ABB LIMITED
7.6	BHEL
8.0	CVT
8.1	CROMPTON GREAVES LIMITED
8.2	ABB LIMITED
8.3	MEHRU
8.4	GE
8.5	SIEMENS
8.0	33&66KV Lightning Arrestor
8.1	ALSTOM
8.2	OBLUM ELECTRICAL INDUSTRIES PVT. LIMITED.
8.3	LAMCO INDUSTRIES PVT. LIMITED.
8.4	ABB LIMITED
8.5	CROMPTON GREAVES LIMITED.
8.6	ELECTROLYTE
8.7	RAYCHEM
9.0	66KV Isolators
9.1	ABB LIMITED.
9.2	SIEMENS LIMITED.
9.3	CROMPTON GREAVES LIMITED.
10.0	66KV Control & Relay Panel
10.1	ABB LIMITED.
10.2	SCHNEIDER ELECTRIC LIMITED.
10.3	SIEMENS LIMITED.
11.0	11KV Capacitor Bank
11.1	UNIVERSAL CABLES LIMITED.
11.2	SHREEM ELECTRIC LIMITED
11.3	ABB LIMITED
11.4	LARSEN & TOUBRO LIMITED
11.5	EPCOS INDIA PVT. LIMITED
12.0	ACDB &BMK
12.1	NEPTUNE
12.2	CMKL
12.3	NEC

Technical Specification for Approved Makes & Vendors

12.4	EATHUN
12.5	POPULAR SWITCHGEAR
12.6	SHIVALIC
13.0	St. through jointing and Termination Kits – 1.1KV,11KV
13.1	RAYCHEM RPG LIMITED
13.2	3M ELECTRO & COMM. INDIA (P) LIMITED.
13.3	DENSON
14.0	St. through jointing and Termination Kits – 66KV
14.1	RAYCHEM RPG LIMITED
14.2	3M ELECTRO & COMM. INDIA (P) LIMITED.
15.0	LED/HPSV/Fluorescent Lamps, Ballasts, Starters / Igniters, Fittings, Lamp Holder
15.1	PHILIPS ELECTRONICS INDIA LIMITED
15.2	CROMPTON GREAVES LIMITED
15.3	BAJAJ ELECTRICALS LIMITED
15.4	SURYA ROSHNI LIMITED
16.0	Transformer oil
16.1	APAR INDUSTRIES LIMITED
16.2	SAVITA OIL TECHNOLOGIES LIMITED
16.3	RAJ PETRO SPECIALITIES PVT. LIMITED.
17.0	Protective Relays (Refer Technical specification for details)
17.1	SIEMENS LIMITED
17.2	A-EBERLE
17.4	ABB LIMITED
17.5	SCHNEIDER ELECTRIC
17.6	GE
18.0	Overhead Line accessories e.g. Clamps, Connectors, Line Hardware fitting
18.1	RAYCHEM RPG PVT.LIMITED
18.2	RASHTRA UDHYOG LIMITED.
18.3	KLEMMEN ENGINEERING
18.4	LEGION
18.5	BURMA
19.0	Disc and Pin Insulators
19.1	ADITYA BIRLA INSULATORS
19.2	MORDEN INSULATORS LIMITED.
19.3	BHEL
19.4	IEC
19.5	W.S. INDUSTRIES

Technical Specification for Approved Makes & Vendors

20.0	STEEL TUBULAR POLES
20.1	FABRICO (INDIA) PVT. LIMITED.
20.2	ADVANCE STEEL TUBES LIMITED.
20.3	GOOD LUCK STEEL TUBES LIMITED.
20.4	RAMA STEEL TUBES LIMITED.
21.0	ACSR Conductors
21.1	HINDUSTAN VIDYUT PRODUCTS LIMITED
21.2	GUPTA POWER
21.3	LUMINO INDUSTRIES LIMITED
21.5	POLYCAB WIRES PRIVATE LIMITED
22.0	Battery Bank
22.1	Panasonic
22.2	Samsung
22.3	Coslite
22.4	Okaya
23.0	Battery Charger cum DC DB
23.1	MASS-TECH CONTROLS PRIVATE LIMITED
23.2	CALDYNE AUTOMATICS LIMITED.
23.3	CHABI ELECTRICALS
24.0	PAINTS & CHEMICALS
24.1	BERGER PAINTS INDIA LIMITED BRITISH PAINTS DIVISION
24.2	SHALIMAR PAINTS LIMITED.
24.3	NEROLAC PAINTS LIMITED.
24.4	ASIAN PAINTS LIMITED.
25.0	CEMENT
25.1	ACC
25.2	ULTRA TECH
26.0	STEEL
26.1	TATA
26.2	SAIL
27	NIFPS
27.1	CTR
28	High Mast
28.1	Bajaj Electricals Ltd
29	Cable Seal
29.1	Roxtec

Technical Specification for Approved Makes & Vendors

29.2	MCT Brattberg
29.3	UGA Cable and Pipe Sealing Systems India Pvt. Ltd.
30	EOT Crane
30.1	REVA
30.2	DEMAG
31	66kV GIS
31.1	Siemens
31.2	GE
31.3	ABB
32	GIS Gas Handling kit(Gas filling, filter and evacuation kit)
32.1	DILO
33	Cable Sealing
33.1	Roxtec
33.2	MCT Bratberg

TECHNICAL SPECIFICATION

TRAINING AND INSPECTION

Prepared by	Javed Ahmed		Rev: 0
Reviewed by	Abhinav Srivastava		Date: 17.05.2021
Approved by	K.Sheshadri		

Volume – I Technical Specification for Training and Inspections

Training and Inspection

The Scope includes training and inspection of BRPL Officials at site and at OEM's factory on overall product and all its sub-components. Cost of travel by flight and

1. Training of BRPL officials

The Scope includes training of BRPL Officials at site and at OEM's factory on overall product and all its sub-components.

BRPL official will include departmental personnel from Operation & Maintenance, Protection, SCADA and Engineering.

Training will include, but not limited to, verbal and written communication on aspects ranging from operation, maintenance, safety, features and functions.

It will be the responsibility of contractor to arrange the following:

- i) To arrange Air travel and Taxi for local conveyance at the contractors cost for the engineers/ officers deputed for carrying out the inspection of the material.
- ii) To arrange the minimum 4 star accommodation at the contractors cost for the boarding/ lodging and meals thereof for the engineers/ officers deputed for carrying out the inspection of the material.
- ii) To depute his competent representative to impart training of the material.

Following Table defines mandays required for training of each equipment.

S. No.	Equipment	Training at Site (No. of Days)	Training at Factory (No of Days)	No. of BRPL Representatives for Factory Visit
1	C&R Panels	6	2	3
2	Power Transformer	1	1	2
3	11 kV Panels	3	2	3
4	SCADA – RTU	3	2	2
5	Battery Bank	1	1	1
6	Battery Charger	1	1	1
7	11kV APFC with Controller	3	2	3
8	PQ Analyser	1	0	0
9	Grid Monitoring System	1	0	0
10	Video Surveillance System	1	0	0
11	Fire Detection System	1	0	0
12	Fire Suppression System	1	0	0
13	CT,PT and CVT	1	0	0

Volume – I Technical Specification for Training and Inspections

2. Inspection & Testing

2.1 Independent Inspection

BRPL may at his discretion delegate inspection and testing of material to an independent inspector.

2.2. Dates for Inspection and Testing

The Contractor shall give the Owner reasonable notice (minimum 10 days) in writing of the date and the place at which any material will be ready for testing as provided in the Contract and Owner shall attend at the place so named within fifteen (15) days of the date, which the Contractor has stated in his notice. The Owner shall give the Contractor twenty four (24) hours notice in writing of his intention to attend the tests. The above notices shall be given at first by the quickest possible means and confirmed later in writing.

If on receipt of the Contractor's notice of testing, the Owner's representative does not find the material to be ready for testing, the costs incurred for re-deputation of inspector and re-inspection shall also be in Contractor's Scope.

2.3 Inspection charges:

Detailed Breakup of no. of inspectors for each inspection shall be as under.

S. No	Equipment	No of Inspectors
1	Power Transformer	2
2	CRP	3
3	RTU	2
4	HT Panels	2
5	For all other equipments	1
6	For all testing and measuring instruments	2
7	For all Stage inspections	1

It will be the responsibility of contractor to arrange the following:

i) Cost of all the inspections within India and abroad (including re inspections) including flight Tickets, local conveyance, Boarding and lodging (Minimum 4 Star Hotel for India and Minimum 4 Star for Abroad) shall be in scope of Vendor. The Factory visits will be held at OEM Factory only.

ii) To depute his authorized representative to associate during the inspection of the material.

In case of fake call or rejection of material or any other cause, the Owner is

Volume – I Technical Specification for Training and Inspections

not liable for reimbursement of the expenditure so incurred by the contractor.

2.4 Rejection

If as-a-result of the inspection, examination or testing as per approved QAP, the Owner decides that any equipment is defective or otherwise not in accordance with the Contract, he may reject such equipment and shall notify the Contractor there-of, immediately. The notice shall state the Owner's objections with reasons.

The Contractor shall then with all speed make good the defect or ensure that any rejected equipment complies with the Contract.

If the Owner requires such Equipment to be re-tested, the tests shall be repeated under same terms and conditions. All costs incurred for re-deputation of inspector and re-inspection shall also be in Contractor's Scope.

VOLUME – II
SCHEDULE AND ANNEXURE

SCHEDULE – A
GENERAL PARTICULARS

(This shall from part of Technical Bid)

1.0 Bidder

- | | | | |
|------------|--|---|--------|
| 1.1 | Name | : | |
| 1.2 | Postal Address | : | |
| 1.3 | Telegraphic Address | : | |
| 1.4 | Telex number / Answer back code | : | |
| 1.5 | Phone(s) | : | |
| 1.6 | Name and Designation of the person who should be contacted in case of clarifications / details etc. not received expeditiously from the officer mentioned in item 1.6 above | : | |
| 1.7 | Brief write-up giving details of the organization, years of establishment and and commercial production activities, manufacturing, fabrication, shop testing, erection, testing, commissioning and after-sales service facilities, key personnel with their qualifications and experience, collaboration agreements, if any number of employees in various categories and last three (3) years turn over | : | |
| 2.0 | Bid Validity | : | |
| 3.0 | All the Schedules filled-in | : | Yes |
| 4.0 | All the Deviations brought out in Schedule – E1and E2 | : | Yes |
| 5.0 | All the drawings, write-ups, literature, leaflets, calculations, details, etc as called for in the specification attached | : | Yes |
| 6.0 | Is the Bidder agreeable to undertake this contract, if deviations stipulated by him are not acceptable to the Purchaser | : | Yes/No |

Schedules & Annexure

Schedule A

	Bidders Name	:	_____
	Signature	:	_____
	Name	:	_____
	Designation	:	_____
Seal of Company	Date	:	_____

SCHEDULE – B

LIST OF DRAWINGS ENCLOSED WITH BID

(This shall form part of Technical Bid)

S.No.	Drawing No	Title
1	2	3

Name of Firm : _____

Signature of Bidder : _____

Designation : _____

Date : _____

Seal of Company

SCHEDULE – C1
11KV INDOOR SWITCHGEAR

Sr. No.	Description	Incomer	Bus coupler	Outgoing	Capacitor	Transformer
1	Switchgear assembly					
1.1	Make					
1.2	Type					
1.3	Reference standard					
1.4	Voltage (normal / Max. KV)					
1.5	Frequency (HZ)					
1.6	Short circuit rating					
1.7	Short time current and duration					
A	Impulse withstand (KV peak)					
B	1min. Power freq. withstand test(KV rms)					
2	Construction					
2.1	Metal clad construction (Yes / No)					
2.2	Degree of Portion					
2.3	Minimum thickness of sheet metal used (mm)					
2.4	Draw out feature provided for					
A	Breaker with service, test & isolated position - Yes /No					
B	Voltage Transformer- Yes / No					
C	Protection relays -Yes /No					
2.5	Breaker cubicle					
A	Cubical door can be closed with breaker in test and isolated position -Yes / No					
B	Working zone units from floor level (mm)					
2.6	All meters, switchgear & relays flush mounted type -Yes /No					
2.7	Minimum clear space required					
A	Front for breaker withdrawal (mm)					

Schedules & Annexure

Schedule C1

B	Rear (mm)					
2.8	Typical vertical section					
A	Overall dimensions					
	i. Length (mm)					
	ii. Breath (mm)					
	iii. Height (mm)					
B	Weight (Kg)					
3	Bus Bar					
3.1	Make					
3.2	Material & grade					
3.3	Reference standard					
3.4	Cross section area (mm ²)					
3.5	Bus connection (joints)					
A	Silver plated -Yes /No					
B	Conventional made with anti oxide grease -Yes /No					
3.6	Rated continuous current amps					
3.7	Maximum temp. rise at rated continuous current DFG C					
3.8	Short time current and duration KA ... secs					
3.9	DC resistance at 85 DEG C ($\Omega/m/\emptyset$)					
3.10	Minimum clearance of bus bar and connection					
A	Phase to phase (mm)					
B	Phase to earth (mm)					
3.11	Bus bar provided with					
A	Insulation sleeve					
B	Phase barriers					
C	Cast resin shrouds for joint					
3.12	Bus bar supported spacing (mm)					
3.13	Bus bar insulators					
A	Make					
B	Type					
C	Reference standard					
D	Voltage class (KV)					
E	Min. creepage distance (mm)					
F	Cantilever strength Kg/mm ²					
G	Net weight (Kg)					

Schedules & Annexure

Schedule C1

4	Circuit Breaker					
4.1	Make					
4.2	Type					
4.3	Reference standard					
4.4	Related Voltage					
4.5	Related frequency					
4.6	Related current and its reference ambient temp					
A	Continuous current to limit the max. temp. rise to 55DEG C for silver plated connections and 40DEG C for conventional connections					
4.7	Related operating duty					
4.8	Symmetrical breaking capacity at rated voltage & operating duty KA rms.					
4.9	Rated making current (Kap)					
4.10	Short time current and duration KA ... secs					
4.11	Insulation level					
A	Impulse voltage withstand on 1/50 full wave					
A	1min. Power freq. withstand test(KV rms)					
4.12	Maximum overvoltage factor while switching off					
A	Un loaded transformer					
B	Loaded transformer					
C	Un loaded CABLES					
D	Capacitor					
E	Motors					
4.13	Opening time max. No load condition (ms)					
4.14	Number of permissible breaker operation under vacuum loss					
4.15	At 100% breaking capacity					
A	Opening time Max. (ms)					
B	Arcing time max (ms)					
C	Total break time (ms)					
4.16						
A	Make time (Max) (ms)					
B	Total closing time (ms)					

Schedules & Annexure

Schedule C1

4.17	Total length of contact travel (mm)					
4.18	No. of breaker operation permission without requiring inspection, replacement of contacts and other main parts.					
A	At 100% rated current					
B	At 100% rated breaking current					
4.19	Types of contents					
4.20	Maximum clearance in air (mm) from live part					
4.21	Between phases					
A	Between live parts and ground					
B	Type of arc control device provided					
4.22	Operating mechanism closing					
4.23	Type					
A	No. of breaker operations stored					
B	Trip free or fixed trip					
C	Anti pumping features provided					
4.24	Operating mechanism tripping					
A	Type					
B	No. of breaker operations stored					
C	Trip free or fixed trip					
D	Anti pumping features provided					
4.25	Spring charging motor					
A	Rating					
B	Make					
C	Voltage and permissible variation(%)					
4.26	Closing coil					
A	Voltage (V)					
B	Permissible voltage variation (%)					
C	Closing current at rated voltage (A)					
D	Power at rated voltage (w)					
4.27	Trapping Coil					

Schedules & Annexure

Schedule C1

A	Voltage (V)					
B	Permissible voltage variation (%)					
C	Tripping current rated voltage (A)					
D	Power at rated voltage (w)					
4.28	Breaker / Accessories Accessories such as control switch indication lamps etc. furnished as specified. (Please attach separate sheet giving details of all Accessories, inter locks and safety shutters)					
A	Mechanical safety interlock					
B	Automatic safety interlock					
C	Operational interlock					
D	Emergency manual trip					
E	Operation counter					
F	Change / discharge indicator					
G	Manual spring charging facility					
H	Auxiliary switch with 6 No + 6 NC for owner's use					
I	Contacts wear indicator					
4.29	Auxiliary Switch					
A	Switch contacts type					
B	Contacts rating at					
	1) Make & Continuous (Amps)					
	2) Break (Inductive) (Amps)					
4.30	Net weighting of the breaker (Kg)					
4.31	Impact load foundation design (to include dead load plus impact value on opening at maximum interrupting rating) (Kg)					
4.32	On vacuum loss (Amps)					
A	Possible load current breaker (Amps)					
B	Possible fault current breaker (Amps)					
4.33	Overall dimensions					

Schedules & Annexure

Schedule C1

A	Length (mm)					
B	Breath (mm)					
C	Height (mm)					
4.34	Type test report omidental breaker furnished					
5	Control & Indications					
5.1	Push Button Make					
A	Type & Catalog No.					
B	Contact rating at 110V/220V.D.C					
C	Make & continuous (Amps)					
5.2	LED lamps: Make:					
A	Type & Catalog No.					
B	Watts /Voltage					
C	Lamps & lens replaceable from front with glass cover					
5.3	Selector switch: Make:					
A	Type & Catalog No.					
B	Contact rating					
C	Make & continuous (Amps)					
D	Break (Inductive)(Amps)					
6	Current Transformer					
6.1	Make					
6.2	Types & Voltage Level					
6.3	Reference standard					
6.4	C.T ratio as specified					
6.5	Short circuit withstand short time current for 1 sec. - KA rms Dynamic current -KA peak					
6.6	Class of insulation					
6.7	Temperature rise					
6.8	Basic insulation level					
6.9	For metering & protection					
A	CT ratio					
B	Class of accuracy					
C	Rated burden VA					
D	Knee point voltage V					
E	Excitation current at $V_K / 4$					
F	Rated saturating current Amp					
6.10	For differential & restricted earth fault protection					

Schedules & Annexure

Schedule C1

A	CT ratio					
B	Class of accuracy					
C	Rated burden VA					
D	Knee point voltage V					
E	Excitation current at $V_K / 4$					
F	Rated saturating current Amp					
6.11	For restricted earth fault protection					
A	CT ratio					
B	Class of accuracy					
C	Rated burden VA					
D	Knee point voltage V					
E	Excitation current at $V_K / 4$					
F	Rated saturating current Amp					
G	Secondary resistance (Ω)					
6.12	For stand by earth fault protection					
A	CT ratio					
B	Class of accuracy					
C	Rated burden VA					
D	Knee point voltage V					
E	Excitation current at $V_K / 4$					
F	Rated saturating current Amp					
G	Over current rating continuous % over load (%)					
6.13	For sensitive by earth fault protection (CBCT)					
A	CT ratio					
B	Class of accuracy					
C	Rated burden VA					
D	Knee point voltage V					
E	Excitation current at $V_K / 4$					
F	Rated saturating current Amp					
G	Over current rating continuous % over load (%)					
7	Potential Transformer					
7.1	Make					
7.2	Types & Voltage Level					
7.3	Reference standard					

Schedules & Annexure

Schedule C1

7.4	Voltage ratio					
7.5	Accuracy					
A	Corer-1					
B	Corer-2					
7.6	Rated burden					
A	Corer-1					
B	Corer-2					
7.7	Over voltage factor					
A	Continuous					
B	30 Seconds					
7.8	Class of insulation					
7.9	Temperature rise over ambient (° C)					
7.10	Basic impulse level (KV peak)					
7.11	Winding connection					
A	Primary					
B	Secondary					
7.12	Fuses					
A	Continuous rating HV / LV (Amp)					
B	Symmetrical fault rating HV /LV KA rms					
C	Make					
7.13	Maximum ratio error at					
A	90% to 100% of rated voltage and 25% to 100% of rated secondary burden at unity power factor					
B	90% to 106% of rated voltage and 10% to 50% of rated secondary burden at 0.2 p.f.					
7.14	Maximum Phase difference at					
A	90% to 106% of rated voltage and 10% to 50% of rated secondary burden at 0.2 p.f.					
B	90% to 106% of rated voltage and 10% to 50% of rated secondary burden at 0.2 p.f.					
7.15	E=Weight (Kg)					
8	Relay					
8.1	Manufacture					
8.2	Model Type					

Schedules & Annexure

Schedule C1

8.3	Draw out type with built in test facilities. Yes/ No					
8.4	Built in test facility Yes /No					
8.5	Type of mounting					
8.6	Reference standard					
8.7	All relays furnished as per drawing and specification					
8.8	All relevant relay leaflets and catalogue furnished					
8.9	Communication port type					
8.10	Auxiliary Supply					
8.11	Measurement and data acquisition feature					
8.12	Control and supervision					
A	IEC protocol					
B	Open protocol feature					
C	Programming facility					
D	Separate output for individual element					
E	Event recording facility number of events					
F	Required software offered					
8.13	C.T.secondary current					
8.14	Self diagnostic feature					
8.15	Modular design					
8.16	Relay details					
8.16.1	Over current					
A	Make					
B	Type					
C	Characteristic available					
D	Range of setting i. Current ii. Time					
E	Range of setting i. Current ii. Time					
F	Rated burden					
8.16.2	Synchronizing check relay					
A	Make					
B	Type					
C	Setting range					
8.16.3	Earth fault					
A	Make					
B	Type					
C	Characteristic available					

Schedules & Annexure

Schedule C1

D	Range of setting i. Current ii. Time					
E	Rated burden					
8.16.4	Over current (Directional)					
A	Make					
B	Type					
C	Characteristic available					
D	Range of setting i. Current ii. Time					
E	Rated burden					
8.16.5	Earth fault (Directional) if applicable					
A	Make					
B	Type					
C	Characteristic available					
D	Range of setting i. Current ii. Time					
E	Rated burden					
8.16.6	Neutral unbalance relay					
A	Make					
B	Type					
C	Characteristic available					
D	Range of setting i. Current ii. Time					
E	Rated burden					
8.16.7	Under voltage relay					
A	Make					
B	Type					
C	Range of setting i. Current ii. Time					
D	Rated burden					
8.16.8	Over voltage relay					
A	Make					
B	Type					
C	Range of setting i. Current ii. Time					
D	Rated burden					
8.16.9	Busbar differential relay					
A	Make					

Schedules & Annexure

Schedule C1

B	Type					
C	High impedance / low impedance					
D	Facility of CT ratio adjustment possible through software. Yes / No					
E	CT supervision facility available. Yes /No					
8.16.10	Transformer differential relay					
A	Make					
B	Type					
C	High impedance / low impedance					
D	Facility of CT ratio adjustment possible through software. Yes / No					
E	Facility of transformer vector group adjustment possible through software. Yes/ No					
F	Setting range					
G	Rated burden					
8.16.11	Restricted earth fault relay					
A	Make					
B	Type					
C	Combined with differential relay. Yes / No					
D	Setting range					
E	Rated burden					
8.16.12	Stand by earth fault relay					
A	Make					
B	Type					
C	Characteristics					
D	Setting range					
E	Rated burden					
9	Meters					
9.1	ammeter					
A	Make					
B	Type					
C	Reference standard					
D	Size					
E	Scale					
F	Accuracy class					
9.2	Voltmeter					
A	Make					

Schedules & Annexure

Schedule C1

B	Type					
C	Reference standard					
D	Size					
E	Scale					
F	Accuracy class					
9.3	Energy Meter					
A	Make					
B	Type					
C	Reference standard					
D	Size					
E	Scale					
F	Accuracy class					
G	Measurement					
H	kWh					
I	kVARh					
J	kVAH					
K	Any Other					
L	Data stored capability					
M	Pulse output facility					
N	Data down loading facility					
10	Secondary Wiring					
10.1	Type of insulation					
10.2	Voltage grade					
10.3	Conductor material					
10.4	Conductor Size (minimum) and insulation wiring					
A	Potential circuit					
B	Control & current circuit					
11	Terminal Block					
11.1	Make					
11.2	Type					
11.3	Catalog No.					
11.4	20% spare terminal furnished					
12	Cable Termination					
12.1	Clearance for power cable termination					
12.2	Removable gland plate					
A	Material for multicore cable					
B	Material for single core cable					
C	Thickness of plate					
13	Name Plate					
13.1	Material					

Schedules & Annexure

Schedule C1

13.2	Thickness					
13.3	Size for					
A	Breaker cubicle					
B	Instrument / devices					
14	Space heater / plug socket					
14.1	Cubicle heater					
A	Thermostat controlled					
B	Wattage					
C	Voltage					
D	Resistance (ohms)					
E	Thermostat range					
14.2	Plug Socket					
A	Type					
B	Rating					
14.3	Cubical heater & plug socket circuit provided with MCB's					
15	A.C. /D.C. Supply					
15.1	Isolated switches for incoming supply					
A	A.C. Type & rating					
B	D.C. Type & rating					
15.2	Isolated switches at each cubicle					
A	A.C. Supply type & rating					
B	D.C. Supply type & rating					
16	Tropical Protection					
16.1	Any Special treatment for tropical protection					
17	Painting					
17.1	Finish of switchgear					
A	Inside					
B	Outside					
18	No. of Accessories furnished					
A	Breaker lifting & handling trolley					
B	Any other					
19	Tests					
19.1	Reference standard					
19.2	Routine test to be performed on switchgear					
19.3	Type test certificates submitted					
20	Drawing / Data					

Schedules & Annexure

Schedule C1

20.1	General arrangement for panel board					
20.2	Foundation Panel					
20.3	Bill of material					
20.4	Cross sectional drawing for every type of switchgear (Add sheets if necessary)					

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Date : _____

Seal of Company

SCHEDULE – C2
66 kV CONTROL & RELAY PANEL

	Parameter	Technical Particulars	
1.00.00	CONTROL PANEL BOARD		
1.01.00	Make		
1.02.00	Type		
1.03.00	Reference Standard		
1.04.00	Construction		
1.04.01	Degree of protection		
1.04.02	Sheet metal thickness mm		
1.04.03	Floor channel sills, vibration damping pads and kick plate furnished?		
1.05.00	Equipment Mounting		
1.05.01	All relays, meters and switches are flush mounted?		
1.05.02	Relays furnished in draw out cases with built in test facilitate?		
1.06.00	Name plate		
1.06.01	Material		
1.06.02	Thickness		
1.06.03	Size for:-		
	Equipment		
	Panels		
1.07.00	Mimic		
1.07.01	Material		
1.07.02	Width		
1.08.00	Internal Illumination		
1.08.01	Volt		
1.08.02	Watt		
1.08.03	Door switched controlled		
1.09.00	Space Heater		
1.09.01	Volt		
1.09.02	Watt		
1.09.03	Thermostat Controlled?		
1.10.00	Plug Socket		
1.10.01	Type		
1.10.02	Rating		
1.11.00	Panel Illumination, space heater & plug socket circuits provided with individual switch fuse units?		
1.12.00	AC/DC Supply - Type & rating of isolating switch fuse units for		
1.12.01	Incoming AC Supply		
1.12.02	Incoming DC Supply		
1.13.00	Internal Wiring		
1.13.01	Wire Type		
1.13.02	Voltage Grade		

Schedules & Annexure

Schedule C2

1.13.03	Conductor Material		
1.13.04	Conductor Size for		
	i) Current / control circuit		
	ii) Voltage Circuit		
1.13.05	Wires identified at both ends with ferrules?		
1.14.00	Terminal block		
1.14.01	Make		
1.14.02	Type / Catalogue No		
1.14.03	20% spare terminals furnished?		
1.15.00	Ground Bus		
1.15.01	Materials		
1.15.02	Size (mm)		
1.16.00	Painting		
1.16.01	Type of finish		
1.16.02	Colour Shade - Inside/Outside		
1.16.03	Details of Painting procedure finished?		
2.00.00	BREAKER CONTROL SWITCH		
2.01.00	Make		
2.02.00	Type		
2.03.00	Reference Standard		
2.04.00	Contact Rating	220V DC	240V AC
2.04.01	Make & Continuous (A)		
2.04.02	Break (inductive) (A)		
3.00.00	ISOLATING CONTROL SWITCH		
3.01.00	Make		
3.02.00	Type		
3.03.00	Reference Standard		
3.04.00	Contact Rating	220V DC	240V AC
3.04.01	Make & Continuous (A)		
3.04.02	Break (inductive) (A)		
4.00.00	METER SELECTOR SWITCH		
4.01.00	Make		
4.02.00	Type		
4.03.00	Reference Standard		
4.04.00	Contact Rating	220V DC	240V AC
4.04.01	Make & Continuous (A)		
4.04.02	Break (inductive) (A)		
5.00.00	PUSH BUTTON		
5.01.00	Make		
5.02.00	Type		
5.03.00	Reference Standard		
5.04.00	Contact Rating		
5.04.01	Make & Continuous (A)		
5.04.02	Break (inductive) (A)		
5.05.00	NO & type of Contacts provided per button		
6.00.00	LAMPS		
6.01.00	Make		
6.02.00	Type		
6.03.00	Reference Standard		
6.04.00	Rating:		

Schedules & Annexure

Schedule C2

6.04.01	Volt		
6.04.02	Watt		
6.04.03	Series Resistance		
6.05.00	10 % Extra lamps furnished?		
6.06.00	Size of lens		
7.00.00	SEMAPHORE INDICATORS		
7.01.00	Make		
7.02.00	Type		
7.03.00	Diameter of the Disc		
7.04.00	Operating voltage		
7.05.00	Burden (Watt DC)		
7.06.00	Whether latch in type or supply Failure type		
8.00.00	INDICATING INSTRUMENT	Ammeter	Voltmeter
8.01.00	Make		
8.02.00	Type		
8.03.00	Reference Standard		
8.04.00	Type of Movement		
8.05.00	Accuracy Class		
8.06.00	Scale in Degrees		
8.07.00	VA Burden		
9.00.00	MULTIFUNCTION METER		
9.01.00	Make		
9.02.00	Type		
9.03.00	Reference Standard		
9.04.00	Furnished in Draw out Case or not		
9.05.00	Type of Register		
9.06.00	Accuracy Class		
9.07.00	VA Burden		
9.07.01	Current Coil		
9.07.02	Voltage Coil		
10.00.00	ANNUNCIATOR		
10.01.00	Make		
10.02.00	Type		
10.03.00	Reference Standard		
10.04.00	No. of Annunciator groups furnished?		
10.05.00	No. of Windows per group		
10.06.00	Overall Dimension of a group (mm)		
10.07.00	Detailed Write-up on Scheme furnished?		
11.00.00	TRANSDUCERS		
11.01.00	Whether provided as per specification		
11.02.00	Make		
11.03.00	Type		
11.04.00	Output		
11.05.00	Accuracy		
11.06.00	Response Time		
11.07.00	Power Supply		
11.08.00	Isolation		
11.09.00	Catalogue furnished		

Schedules & Annexure

Schedule C2

12.00.00	RELAYS	Make	Type
12.01.00	Relays furnished in draw out cases with built in test facilities?		
12.02.00	Line Protection Panel		
12.03.00	Transformer Panel		
12.04.00	Bus coupler Panel		
12.05.00	Miscellaneous Auxiliary Relays		
12.06.00	Auxiliary Relay, Voltage Operated with 4 pair of contacts		
	8 pair of contacts		
12.07.00	Auxiliary Relay, Current Operated with 4 pair of contacts		
12.08.00	Catalogue of all relays submitted with bid		

Bidders Name : _____
 Signature : _____
 Name : _____
 Designation : _____
 Date : _____

Seal of Company

**SCHEDULE – C3
BATTERY CHARGER**

Sr. No.	Description	Data to be filled by manufacturer
1	Manufacturer equipment type	
2	Conformance to design standards as per specification Yes / No	
3	Conformance to design features as per specification Yes / No	
4	Submitted to deviation sheet for each specification clause no - Yes / No	
5	Panel dimension in mm (length x depth x height)	
6	Panel weight in kg	
7	Panel enclosure protection offered	
8	Voltage regulation as per specification (value to be specified)	
9	Boost charging DC current adjustment range (Value to be specified)	
10	Amount of Ripple in DC in % - output with battery - without battery	
11	Charger efficiency offered	
12	Max temperature rise above ambient	
13	Power factor at rated load	
14	Rectifier bridge as per specification	
15	Heat generated by the panel in Kw	
16	AC MCCB - Make , rating	
17	DC MCCB - Make , rating	
18	Rectifier transformer - Make , rating	
19	Semiconductor rectifier - Make , rating	
20	DC conductor - Make , rating	
21.1	DCDB integral part of charger or separate?	
21.2	MCB for DC distribution boards - Make, rating	
22	Conformance to metering & indication as per specification	
23	Conformance to make of component as per specification	
24	Conformance to mimic diagram, labels & finish as per specification	
25	Submission of component catalogue - Yes / No	
26	DC charger nominal output current - (battery trickle charge + DC load)	
27	DC charger boost charge current	

Schedules & Annexure

Schedule C3

28	DC battery	
29	DC battery duty cycle	

Seal of Company

Bidders Name : _____
Signature : _____
Name : _____
Designation : _____
Date : _____

SCHEDULE – C4

Li Ion BATTERY

S.NO.	Description	BRPL Requirement	Data to be filled by Manufacturer
1	Battery (as per scope of supply) – Yes / No	Yes	
2	Manufacturing battery type	Li-Ion	
3	Conformance to design standards as per specification clause no. 2.0 – Yes / No	Yes	
4	Conformance to design feature as per specification clause no. 5&6 – Yes / No	Yes	
5	Submitted of deviation sheet for each specification clause no - Yes / No	Furnish each deviation if yes	
6	Battery GA drawing submitted - Yes / No	Required	
6.1	Battery selection / sizing calculation submitted – Yes / No	Required	
7	Battery rating offered in Ahr	Refer specs	
7.1	Rating at temperature 45 deg C	Refer specs	
8	Battery bank dimensions in mm (length x depth x height)	As required	
9	Battery Module weight in kg	As required	
10	Battery nominal voltage	220V for 220VDC	
11	Total battery bank CC-CV charging required in volts	As per clause no 6.1	
12	Heat generated by battery at rated full load (in Kw)	Less than 0.025kW/module	
13	Manufacturer of Li-Ion Battery Cells and Modules	Yes	
14	Manufacturer of Battery management system (BMS)	Yes	
15	Availability of Service team in India	Yes	
16	Built In Battery Management System	Yes	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company

Date : _____

Annexure – C05
Guaranteed Tech. Particulars for 66KV Outdoor Disconnecting Switch

Sr. No.	Description	Data By Purchaser	Data by Supplier
1	Name of manufacturer		
2	Type	Motor operated, central rotating double break with turn & twist mechanism.	
3	Model		
4	No. of units.		
5	Installation	Outdoor horizontal	
6	System Particulars		
i)	Highest System Voltage	72.5 kV	
ii)	Rated frequency	50 Hz \pm 5%	
iii)	System Neutral	Solidly Earthed	
7	Rated Insulation Data		
7.1	1.2/50 μ s lightning impulse withstand voltage (Positive and negative polarity)		
i)	To earth	325 kV	
ii)	Across the isolating distance	375 kV	
7.2	Rated One minute power frequency withstand voltage		
i)	To earth	140 kV	
ii)	Across the isolating distance	160 kV	
8	Main Switch Current Capacity		
i)	Rated normal current	800 A / 1250 A	
ii)	Rated Short time withstand Current	31.5 kA for 3 Sec.	
iii)	Rated peak withstand current	2.5 times of short time withstand current	
iv)	Maximum magnetizing current (Make/ break capacity)	6 - 8 Amps.	
9	Earthing switch current capacity		
i)	Rated Short time withstand Current	31.5 kA for 3 Sec.	
ii)	Rated peak withstand current	2.5 times of short time withstand current	
iii)	Making capacity for discharging line charge		
10	Minimum clearances		
i)	In air between live parts and earth	630 mm	
ii)	In air between Phase to phase	630 mm	
iii)	Minimum ground clearance	4000 mm	

Sr. No.	Description	Data By Purchaser	Data by Supplier
11	Phase spacing	2000 mm (Project Specific)	
12	No. of breaks per circuit pole	Two for double break	
13	Nos. of insulators pedestal	Three stacks per phase of heavy duty post type insulators	
14	Main Switch Contacts		
i)	Type of Contact	High pressure relieving copper contacts (rotating blade features of twist mechanism). The moving arm enters the fixed female contact assembly developing high pressure.	
ii)	Material for rotating blade	Electrolytic tinned copper	
iii)	Material of contact	Silver plated electrolytic copper.	
15	Earth Switch Contacts		
i)	Type of Contact of Earth switch	High pressure banging type	
ii)	Material for earth switch blade	Electrolytic tinned copper	
iii)	Material of earth switch contact	Silver plated electrolytic copper.	
16	Thickness of Silver Coating	15 - 25 microns.	
17	Maximum current density	1.5 A /sq mm	
18	Type of bearing for rotating insulator stocks		
19	Number of auxiliary contacts		
i)	Isolator operating mechanism	10 NO + 10 NC	
ii)	Earthing Device	4 No + 4 NC	
20	Temperature rise	As per IS 9921	
21	Control supply voltage	220 V / 110 V / 50 V DC	
22	AC Aux. Supply (4 wire)	415 V \pm 10%	
23	Inter Locking arrangement	Electrical and mechanical	

Sr. No.	Description	Data By Purchaser	Data by Supplier
24	Terminal connectors	Suitable for twin ACSR Zebra conductor	
25	Minimum creepage distance of insulator		
26	Type of control for		
i)	Disconnection switch	Motorised with Manual Facility	
ii)	Earthing switch	Manual	
27	Locking arrangement		
28	Rated mechanical terminal loads in addition to wind load acting on the equipment and short-circuit forces		
29	Total operating time of disconnection switch including that of its operating mechanism		
30	Weight of Isolators		
31	Post insulators		
i)	Make & type		
ii)	Height		
iii)	Voltage level		
iv)	Cantilever Strength		
v)	Torsional Strength		
vi)	Creepage Distance	Min 31mm/KV	
vii)	Basic insulation level (1 min. power frequency flashover voltage)		
	a) Dry	140 KV rms	
	b) Wet	140 KV rms	
viii)	Visible corona discharge voltage		
ix)	1.2/50 micro second impulse flashover voltage	325 KVp	
x)	Insulation class	A	
32	Drive Motor		
i)	Make		
ii)	KW Rating / rpm		
iii)	Rated current		
iv)	Frame size		
v)	Rated Voltage	415 V AC	
vi)	Degree of Protection	IP-55	
vii)	Insulation Class	B/F	
viii)	Duty		

Annexure – C05
Guaranteed Tech. Particulars for 33KV Outdoor Disconnecting Switch

Sr. No.	Description	Data By Purchaser	Data by Supplier
1	Name of manufacturer		
2	Type	Motor operated, central rotating double break with turn & twist mechanism.	
3	Model		
4	No. of units.		
5	Installation	Outdoor Vertical	
6	System Particulars		
i)	Highest System Voltage	36 kV	
ii)	Rated frequency	50 Hz \pm 5%	
iii)	System Neutral	Solidly Earthed	
7	Rated Insulation Data		
7.1	1.2/50 μ s lightning impulse withstand voltage (Positive and negative polarity)		
i)	To earth	145 kV	
ii)	Across the isolating distance	165 kV	
7.2	Rated One minute power frequency withstand voltage		
i)	To earth	70 kV	
ii)	Across the isolating distance	80 kV	
8	Main Switch Current Capacity		
i)	Rated normal current	1250 A	
ii)	Rated Short time withstand Current	26.3 kA for 3 Sec.	
iii)	Rated peak withstand current	2.5 times of short time withstand current	
iv)	Maximum magnetizing current (Make/ break capacity)	6 - 8 Amps.	
9	Earthing switch current capacity		
i)	Rated Short time withstand Current	26.3 kA for 3 Sec.	
ii)	Rated peak withstand current	2.5 times of short time withstand current	
iii)	Making capacity for discharging line charge		
10	Minimum clearance		
i)	In air between live part and earth	320 mm	
ii)	In air between Phase to phase	320 mm	
iii)	Minimum ground clearance	3700 mm	

Sr. No.	Description	Data By Purchaser	Data by Supplier
11	Phase spacing	1500 mm (Project Specific)	
12	No. of breaks per circuit pole	Two for double break	
13	Nos. of insulators pedestal	Three stacks / phase of heavy duty post type insulators	
14	Main Switch Contacts		
i)	Type of Contact	High pressure relieving copper contacts (rotating blade features of twist mechanism). The moving arm enters the fixed female contact assembly developing high pressure.	
ii)	Material for rotating blade	Electrolytic tinned copper	
iii)	Material of contact	Silver plated electrolytic copper.	
15	Earth Switch Contacts		
i)	Type of Contact of Earth switch	High pressure banging type	
ii)	Material for earth switch blade	Electrolytic tinned copper	
iii)	Material of earth switch contact	Silver plated electrolytic copper.	
16	Thickness of Silver Coating	15 - 25 microns.	
17	Maximum current density	1.5 A /sq mm	
18	Type of bearing for rotating insulator stocks		
19	Number of auxiliary contacts		
i)	Isolator operating mechanism	10 NO + 10 NC	
ii)	Earthing Device	4 No + 4 NC	
20	Temperature rise	As per IS 9921	
21	Control supply voltage	220 V / 110 V / 50 V DC	
22	AC Aux. Supply (4 wire)	415 V \pm 10%	
23	Inter Locking arrangement	Electrical and mechanical	

Sr. No.	Description	Data By Purchaser	Data by Supplier
24	Terminal connectors	Suitable for twin ACSR Zebra conductor	
25	Minimum creepage distance of insulator		
26	Type of control for		
i)	Disconnection switch	Motorised with Manual Facility	
ii)	Earthing switch	Manual	
27	Locking arrangement		
28	Rated mechanical terminal loads in addition to wind load acting on the equipment and short-circuit forces		
29	Total operating time of disconnection switch including that of its operating mechanism		
30	Weight of Isolators		
31	Post insulators		
i)	Make & type		
ii)	Height		
iii)	Voltage level		
iv)	Cantilever Strength		
v)	Torsional Strength		
vi)	Creepage Distance	Min 31mm/KV	
vii)	Basic insulation level (1 min. power frequency flashover voltage)		
	a) Dry	70 KV rms	
	b) Wet	70 KV rms	
viii)	Visible corona discharge voltage		
ix)	1.2/50 micro second impulse flashover voltage	145 KVp	
x)	Insulation class	A	
32	Drive Motor		
i)	Make		
ii)	KW Rating / rpm		
iii)	Rated current		
iv)	Frame size		
v)	Rated Voltage	415 V AC	
vi)	Degree of Protection	IP-55	
vii)	Insulation Class	B/F	
viii)	Duty		

Annexure – 05

Recommended spares (Data by supplier)

List of recommended spares shall be submitted as follows –

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

SCHEDULE – C6
11KV AUTO-SWITCHED CAPACITOR BANK

S.No.	Description	
1	Manufacturer equipment type/make	
2	Conformance to design standards as per specification Yes/No	
	- Capacitor Unit	
	- Series Reactor	
	- LA	
	- Isolator	
	- NCT	
3	Conformance to capacitor design requirements as per specification clause no.3.0 to 7.0 - Yes/No	
4	Submission of deviation sheet for each specification clause no. -Yes/No	
5	APP type capacitors offered?	
6	Capacitor bank arrangement / scheme conforming to specification?	
7	Capacitor bank (3 phase system)	
7.1	Capacitor bank (Rated capacitance at 50Hz)	
7.2	Capacitor bank rated voltage – 12Kv	
7.3	Capacitor bank KVAR at 11kV	
7.4	Capacitor bank KVAR at 12kV	
7.5	Capacitor bank line current at rated voltage, continuous operation	
7.6	Designed short circuit withstand capacity for 3sec	
7.7.1	Capacitor bank insulation level at 50Hz	

Schedules & Annexure

Schedule C6

7.7.2	Capacitor bank impulse voltage withstand	
7.8	One spare single phase capacitor unit offered?	
8	Capacitor single phase unit	
8.1	Capacitor single unit capacitance at 50Hz	
8.2	Capacitor single unit rated operating voltage	
8.3	Capacitor KVAR (at rated voltage)	
8.4	Capacitor single unit continuous operating rated current	
8.5	Designed short circuit withstand capacity of single capacitor unit for 3sec	
8.6	Capacitor unit temperature category (required +5/ C)	
9	Single capacitor unit construction	
9.1	Enclosure sheet metal CRCA	
9.2	Enclosure sheet metal thickness in mm	
9.3	Hermetic sealing method (pressure welding/gas welding/sealant/ if any other pl. specify)	
9.4	Dimensions of a single capacitor unit	
	Height	
	Length	
	Width	
9.5	Weight of a single capacitor unit	
9.6	Single capacitor unit bushings	
	Type of insulator	
	Creepage distance	
	Clearance between two terminals	
9.7	No. of series group/unit	
9.8	No. of parallel elements/ series group	
9.9	No. of APP layers -double/triple	

Schedules & Annexure

Schedule C6

9.10	Thickness of APP film	
9.11	Width of APP film	
9.12	Thickness of Al foil	
9.13	Width of Al foil	
9.14	Active width of Al foil	
9.15	Maximum voltage stress per APP layer	
9.16	Element connection method	
9.17	Discharge device	
10	Capacitor bank maximum permissible over voltage	
11	Capacitor power loss at rated voltage	
12	Capacitor tan delta (Tangent of power loss angle) at maximum operating conditions	
13	Guaranteed temperature rise of capacitor above ambient temperature	
14.1	Type of discharge device – internal resistor	
14.2	Discharge device material	
14.3	Value of discharge device	
14.4	Discharge time required to attain residual voltage equal to 50 volts	
15	Capacitor bank overall dimensions	
	Height x Length x Width	
16	Capacitor bank total weight	
17	Capacitor bank clearances	
	i)Phase to Phase	
	ii)Phase to neutral	
	iii)Phase to earth	
18	Tinned copper Bus bar cross-section in sq. mm	

Schedules & Annexure

Schedule C6

19	Tinned copper Bus bar continuous rating	
20	Bus bar short time withstand capacity in kA for 3sec	
21	Flexible tinned copper connector rating	
22.1	Bus bar support insulator make & type	
22.2	Bus bar support insulator voltage class	
23	Bus bar provided with insulating sleeve and phase barriers?	
24	Neutral Current transformer	
24.1	Neutral current transformer make	
24.2	Neutral current transformer outdoor type	
24.3	Cast resin type NCT offered?	
24.4	Neutral current transformer ratio	
24.5	Neutral current transformer accuracy class (0.5 & 5P10min)	
24.6	Neutral current transformer rating(10 & 15VA)	
24.7	Neutral current transformer terminal box ingress protection (IP55min)	
24.8	Residual Voltage Transformer	
25	Series Reactor	
25.1	Series reactor make	
25.2	Continuous current rating of series reactor	
25.3	Series reactor kVAr rating per phase per star	
25.4	Series reactor rated voltage	
25.5	Type –dry air cooled	
25.6	Short time withstand current capacity for 3sec (min 16 times capacitor rated current at 130% rated voltage)	
25.7	Series reactor single phase unit connected between single phase capacitor units and neutral star pint	

Schedules & Annexure

Schedule C6

25.8	Series reactor power frequency withstand voltage 28Kv MIN	
25.9	Series reactor lightning impulse withstand voltage 75kv min	
26	Lightning Arrestor	
26.1	Name of manufacturer	
26.2	Type – Gapless ZnO	
26.3	Rated voltage	
26.4	Nominal Discharge Current	
26.5	Class - III	
26.6	Insulation withstand voltage	
26.7	Crrepage distance	
27	Vacuum Contactor / switch for Auto Switching	
27.1	Rated Voltages	
27.2	Rated Continuous Current	
27.3	Rated Capacitor Switching Current	
27.4	Frequency	
27.5	Control supply	
27.6	Type	
27.8	Installation	
27.9	Mechanical Endurance	
27.10	Electrical Endurance	
27.11	Mechanical Indicator	
27.12	Trip lever	
27.13	Closing lever	
28	Isolator	

Schedules & Annexure

Schedule C6

28.1	Name of manufacturer	
28.2	Isolator ratings	
28.3	Type of operation	
28.4	Type	
28.5	Operating mechanism	
28.6	Voltage rating	
28.7	Rated current	
28.8	No.of poles	
28.9	Rated short time current	
28.10	Type of mounting	
28.11	Construction	
28.12	Earth switch provided	
28.13	Auxiliary contacts provided	
28.14	Electrical interlocks	
28.15	Mechanical interlocks	
28.16	Creepage distance	
28.17	Insulation level - Power frequency withstand Voltage - Impulse withstand voltage	
28.18		
	Terminal arrangement a) Incoming suitable for b) Outgoing suitable for	
28.19	Overload capacity	
28.20	Control voltage	
29	Name plate and labels as per specification?	

Schedules & Annexure

Schedule C6

30	Painting of capacitor and mesh enclosure	
30.1	Shade RAL 7032	
30.2	Material – Pure polyester grade A	
30.3	Minimum thickness (80 microns)	
31	Power cable terminal suitable for 3CX300Sqmm XLPE HT	
32	Space provided for future capacity	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Date : _____

Seal of Company

SCHEDULE – C7
LT POWER CABLES

For each size / rating separate GTP need to be furnished.			
S.No.	Description	Buyer's requirement	Seller's Data
1	Make	.....
2	Type (AS PER IS)	A2XFY (Multicore)	
3	Voltage Grade (KV)	1.1	
4	Maximum conductor temperature		
A	Continuous (° C)	90 °C	
B	Short time (° C)	250 °C	
5	Conductor		
A	Size (mm ²)	4CX300,4CX50, 4CX25, 4CX10 & 2CX10 Sqmm	
B	No. of wire in each conductors Nos.	As per Manufacturer standard	
C	Dia of wires in each conductors before compaction (mm)	As per Manufacturer standard	
D	Shape of conductor	As per specification	
E	Diameter over conductor (mm)	.....
F	Maximum conductor resistance at 20 ⁰ C (ohm / km)	As per table 2 of IS -7098 Part -1	
6	Insulation		
A	Nominal thickness (mm)	As per table 3 of IS -7098 Part -1	
B	Minimum thickness (mm)	.....
C	Diameter over insulation (mm) Approx	.....
7	Inner Sheath		
A	Minimum thickness	As per table 5 of IS -7098 Part -1	
B	Approx dia over sheath (mm) Approx	.....
8	Galvanized steel Armour	As per table 6 of IS -7098 Part -1	
A	Number of strips	As per manufacturer Std.	
B	Size (Thickness X width) in mm	0.8 x 4	
C	Dia of wire for 2CX10sqmm	1.4mm Min	
D	Dia over Armour -Approx	.....
9	Outer Sheath	As per table 8 of IS -7098 Part -1	
A	Thickness (Minimum)		
B	Colour	Yellow	
C	Weather proof paint (applicable for 2c x 10 sqmm and 4c x 10 sqmm only)	.....
10	Approx. overall dia (mm)	.....
11	End Cap	Required	
12	Continuous current rating for standard I.S. condition laid Direct		

Volume-II Schedules & Annexure

Schedule C7

	a. In ground 30 °C Amps	.....
	a. In duct 30 °C Amps	.....
	a. In air 40 °C Amps	.....
13	Short circuit current for 1 sec of conductor (KAmp)	.....
14	Electrical Parameters at Maximum operating temperature		
A	Resistance (Ohm / Km) (AC Resistance)	.....
B	Resistance AT 50 C/s (Ohm / Km)	.....
C	Impedance (Ohm / Km)	.....
D	Capacitance (Micro farad /Km)	.....
15	Recommended minimum bending radius	..... X O/D	
16	De-rating factor for following Ambient Temperature in	Ground /Air	
	a. At 30 °C		
	a. At 35 °C		
	a. At 40 °C		
	a. At 45 °C		
	a. At 50 °C		
17	Group factor for following Nos. of cables laid	Touching Trefoil	
A	3 Nos.		
B	4 Nos.		
C	5 Nos.		
D	6 Nos.		
18	Process of cross linking of polyethylene	Dry cure	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company

Date : _____

**SCHEDULE – C8
CONTROL CABLES**

Sr.	Description	Buyer's requirement	Seller's Data
	Purchase Req. No.	....
	Guarantee Period: 5 Years	60/66 Months	
1.0	Make	....
2.0	Type (AS PER IS 1554 part -1)	YWY	
3.0	Voltage Grade (KV)	1.1	
4.0	Maximum Conductor temperature		
A	Continuous (° C)	70°C	
B	Short time (° C)	160°C	
5.0	Conductor		
A	Size (mm ²)	2.5 / 4 sq mm	
B	No. of wires in each conductor Nos.	As per Manufacturer standard	
C	Dia. of wires in each conductor before compaction (mm)	As per Manufacturer standard	
D	Shape of Conductor	As per Cl.2.1.1 of specification	
E	Diameter over conductor mm	....
F	Maximum Conductor resistance at 20 ° C (Ohm/Km)	As per Table 2 of IS 8130	
6.0	Insulation	As per Table 1 of IS:5831 – 1984	
A	Nominal thickness (mm)	As per Cl.2.1.2 of specification & Table 2 of IS 1554(Part-1)	
B	Minimum thickness (mm)		
C	Core Identification	Color of all the cores shall be different	
D	Diameter over Insulation (mm) Approx.	....

Volume-II Schedules & Annexure

Schedule C8

7.0	Inner Sheath	As per Table 2 of IS:5831 – 1984	
A	Minimum thickness (mm)	As per Table 4 of IS 1554(Part-1)	
B	Approx. dia. Over sheath (mm)- Apprx.	....
8.0	Galvanized Steel Armour	As per Cl 2.1.5 of specification	
A	Number of armour wire	As per Manufacturer Std.	
B	nominal Dia of Round Wire	As per Table 5 of IS 1554(Part-1)	
C	Dia. over Armour – Approx.	....
D	Lay Ratio	....
E	Confirm minimum 90% coverage (submit calculation)		
9.0	Outer Sheath (FRLS)	As per Table 2 of IS:5831 – 1984	
A	Thickness (Minimum)	As per Table 7 of IS 1554(Part-1)	
B	Color	Black	
10.0	Approx. overall dia. (mm)	....
11.0	Drum Length & tolerance	As per Spec.Cl. 6.0.0	
12.0	End Cap	Required	
13.0	Drums provide with MS Spindle plate & Nut bolts arrangement	Required	
14.0	Net Weight of cable (Kg/Km.) – Approx.	....

Volume-II Schedules & Annexure

Schedule C8

15. 0	Continuous current rating for standard I.S. condition laid Direct		
	a) In ground 30° C Amps	....
	b) In duct 30° C Amps	....
	c) In Air 40° C Amps	....
16. 0	Short circuit current for 1 sec of conductor. (Kamp)	....
17. 0	Electrical Parameters at Maximum Operating temperature:		
A	Resistance (Ohm/Km) (AC Resistance)	....
B	Reactance at 50 C/s (Ohm/Km )	....
C	Impedance (Ohm/Km )	....
D	Capacitance (Micro farad / KM)	....
18. 0	Recommended minimum bending radius	.... x O/D	
19. 0	FRLS Properties		
	i) Oxygen Index		
	ii) Temperature Index		
	iii) Max Acid Gas Generation		
	iv) Light Transmission / Smoke Density		

Bidders Name : _____

Volume-II Schedules & Annexure

Schedule C8

	Signature	:	_____
	Name	:	_____
	Designation	:	_____
Seal of Company	Date	:	_____

**SCHEDULE – C9
ILLUMINATION SYSTEM**

1	General			
+1.01	Make			
*1.02	Applicable Standards			
*1.03	Degree of protection			
2	Lighting Panel /Feeder Pillarm Box (LP/ELP/DLP/FPB/EPB/LDB/ELDB/ Construction Features)			
2.01	Make			
2.02	Rated Value (V)			
*2.03	Busbar continuous current rating (A)			
*2.04	Busbar material and cross section	1	2	3
3	Minimum current breakers :			
+3.01	Service			
3.02	Make			
+3.03	Type			
*3.04	No. of poles			
*3.05	Rated continuous current (A)			
*3.06	Short time current rating (Ka)			
*3.07	Related Voltage (V)			
*3.08	Breaking Current (Ka)			
4	Load Breaking Switches			
4.01	Service			
+4.02	Make			
+4.03	Type			
*4.04	No. of poles			
*4.05	Related Voltage (V)			
*4.06	Rated continuous current (A)			
*4.07	Rated making current (Ka peak)			
*4.08	Rated breaking current (Ka)			
*4.09	Rated short time one (1) second current (Ka)			
*4.10	Rated dynamic current (kApeak)			
5	Fuses			
5.01	Service			
+5.02	Make			
*5.03	Type			
*5.04	Standard applicable			
*5.05	Related Voltage (V)			
*5.06	Rated current (A)			
*5.07	Fusing factor			

Volume-II Schedules & Annexure

Schedule C9

*5.08	Category of duty			
*5.09	Rupturing capacity (prospective current) (Ka)			
6	Earth Leakage current Breaker			
+6.01	Make			
+6.02	Type			
*6.03	No. of poles			
*6.04	Rated continuous current (A)			
6.05	Short time current rating (Ka)			
6.06	Rated Tripping current			
7	Lighting Fixtures	Type A	B	C
+7.01	Manufacturer			
+7.02	Type			
7.03	Description of different types			
*7.04	Type and wattage of lamp			
*7.05	Rated life of the lamp			
*7.06	Applicable standards			
	Note:- In case luminaries other than the ones specified in specification are offered, all the deviations shall be listed out otherwise these shall be considered as being fully in line with luminaries specified.			
8	Receptacles with Switches	1	2	3
+8.01	Make			
+8.02	Type			
+8.03	Related Voltage (V)			
*8.04	Rated current (A)			
8.05	Technical brochures (Attach brochures and state brochure Nos.)			
9	Cables / Wire	1	2	3
9.01	Service			
+9.02	Make			
+9.03	Type			
*9.04	Voltage Grade (V)			
*9.05	Conductor Material			
*9.06	Size of conductors (mm ²)			
*9.07	Current rating of conductors (A)			
9.08	Applicable Standards			
10	Conduits and Accessories			
10.01	Make			
10.02	Type			
10.03	Material			
10.04	Applicable Standards			
11	Lamp and Luminaries	Incandescent Lamps	Fluorescent Tubes	HPSV Lamps
11.01	Make			

Volume-II Schedules & Annexure

Schedule C9

11.02	Type			
*11.03	Lumen output throughout life (Lumen)			
*11.04	Derating factor due to temperature			
*11.05	Derating factor due to aging			
12	Lighting Poles / Towers			
12.01	Manufacturer			
12.02	Applicable Standards			
12.03	Material and Painting			
12.04	Height			

Notes :

1. Single asterisk (*) marked particulars are guaranteed.
2. Other particulars are bonafide and may vary slightly upon completion of detailed design.
3. Particulars against items marked * and + shall be furnished with the Bid.

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company

Date : _____

SCHEDULE – C10
AC DISTRIBUTION BOARDS

S.No	Description	Buyers Requirement	Sellers Data
1	Panel Construction		
1.1	Enclosure Type	Free standing, indoor, Fully compartmentalized, Metal clad, Vermin Proof	
1.2	Enclosure degree of protection	IP 5X	
1.3	Enclosure Material	CRCA steel	
1.4	Load bearing members	Minimum 2.5 mm thick	
1.5	Doors and covers	Minimum 2.0 mm thick	
1.6	Gland Plate (detachable type)	3.0mm MS detachable type or Aluminum 5.0mm for single core cables	
1.7	Separate compartment for	Bus bar, circuit breaker, incoming cable, outgoing cable PT, LV instruments.	
1.8	Breaker compartment door	Separate with lockable handle	
1.9	Fixing arrangement i. Doors ii. Covers iii. Gasket	Concealed hinged Bolted with SS bolts Neoprene	
1.10	Panel Base Frame	Steel base frame as per manufacturer's standard.	
1.11	Handle	Removable bolted covers for cable chamber and busbar chamber shall be provided with "C" type handles	
1.12	Space Heater	Required	
1.13	Panel extension possibility	Required	
2	MCCB		
2.1	Mounting	Flush Mounted	
2.2	Rated Operational Voltage(V)	415 volt	
2.3	Ultimate breaking Capacity		
2.3.1	630A MCCB	As per requirement	
2.3.2	100A MCCB	As per requirement	
2.4	Rated Service breaking capacity at rated voltage Ics	Ics =100% Icu	
2.5	Rotary handle	Required	
2.6	Interlocking arrangement	Between Incomer MCCBs	
2.7	Trip time	As per requirement	
2.8	Test Certificates	Should have test certificates for breaking capacities from independent test authorities	

Volume-II Schedules & Annexure

Schedule C10

		CPRI / ERDA or equivalent	
3	MCB		
3.1	Rated Operational Voltage(V)	415 VAC 50 Hz	
3.2	Protection relay/Release	Magnetic thermal release for over current and short circuit protection	
3.3	Breaking capacity	Shall not be less than 10 KA at 415 VAC	
3.4	Mounting	Din mounted	
3.5	MCB classification	As required	
3.6	ISI Marked	The complete range shall be ISI marked	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company

Date : _____

Schedules & Annexure

Schedule C11

SCHEDULE – C11
STATION AUXILIARY TRANSFORMER

Sr.	Particulars	Specified / Required	Offered
1.0	General		
1.1	Make		
1.2	Type	Oil immersed, core type, step down located generally outdoor but may be located indoor also with poor ventilation. Bidder shall confirm full rating available in indoor location also	
2.0	Nominal Continuous Rating, KVA		
2.1	HV winding	400kVA	
2.2	LV winding	400kVA	
3.0	Rated voltage (kV)		
3.1	HV Winding	11 kv	
3.2	LV Winding	433 volt	
4.0	Rated current (Amps)		
4.1	HV Winding		
4.2	LV Winding		
5.0	Connections		
5.1	HV Winding	Delta	
5.2	LV Winding	Star with neutral	
5.3	Vector Group reference	Dyn11	
6.0	Impedance at principal tap rated current and frequency, ohm @75 deg C		
6.1	Impedance	5.0 % with IS tolerance	

Schedules & Annexure

Schedule C11

6.2	Reactance		
6.3	Resistance		
6.4	Impedance at lowest tap at rated current and frequency		
6.5	Impedance at highest tap at rated current and frequency		
7.0	Resistance of the winding at 75 ^o C in ohm		
7.1	a) HV		
7.2	b) LV		
8.0	Zero sequence impedance in ohm		
8.1	a) HV		
8.2	b) LV		
9.0	Guaranteed maximum losses at principal tap full load and 75°C without any positive tolerance, kW		
9.1	No load losses (max.)	0.7	
9.2	Load losses (max.)	5.1	
9.4	Total I ² R losses of windings @ 75 deg C, KW		
9.5	Total stray losses @ 75 deg C, KW		
9.6	Total losses (max.), KW	5.8	
9.7	No load loss at maximum permissible voltage and frequency (approx.),kW		
10.0	Temperature rise over reference ambient of 50 °C		
10.1	Top oil by thermometer ° C	40 °C	
10.2	Winding by resistance ° C	45 °C	

Schedules & Annexure

Schedule C11

11.0	Efficiency		
11.1	Efficiency at 75 ⁰ C and unity power factor %		
11.1.1	at 110% load		
11.1.2	at 100% load		
11.1.3	at 80% load		
11.1.4	at 60% load		
11.1.5	at 40% load		
11.1.6	at 20% load		
11.2	Efficiency at 75 ⁰ C and 0.8 power factor lag %		
11.2.1	at 110% load		
11.2.2	at 100% load		
11.2.3	at 80% load		
11.2.4	at 60% load		
11.2.5	at 40% load		
11.2.6	at 20% load		
11.3	Maximum efficiency at 75 ⁰ C %		
11.4	Load and power factor at which it occurs		
12.0	Regulation , (%)		
12.1	Regulation at full load at 75 ⁰ C		
12.1.1	at unity power factor		
12.1.2	at 0.8 power factor lagging		
12.2	Regulation at 110% load at 75 ⁰ C		
12.2.1	at unity power factor		
12.2.2	at 0.8 power factor lagging		
13.0	Tappings		

Schedules & Annexure

Schedule C11

13.1	Type	Off Circuit taps on HV winding	
13.2	Capacity	Full capacity	
13.3	Range-steps x % variation	+5% to -5% @ 2.5%	
13.4	Taps provided on HV winding (Yes / No)	Yes.	
13.5	Rated current of rotary switch	60 A	
14.0	Cooling system	-	
14.1	Type of cooling	ONAN	
14.2	No. of cooling unit Groups		
14.3	Capacity of cooling units		
14.4	Mounting of radiators		
14.5	Number of Radiators		
14.8	Total radiating surface , sqmm		
14.9	Thickness of radiator tubes, mm	Minimum 1.2 mm	
15.0	Details of Tank		
15.1	Material	Robust mild steel plate without pitting and low carbon content	
15.2	Thickness of sides mm		
15.3	Thickness of bottom mm		
15.4	Thickness of cover mm		
15.5	Confirmation of Tank designed and tested for Vacuum, Pressure (Ref: CBIP Manual) , (Yes/ No)		
15.5.1	Vacuum mm of Hg. / (kN/m ²)	As per CBIP	
15.5.2	Pressure mm of Hg.	Twice the normal head of oil / normal pressure + 35kN/m ² whichever is lower, As per CBIP	
15.6	Is the tank lid sloped?	Yes	
15.7	Inspection cover provided (Yes / No)	as per clause 4.2.1.5	
15.8	Location of inspection cover (Yes / No)		
15.9	Min. dimensions of inspection cover (

Schedules & Annexure

Schedule C11

	provide list of all inspection cover with dimension), mm x mm		
16.0	Core		
16.1	Type:	Core	
16.2	Core material grade	Premium grade minimum M4	
16.3	Core lamination thickness in mm	0.27 Max	
16.4	Insulation of lamination	With insulation coating on both sides	
16.5	Design flux density at rated condition at principal tap, Tesla		
16.6	Maximum flux density at 10 % overexcitation /overfluxing, Tesla	1.9 Tesla	
16.7	Equivalent cross section area mm ²		
16.8	Guaranteed No Load current at 100% rated voltage , Amps		
16.8.1	HV		
16.8.2	LV		
16.9	Guaranteed No Load current At 110% rated voltage, Amps		
16.9.1	HV		
16.9.2	LV		
17.0	Type of Winding		
17.1	HV		
17.2	LV		
17.3	Conductor material	Electrolytic Copper	
17.4	Current density (HV/LV)	Maximum allowed 3.0 A per sqmm. At any tap	
17.5	Gauge/area of cross section of conductor		
17.5.1	a) HV		
17.5.1	b) LV		

Schedules & Annexure

Schedule C11

17.6	Insulating material		
17.6.1	HV Turn		
17.6.2	LV Turn		
17.6.3	LV Core	-	
17.6.4	HV - LV	-	
17.7	Insulating material thickness, mm		
17.7.1	HV Turn		
17.7.2	LV Turn	-	
17.7.3	LV to Core		
17.7.4	HV to LV		
		-	
18.0	Minimum design clearance, mm		
18.1	HV to earth in Air		
18.2	HV to earth in oil		
18.3	LV to earth in Air		
18.4	LV to earth in oil		
18.5	Between HV & LV in Air		
18.6	Between HV & LV in oil		
18.7	Top winding and yoke		
18.8	Bottom winding and yoke		
19.0	Insulating oil		
19.1	Quantity of oil Ltrs		
19.1.1	In the Transformer tank		
19.1.2	In each radiator		
19.1.4	Total quantity		
19.2	10% excess oil furnished?	Yes	
19.3	Type of Oil	As per BSES Spec Annex -C	
20.0	Bushing / Support Insulator		
20.1	Make	-	
20.2	Type		

Schedules & Annexure

Schedule C11

20.2.1	HV side	As per Cl. 3.2.7.1 of the spec	
20.2.2	LV side	As per Cl. 3.2.7.2 of the spec	
20.3	Reference Standard		
20.4	Voltage class, kV		
20.4.1	HV side Bushing/ Support Insulator	12 kV	
20.4.2	LV side line and neutral bushing/ Support Insulator	1.1 kV	
20.5	Creepage factor for all bushing / Support Insulator mm/KV	31 mm / kV	
20.6	Rated thermal short time current		
20.6.1	HV bushing	25 times rated current for 2 secs.	
20.6.2	LV line and neutral bushing	25 times rated current for 2 secs.	
20.7	Weight, Kg		
20.7.1	HV bushing		
20.7.2	LV line and neutral bushing		
20.8	Free space required for bushing removal, mm		
20.8.1	HV bushing		
20.8.2	LV line and neutral bushing		
21.0	Terminal connections		
21.1	HV	Cable size as per annexure A 22.0	
21.2	LV	Cable size as per annexure A 23.0	
21.3	LV Neutral	Cable size as per annexure A 23.0	
22.0	H.V. Cable box	Required	
22.1	Suitable for cable type , size	As per annexure A cl. 22.0	
22.2	Termination height, mm	750 mm, minimum	
22.3	Gland Plate dimension, mm x mm		
22.4	Gland Plate material	Aluminium	
22.5	Gland Plate Thickness, mm	5 mm minimum	
22.5	Phase to phase clearance inside box, mm	180 mm	
22.6	Phase to earth inside box, mm	120 mm	

Schedules & Annexure

Schedule C11

22.7	HV Cable Box Protection Class	IP 55	
23.0	L.V Cable termination arrangement	With cable box	
23.1	Suitable for cable type , size	Cable size as per annexure A cl. 23.0	
23.2	Termination height, mm	1000 mm, minimum	
23.3	Gland Plate dimension, mm x mm		
23.4	Gland Plate material	Aluminium	
23.5	Gland Plate Thickness, mm	5 mm minimum	
23.5	Phase to clearance inside box, mm	25 mm minimum	
23.6	Phase to earth inside box, mm	25 mm minimum	
23.7	LV Cable Box Protection Class	IP 55	
24.0	L.V neutral Cable termination arrangement	Separate cable box not required	
25.0	Current Transformer on LV phases		
25.1	Type		
25.2	Make		
25.3	Reference Standard		
25.4	CT Ratio	As per annexure C cl 21.0	
25.5	Burden, VA	As per Cl. 3.2.9.5 of the spec.	
25.6	Class of Accuracy	As per Cl. 3.2.9.4 of the spec.	
25.7	CT terminal box size	As per Cl. 3.2.9.8.1 of the spec.	
26.0	Pressure release device		
26.1	Minimum pressure the device is set to rupture		
26.1.1	For Main Tank		
27.0	Fittings Accessories Each Transformer furnished as per Clause No 5. (Bidder shall attach separate sheet giving details, make and bill of materials)		

Schedules & Annexure

Schedule C11

28.0	Painting: as per clause for the transformer, cable boxes, radiator, Marshalling box (Yes/No)		
29.0	Over all transformer dimensions		
29.1	Length, mm	1700	
29.2	Breadth, mm	1500	
29.3	Height, mm	1700	
30.0	Transformer Tank Dimensions		
30.1	Length, mm		
30.2	Breadth, mm		
30.3	Height, mm		
31.0	Weight data		
31.1	Core, kG		
31.2	Frame parts, kG		
31.3	Core and frame, kG		
31.4	Total Winding, kG		
31.5	Core , Frame, Winding, kG		
31.6	Tank, kG		
31.7	Tank lid, kG		
31.8	Empty conservator tank, kG		
31.9	Each radiator empty, kG		
31.10	Total weight of all radiators empty, kG		
31.11	Weight of oil in Tank, kG		
31.12	Weight of oil in Conservator, kG		
41.13	Weight of oil in each Radiators, kG		
31.14	Total weight of oil in Radiators, kG		
31.16	Total Transport weight of the transformer, kG		
32.0	Volume Data		

Schedules & Annexure

Schedule C11

32.1	Volume of oil in main tank, litres		
32.2	Volume of oil between highest and lowest levels of main conservator, litres		
32.4	Volume of oil in each radiator, litres		
32.5	Total volume of oil in radiators, litres		
32.7	Transformer total oil volume, litres		
33.0	Shipping Data		
33.1	Weight of heaviest package, kG		
33.2	Dimensions of the largest package (L x B x H) mm		
34.3	Tests		
34.1	All in process tests confirmed as per Cl. (Yes/ No)		
34.2	All Type Tests confirmed as per Cl. (Yes / No)		
34.3	All Routine Tests confirmed as per Cl. (Yes/ No)		
34.4	All Special Tests confirmed as per Cl. (Yes/ No)		

Bidders Name : _____
 Signature : _____
 Name : _____
 Designation : _____
 Date : _____

Seal of Company

**SCHEDULE – C12
 GROUNDING & LIGHTNING PROTECTION SYSTEM**

S.No.	Description	Unit	Data by vendor
1	Earth mat		
a	Material		
b	Size of conductor		
c	Fault withstand current & duration		
2	Equipment Earthing		
a	Material		
b	Size of conductor		
3	Earth Electrode		
a	Material		
b	Size		
c	Length		
4	Lightning Protection System		
a	Material and size of horizontal air termination		
b	Material and size of vertical air termination		
c	Material and size of down conductor		
d	Size of test link		
e	Material of enclosure for test link		
f	Material and size of earth electrode		

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company

Date : _____

SCHEDULE – C13
CABLE ACCESSORIES

1	Cable Accessories	
1.01	Makes	
1.02	Termination kits	
1.03	Straight through joint kits	
1.04	Cable glands	
1.05	Cable lugs	
1.06	Termination blocks	
1.07	Types	
1.08	Termination kits	
1.09	Straight through joints	
1.1	Cable glands	
1.11	Cable lugs	
1.12	Terminal blocks	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company

Date : _____

SCHEDULE – C14

**CABLE TRAYS, ACCESSORIES AND TRAY SUPPORT, CONDUITS, PIPES
 AND DUCTS**

1	General	
a	Name of the Contractor	
b	Name of sub contractors, if any	
c	Applicable standards	
2	Cable Trays and Fittings	
a	Cable Trays and Fittings	
i.	Make	
ii.	Type	
iii.	Material	
	1. Thickness (mm)	
	2. Thickness of galvanization (microns)	
	3. Zinc coating per sq meter (gms)	
3	Conduits , Fitting and Accessories	
a	Pipes with fitting	
i.	Make	
ii.	Type	
iii.	Material	
	1. Thickness (mm)	
	2. Thickness of galvanization (microns)	
b	Flexible conduits with fittings and accessories	
i.	Make	
ii.	Type	
iii.	Material	
	1. Thickness (mm)	
	2. Thickness of galvanization (microns)	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company

Date : _____

Annexure - C15 Guaranteed Technical Particulars (66kV Circuit Breaker)

Sr. No.	Description	Data By Purchaser	Data By Supplier
1.0	Name of manufacturer		
2.0	Manufacturer's type and designation		
3.0	Governing standard	As per Clause 1.0.0 Of the specification	
4.0	Type of circuit breaker	SF6	
5.0	Installation	Outdoor	
6.0	No. of phase & no. of pole	3 (Three), 3 (Three)	
7.0	Rated voltage (kV)	66 kV	
8.0	Highest system voltage (kV)	72.5 kV	
9.0	System Neutral	Solidly earthed	
10.0	Rated insulation level	325kVp	
11.0	Frequency (Hz)	50Hz	
12.0	Class		
13.0	Normal current rating (amps)		
13.1	Under standard conditions	2000A	
13.2	Under site conditions overload rating c) 1 Hour d) 3 Hour		
13.3	Derating factor, if any, for site condition		
13.4	Temperature rise at 150% rating for 3 Hours		
14.0	Short time current rating (kA) (a) For 1 Second (b) For 3 Second	31.5kA	

Sr. No.	Description	Data By Purchaser	Data By Supplier
15.0	Maximum temperature rise over highest ambient (refer annexure-B) due to rated current in main contacts, measured after breaking test.	40 deg C	
16.0	Rated short circuit breaking current		
16.1	Rated short circuit current (Ac component)		
16.2	Percentage DC component at KV		
16.3	Asymmetrical breaking Current (including DC Component)		
16.4	Making capacity (KA peak) – at KV		
17.0	Rated operating sequence	O-0.3Sec.-CO-3Min.-CO	
18.0	Total break time (Milli-seconds) :		
18.1	For interruption of 10% of the rated capacity	60ms (max)	
18.2	For interruption of 30% of the rated capacity	60ms (max)	
18.3	For interruption of 60% of the rated capacity	60ms (max)	
18.4	For interruption of the full rated capacity	60ms (max)	
19.0	Arcing time (Milli-seconds)		
20.0	Opening time (Milli-seconds)		
21.0	Break time (Milli-seconds)		

Sr. No.	Description	Data By Purchaser	Data By Supplier
22.0	Closing time (Milli-seconds)	60ms (max)	
23.0	Minimum re-closing time at rated interrupted capacity from the instant of the trip coil energisation (Milli-seconds)		
24.0	Minimum dead time for		
24.1	3 phase re-closing (Milli-seconds)		
24.2	Limit of adjustment of dead time for 3- phase re-closing.		
25.0	Data on re-striking voltage for 100%, 50% or 30% rated capacity	100% 50% 30%	
25.1	Phase factor		
25.2	Amplitude factor		
25.3	Natural frequency (Hz)		
25.4	Rate of rise of re-striking voltage (V/micro sec.)		
26.0	Rated out-of phase breaking current		
27.0	Rated line charging breaking current		
28.0	Maximum line charging current : breaking capacity and corresponding over-voltage recorded in test: c) On supply side d) On line side		

Sr. No.	Description	Data By Purchaser	Data By Supplier
29.0	Maximum cable charging current breaking capacity and corresponding over-voltage recorded in test: a) On supply side. b) On line side		
30.0	Rated single capacitor bank :		
30.1	Capacity in rush current handling, capability		
30.2	Capacitive breaking current Capability.		
31.0	Rated small inductive breaking current and the corresponding over voltage		
32.0	First pole to clear factor	1.5	
33.0	Rated transient recovery voltage for terminal faults		
34.0	Rated characters for short line faults is rate of rise.		
30.0	Rated short circuit breaking current		
35.0	Dry 1-minute power frequency test withstand voltage, for complete circuit breaker		
35.1	Between line terminal and grounded parts (KV rms)	140kV (rms)	
35.2	Between terminals with breaker contact open (KV rms)	140kV (rms)	

Sr. No.	Description	Data By Purchaser	Data By Supplier
36.0	Wet 1-minute power frequency test withstand voltage :		
36.1	Between line terminal and grounded parts (KV rms)	140kV (rms)	
36.2	Between terminals with breakers contacts open (KV rms)	140kV (rms)	
36.3	Between poles		
37.0	1.2/50 microsecond wave impulse with stand test voltage for complete circuit breaker:		
37.1	Between line terminal and ground (KV peak)	325kVp	
37.2	Between terminal with circuit breaker contacts open.	325kVp	
37.3	Between Poles		
38.0	Minimum Clearance in air.		
38.1	Between phases (mm).	630mm (min)	
38.2	Live parts and earth (mm).	630mm (min)	
38.3	Live parts to ground level (mm).	4000mm (min)	
39.0	Number of operation possible without maintenance.		

Sr. No.	Description	Data By Purchaser	Data By Supplier
39.1	At full rated interrupting capacity		
35.2	At 150% of rated current.		
39.3	At 100% of rated current		
39.4	At 50% of rated current.		
40.0	Supporting Insulator		
40.1	Make and type.		
40.2	Insulation class	A	
40.3	Weight.		
40.4	Transport dimensions.		
40.5	Visible corona discharge voltage		
40.6	Dry-1 minute power frequency flashover voltage.	140kV rms	
40.7	Wet-1-minute power frequency lashover voltage.	140kV rms	
40.8	1.2/50 microsecond impulse flashover voltage.	325kVp	
40.9	Creepage distance to ground (mm) c) Total d) Protected	31mm/kV	

Sr. No.	Description	Data By Purchaser	Data By Supplier
41.0	No. of breaks per pole	1 (one)	
42.0	Total length or breaks per phase (mm)		
43.0	Type of main contacts		
44.0	Material of main contacts	Silver plated copper	
45.0	Whether main contacts silver plated (Yes/No.) Thickness of silver coating on main contacts (mm).	15 +/- 5 microns (min)	
46.0	Contact pressure on arcing contacts (kg/m ²).		
47.0	Type of arcing contacts		
48.0	Contact pressure on main contact (kg/m ²).		
49.0	Type of auxiliary switches.		
50.0	Whether all contacts silver plated (Yes/No)		
51.0	No. of auxiliary switch contacts operating with all three poles of breaker		
51.1	Which are closed when breaker is closed.		
51.2	Which are open when breaker is closed		
51.3	Those adjustable with respect to the position of main contacts		

Sr. No.	Description	Data By Purchaser	Data By Supplier
52.0	No. of spare auxiliary switch contacts operation with all three poles of breaker:		
52.1	Which are closed when breaker is closed	6 (six)	
52.2	Which are open when breaker is closed	6 (six)	
52.3	Those adjustable with respect to the position of main contacts		
53.0	Total number of terminal block		
54.0	Number of spare terminal Block:	20%	
55.0	Mounting flange details: (a)Opening. (b)Closing.		
56.0	Tripping and closing circuit voltage (V).	50V/110V/220V DC	
57.0	Power required for trip coil		
58.0	Power required for closing coil.		
59.0	Rated voltage for spring charging motor	240V AC	
60.0	Rated voltage of space heater and socket	240V AC	
61.0	Contingencies for which alarm provided		
62.0	Design data for supporting structure.		

Sr. No.	Description	Data By Purchaser	Data By Supplier
63.0	Weight of supporting steel structure for breaker.		
64.0	Descriptive leaflets enclosed (Yes/No)		
65.0	For SF6 gas circuit breaker		
65.1	Rated pressure of SF-6 Gas in the gas cylinder (kg./sq cm.).		
65.2	Quantity of SF-6 gas required per single pole unit (kg.)		
65.3	Quantity of SF-6 gas required cylinder (kg.)		
65.4	Weight of empty cylinder (kg).		
65.5	Quantity of absorbent required per pole (kg).		
65.6	Recommended interval for renewal of absorbent in case of outdoor circuit breakers operating in tropical conditions.		
65.7	Chemical composition of the absorbent		
65.8	Quantity of absorbent covered in the scope of supply. (including spare qty.) (kg).		
65.9	Limit of gas pressure for proper operation of circuit breaker.		

Sr. No.	Description	Data By Purchaser	Data By Supplier
65.10	Pressure and temperature at which the temperature compensated gas pressure switch will: a) Give alarm. b) Cut off.		
65.11	Name of SF-6 supplier and country of origin.		
65.12	Quantity of SF-6 gas supplied for: a) Actual use in breaker (kg). b) As spare (kg).		
65.13	Chemical composition of gas: a) Qty. of air by weight (ppm). b) Qty. of H ₂ O by weight (ppm). c) Qty. of CF ₄ by weight (ppm).		
66.0	Operating Mechanism		
66.1	Type of operating mechanism offered		
66.2	Manufacturer's type designation		
66.3	Material of control cabinet enclosure		
66.4	Thickness of sheet metal enclosure	3.0mm for bottom and 2.5mm elsewhere.	
66.5	Painting & colour shade	Polyurethane paint, 692 of IS-5	

Sr. No.	Description	Data By Purchaser	Data By Supplier
66.6	Enclosure protection	IP 55	
66.7	Pad locking facility provided (Yes/No)		
66.8	Wring a) Control wire size b) Insulation c) Colour	1.5 Sqmm 650V Grey for control, Black for AC and Green for earth	
66.9	Normal power consumption at rated voltage (Watt)		
66.10	Normal power of spring charging motor		
66.11	Number of close/open operation possible after failure of AC supply to motor		
66.12	Time required to charge the closing spring		
66.13	Whether indication of spring charged condition provided in central control cabinet (Yes/No)		
66.14	Dimension of the control cabinets.		
66.15	Weight of control cabinet		

Sr. No.	Description	Data By Purchaser	Data By Supplier
67.0	Details of safety interlock provided		
68.0	Whether supporting structure for circuit breaker provided (Yes/No)		
68.1	Thickness of galvanizing (mm)		
68.2	Size of foundation bolts		
69.0	Material of nuts & bolts	Stainless steel	
70.0	Weight of 3-phase breaker complete with operating mechanism, insulating support frame work, etc.		
71.0	Impact loading for foundation design to include load plus impact value on opening at maximum interrupting ratings in terms of equivalent of static load.		
72.0	Weight of heaviest package		

Annexure - C15 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			

**SCHEDULE – C16
POWER TRANSFORMER**

Sr.No.	Particular	Specified / Required	Offered
1.0	General		
1.1	Make		
1.2	Type	As per Annexure C of specification	
2.0	Nominal continuous rating, KVA		
2.1	HV winding	As per Annexure C of specification	
2.2	LV winding	As per Annexure C of specification	
2.3	Type of Cooling	ONAN/ONAF	
2.4	Rating available at different cooling	ONAN - 80% ONAF-100%	
3.0	Rated voltage (KV)		
3.1	HV winding	As per Annexure C of specification	
3.2	LV winding	As per Annexure C of specification	
4.0	Rated current (Amps)		
4.1	HV winding		
4.2	LV winding		
5.0	Connections		
5.1	HV winding	As per Annexure C of specification	
5.2	LV winding	As per Annexure C of specification	
5.3	Vector group reference	As per Annexure C of specification	
6.0	Impedance at principal tap rated current and frequency at 75 °C with 100 % Rating (%))		
6.1	Impedance (%))	As per Annexure C of specification	
6.2	Reactance (%))		
6.3	Resistance (%))		
6.4	Impedance at lowest tap rated current and frequency at 75 °C with 100 % Rating (%))		
6.5	Impedance at highest tap rated current and frequency at 75 °C with 100 % Rating (%))		
7.0	Resistance of the winding at 75°C at principal tap (ohm)		
7.1	a) HV		

Schedules & Annexure

Schedule C16

7.2	b)LV		
8.0	Zero sequence impedance (ohm)		
8.1	a) HV		
8.2	b) LV		
9.0	Guaranteed maximum losses at principal tap at full load and 75 ^o C without any positive tolerance kW		
9.1	No load losses (max.)	As per Annexure C of specification	
9.2	Load losses (max.)	As per Annexure C of specification	
9.3	Cooler fan losses (max.)		
9.4	Total I ² R losses of winding @ 75 deg C		
9.5	Total stray losses @ 75 deg C		
9.6	Total Load losses (max.)		
9.7	No load loss at maximum permissible voltage and frequency (approx.) kW		
10.0	Temperature rise over reference design ambient of 40 ^o C		
10.1	Top oil by thermometer ^o C	40 ^o C	
10.2	Winding by thermometer ^o C	45 ^o C	
10.3	Winding gradient at rated current ^o C		
10.3.1	HV		
10.3.2	LV		
11.0	Efficiency		
11.1	Efficiency at 75 ^o C and unity power factor %		
11.1.1	At 110% load		
11.1.2	At 100% load		
11.1.3	At 80% load		
11.1.4	At 60% load		
11.1.5	At 40% load		
11.1.6	At 20% load		
11.2	Efficiency at 75 ^o C and 0.8 power factor lag %		
11.2.1	At 110% load		
11.2.2	At 100% load		
11.2.3	At 80% load		
11.2.4	At 60% load		
11.2.5	At 40% load		
11.2.6	At 20% load		
11.3	Maximum efficiency %		
11.4	Load and power factor at which Max efficiency occurs		
12.0	Regulation (%)		
12.1	Regulation at full load at 75 ^o C		
12.1.1	At unity power factor		
12.1.2	At 0.8 power factor lagging		
12.2	Regulation at 110% load at 75 ^o C		
12.2.1	At unity power factor		
12.2.2	At 0.8 power factor lagging		

Schedules & Annexure

Schedule C16

13.0	Tapping		
13.1	Type		
13.2	Capacity		
13.3	Range-steps x % variation	As per Annexure C of specification	
13.4	Taps provided on HV winding (Yes/No)		
14.0	OLTC gear		
14.1	Make		
14.2	Type		
14.3	Reference std		
14.4	No of compartment		
14.5	Mounting arrangement	Side mounted	
14.6	Rated current Amp		
14.7	Rated step capacity, kVA		
14.8	Short circuit withstand for 2 secs, kA		
14.9	Time required for one step change sec.		
14.10	Rated voltage for motor, V AC		
14.11	Rating of motor		
14.12	Rated voltage for auxiliaries V		
14.13	Consumption of auxiliaries		
14.14	OLTC features as per specification, Yes/No		
14.15	Does the overload rating of OLTC match with that of the transformer under all conditions Yes/No		
15.0	Transformer Monitoring relay – REGDA		
15.1	Make		
15.2	Reference standard		
15.3	Overall dimensions, mm		
16.0	Cooling system		
16.1	Type of cooling	As per Annexure C of specification	
16.2	No. of cooling unit groups		
16.3	Capacity of cooling units		
16.4	Mounting of radiators		
16.5	Number of radiators and Size		
16.6	Type & size of radiator header main valve		
16.7	Type & size of individual radiator valve		
16.8	Total radiating surface, sq mm		
16.9	Thickness of radiator tubes, mm	Minimum 1.2 mm	
16.10	Schematic flow diagram of the cooling system furnished (Yes/No)		
16.11	Type and make of Fan motor		
16.12	No. of fan motor per bank (Working + Standby)		
16.13	Rated Power Input (kW)		
16.14	Rated Voltage, Speed of Motor		
16.15	Efficiency of motor at Full load(%)		
16.16	Locked Rotor current(Amps)		
17.0	Details of tank		

Schedules & Annexure

Schedule C16

17.1	Material	Robust mild steel plate without pitting and low carbon content	
17.2	Thickness of sides mm		
17.3	Thickness of bottom mm		
17.4	Thickness of cover mm		
17.5	Confirmation of tank designed and tested for vacuum pressure (Ref: CBIP manual) (Yes/No)		
17.5.1	Vacuum mm of Hg. / (kN/m ²)	As per CBIP	
17.5.2	Pressure mm of Hg	Twice the normal head of oil / normal pressure + 35 kN/m ² whichever is lower , As per CBIP	
17.6	Is the tank lid slopped?	Yes	
17.7	Inspection cover provided (Yes/No)	As per clause No 3.2.1.5	
17.8	Location of inspection cover (Yes/No)	As per clause No 3.2.1.5	
17.9	Min. dimensions of inspection cover (provide list of all inspection cover with dimension), mm x mm		
18.0	Core		
18.1	Type:	Core	
18.2	Core material grade	Premium grade minimum M4 or better	
18.3	Thickness of lamination mm	Max. 0.27 mm with insulating coating on both sides	
18.4	Insulation between core lamination		
18.5	Design flux density of the core at rated condition at principal tap, Tesla		
18.6	Maximum flux density allowed in the core at extreme over excitation / over fluxing , Tesla		
18.7	Equivalent cross section area of core, mm ²		
18.8	Guaranteed No load current at 90% / 100% / 110% rated voltage & frequency (Amp)		
18.8.1	HV		
18.8.2	LV		
19.0	Type of winding		
19.1	HV		
19.2	LV		
19.3	Conductor material	Electrolytic copper as per relevant standard	
19.4	Maximum current density allowed, Amp per mm ²	3.0 A/ mm ²	
19.5	Gauge/area of cross section of conductor, mm ²		
19.5.1	HV		
19.5.2	LV		

Schedules & Annexure

Schedule C16

19.6	Maximum current density achieved in winding (LV/HV/HVT) – Amps/mm ²		
19.7	Insulating material		
19.7.1	HV turn		
19.7.2	LV turn		
19.7.3	LV- core		
19.7.4	HV-LV		
19.8	Insulating material thickness, mm		
19.8.1	HV turn		
19.8.2	LV turn	-	
19.8.3	LV to core		
19.8.4	HV to LV		
20.0	Minimum design clearance , mm		
20.1	HV to earth in air		
20.2	HV to earth in oil		
20.3	LV to earth in air		
20.4	LV to earth in oil	-	
20.5	Between HV & LV in Air		
20.6	Between HV & LV in oil		
20.7	Top winding and yoke	-	
20.8	Bottom winding and yoke		
21.0	Insulating oil		
21.1	Quantity of oil Ltrs	-	
21.1.1	In the transformer tank		
21.1.2	In each radiator		
21.1.3	In OLTC chamber		
21.1.4	Total quantity		
21.2	10% excess oil furnished?	Yes	
21.3	Type of oil	New insulating oil as per IS: 335, and Cl. 4.2.7 of the specification	
21.4	Oil preservation system provided (Yes/No)	As per Annexure C of specification	
22.0	Bushing		
22.1	Make		
22.2	Type		
22.3	Reference standard		
22.4	Voltage class, kV		
22.4.1	HV side bushing		
22.4.2	LV side line and neutral bushing		
22.5	Creepage factor for all bushing mm / kV	As per Annexure C of specification	
22.6	Rated current , Amp		
22.6.1	HV bushing		
22.6.2	LV line and neutral bushing		
22.7	Rated thermal short current		
22.7.1	HV bushing	As per Annexure C of specification	
22.7.2	LV line and neutral bushing	As per Annexure C of	

Schedules & Annexure

Schedule C16

		specification	
22.8	Weight Kg		
22.8.1	HV bushing		
22.8.2	LV line and neutral bushing		
22.9	Free space required for bushing removal, mm		
22.9.1	HV bushing		
22.9.2	LV line and neutral bushing		
23.0	Terminal connections		
23.1	HV	As per Annexure C of specification	
23.2	LV	As per Annexure C of specification	
23.3	LV Neutral	As per Annexure C of specification	
24.0	H.V. Cable box/Terminals		
24.1	Suitable for cable/conductor type size	As per Annexure C of specification	
24.2	Termination height , mm	1000 mm , minimum	
24.3	Gland plate dimension mm x mm		
24.4	Gland plate material	Aluminum	
24.5	Gland plate thickness , mm	5 mm minimum	
24.5	Phase to clearance inside box / terminals , mm		
24.6	Phase to earth inside box / terminals , mm		
25.0	L.V line side cable box		
25.1	Suitable for cable type , size	As per Annexure C of specification	
25.2	Termination height , mm	1000 mm , minimum	
25.3	Gland plate dimension mm x mm		
25.4	Gland plate material	Aluminum	
25.5	Gland plate thickness , mm	5 mm minimum	
25.6	Phase to clearance inside box / terminals , mm		
25.7	Phase to earth inside box , mm		
26.0	LV Neutral cable box		
26.1	Suitable for cable type , size	As per Annexure C of specification	
26.2	Termination height , mm		
26.3	Gland plate dimension mm x mm		
26.4	Gland plate material	Aluminum	
26.5	Gland plate thickness , mm	5 mm minimum	
26.6	Phase to clearance inside box , mm		
26.7	Phase to earth inside box , mm		
27.0	Marshalling box cubical provided as per clause no. of spec. (Yes / no)		
27.1	Mounting of marshalling box	Project specific to be filled up (Separate / tank mounted)	

Schedules & Annexure

Schedule C16

28.0	Neutral Current Transformer (NCT)		
28.1	Type		
28.2	Make		
28.3	Reference standard		
28.4	CT Ratios		
28.5	Burden ,VA		
28.6	Class of Accuracy	PS	5P20
28.7	KPV , volts , minimum		
28.8	Resistance, ohm @ 75 deg C, maximum		
28.9	Magnetizing current @ $V_k/4$, mA , maximum		
28.10	Short time withstand current	26.3 kA for 3 sec.	
29.0	Winding current transformer (WCT)		
29.1	Type		
29.2	Make		
29.3	Reference standard		
29.4	CT ratio		
29.5	Burden ,VA	Manufacturer Std.	
29.6	Class of accuracy	Manufacturer Std.	
30.0	Pressure release device		
30.1	Minimum pressure the device is set to rupture		
30.1.1	For main tank		
30.1.2	For OLTC		
31.0	Alarm and trip contact ratings of protective devices		
31.1	Rated/making/ breaking currents , Amp @ voltage for		
31.1.1	PRV for main tank		
31.1.2	PRV for OLTC		
31.1.3	Buchholz relay		
31.1.4	Oil surge relay for OLTC		
31.1.5	Sudden pressure relay		
31.1.6	OTI		
31.1.7	WTI		
31.1.8	Magnetic oil gauge		
32.0	Fittings accessories each transformer furnished as per clause No. (Bidder shall attach separate sheet giving details, make and bill of materials)		
33.0	Painting: as per clause for the transformer , cable boxes, radiator, marshalling box, RTCC etc (Yes/No)		
34.0	Over all transformer dimensions		
34.1	Length , mm	6.5 meters maximum allowed	
34.2	Breadth , mm	5.0 meters maximum allowed	
34.3	Height , mm	5.0 meters maximum	

Schedules & Annexure

Schedule C16

		allowed	
35.0	Transformer tank dimensions		
35.1	Length , mm		
35.2	Breadth , mm		
35.3	Height , mm		
36.0	Marshalling box dimensions		
36.1	Length , mm		
36.2	Breadth , mm		
36.3	Height , mm		
37.0	Weight data		
37.1	Core, kG		
37.2	Frame parts, kG		
37.3	Core and frame, kG		
37.4	Total winding, kG		
37.5	Core and frame winding, kG		
37.6	Tank, kG		
37.7	Tank lid, kG		
37.8	Empty conservator tank , kG		
37.9	Each radiator empty , kG		
37.10	Total weight of all radiator empty , kG		
37.11	Weight of oil in tank , kG		
37.12	Weight of oil in each conservator , kG		
37.13	Weight of oil in each radiators , kG		
37.14	Total weight of oil in radiator , kG		
37.15	OLTC gear including oil , kG		
37.16	Total transport weight of the transformer , kG		
37.17	Total transport weight of the transformer with OLTC and all accessories		
38.0	Volume data		
38.1	Volume of oil in main tank , liters		
38.2	Volume of oil between highest and lowest levels of main conservator ,liters		
38.3	Volume of oil between highest and lowest levels of OLTC conservator, liters		
38.4	Volume of oil in each radiator , liters		
38.5	Total volume of oil in radiators , liters		
38.6	Volume of oil in OLTC , liters		
38.7	Transformer total oil volume , liters		
39.0	Shipping data		
39.1	Weight of heaviest package, kG		
39.2	Dimensions of the largest package (L x B x H) mm		
40.0	Tests		
40.1	All in process tests confirmed as per Cl. (Yes /No)		
40.2	All types tests confirmed as per Cl. (Yes /No)		
40.3	All in routine tests confirmed as per Cl.		

Schedules & Annexure

Schedule C16

	(Yes /No)		
40.4	All in special tests confirmed as per Cl. (Yes /No)		

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company

Date : _____

SCHEDULE – C17

66 KV OUT DOOR LIGHTNING ARRESTER

Sr. No.	Description	Data By Purchaser	Data by Supplier
1	Name of manufacturer		
2	Type	Gapless, ZnO type, single pole, heavy duty, station class, pedestal mounted	
3	Model		
4	No. of units.		
5	Installation	Outdoor	
6	Application	Protection of Transformers, circuit breakers, lines and other outdoor S/S equipment.	
7	LA connection to system	Phase to earth	
8	Type of Conductor	ACSR Zebra / Goat	
9	Construction	Single Phase	
10	Rated voltage of arrester (KVrms)	60 KV	
11	Nominal discharge current (Amps) (8x20 micro sec. wave) peak value	10KA	
12	System Particulars		
i)	Highest System Voltage	72.5 KV	
ii)	Frequency	50HZ \pm 5%	
iii)	System neutral	Solidly earthed	
iv)	Max. value of temporary over voltage & its max. duration		
	- Insulation level of equipment to be protected	325 KVp	
	- System short circuit level	31.5KA for 3 seconds.	
13	Maximum continuous operating voltage (MCOV)	52KV	
14	Impulse withstand current	100KAp	
15	Long Duration discharge class	3	
16	Minimum single impulse energy capability		
17	Maximum residual voltage at switching impulse current of 1KAp (30/60 micro sec. wave)	136 KVp	

Schedules & Annexure

Schedule C17

Sr. No.	Description	Data By Purchaser	Data by Supplier
18	Max. residual voltage (1x20 micro sec. wave)		
i)	At 05 KAp		
ii)	At 10 KAp		
iii)	At 20 KAp		
19	Minimum creepage distance	31 mm/KV	
20	Pressure relief class	40KA	
21	Reference current (mA)		
22	Leakage current at COV (mA)		
	Resistive		
	Capactive		
23	Dry and wet power frequency withstand voltage of arrester insulation (KVrms)		
24	Virtual steepness for front of wave for above (KV/micro sec.)		
25	Ratio of system voltage withstand level to protection level of surge arrester		
26	High current impulse withstand 4/10 micro second peak value (KV)		
27	Long duration current Impulse		
i)	Current peak		
ii)	Virtual duration.		
28	Temporary Over Voltage Capacity (KVp)		
i)	At 0.1 Sec.		
ii)	At 1.0 Sec.		
iii)	At 10.0 Sec.		
iv)	At 100.0 Sec.		
29	Weight of complete unit (Kg)		
30	Height of complete unit from base to the line side (mm)		
31	Minimum recommended spacing between arresters Centro to Centro (mm)		
32	Clearance required from ground equipment at various heights of arresters unit (mm)		

Schedules & Annexure

Schedule C17

Sr. No.	Description	Data By Purchaser	Data by Supplier
33	Earthing arrangement provided for earthing side of arresters.		
34	Mounting flanges dimensional details.		
35	Type and range of milli-ampere meter.		
36	Type and specifications of the surge connectors.		
37	Surge counter min. current for recording a lightning stroke	200 Amp	
38	Surge counter max. disch. Current withstand	100KA peak for 4/10 wave shape.	
39	Range of continuous leakage current at rated voltage with variation due to change in temperature & frequency		
40	Size and length of flexible Cu cable for connection between LA & surge counter		
41	Voltage time curve for thermal stability of LA after a stroke	To be provided	
42	Paint shade of surge counter housing	Polyurethane, 692 of IS-5	

Bidders Name : _____
 Signature : _____
 Name : _____
 Designation : _____
 Date : _____

Seal of Company

Schedule C18

HIGH MAST

Sl. No.	Particulars	Data by purchaser			Data by seller
1	Name and address of manufacturer				
2	Overall height of high mast	12 mtrs	16 mtrs	20 mtrs	
2.1	Make				
2.2	Material of construction of shaft	Grade S355 J O as per BSEN 10025 or equivalent			
2.2	Cross section of mast	20 sided, regular continuously tapered polygonal			
2.3	Number of sections	One	Two	Two	
2.3	Minimum thickness of shaft (mm)	4 mm	Bottom section: 5 mm Top section: 4mm	Bottom section: 5 mm Top section: 4mm	
2.4	Length of individual section (mm)	12000 mm	10900mm / 5850mm	10375mm / 10375mm	
2.5	Minimum Base and top diameter	340mm (A/F) and 150 mm (A/F)	450mm (A/F) and 150 mm (A/F)	500mm (A/F) and 150 mm (A/F)	
2.6	Type of joints	No site joints, mast should be delivered in a single section	Telescopic slip joint, stress fitted	Telescopic slip joint, stress fitted	
2.7	Length of overlap	N/A	750mm	750mm	
2.8	Metal protection treatment of fabricated mast section	Hot dip galvanization through single dipping process			
2.9	Thickness of galvanizations	Minimum 85 microns as per IS:2629			
2.10	Size of opening	Approx. 250 X 1200 mm			

Sl. No.	Particulars	Data by purchaser			Data by seller
	door at base				
2.11	Type of locking arrangement and door construction	Anti vandal type			
2.12	Details of struck board inside	Insulated base board			
2.13	Size , material and thickness of cable termination box				
2.14	Minimum size of base plate diameter	540 mm (min.)	650 mm (min.)	680 mm (min.)	
2.15	Minimum size of base plate thickness	25 mm thick			
2.16	Minimum size of anchor plate thickness	8 mm			
2.17	Details of template	Same as anchor plate but 2 mm thick			
3	Dynamic loading as prevailing at site				
3.1	maximum wind pressure (basic wind speed)	47m/s as per IS:875, p-3			
3.2	Maximum gust speed time	3 seconds			
3.3	Height above ground level at which wind speed is consider	10 mtrs			
3.4	Factor of safety for wind load	1.25			
3.5	Factor of safety for other load	1.15			
3.6	Application standard for mast design	Technical report #7:2000 by ILE, UK			
4	Foundation details				
4.1	Type of foundation	Open raft shallow footing or pile as applicable			

Sl. No.	Particulars	Data by purchaser			Data by seller
4.2	Size of foundation	as per design conforming to IS:456			
4.3	Design safety factor	2			
4.4	Considered wind speed	180 m /s			
4.5	Depth of foundation	As per requirement of design			
4.6	Average soil bearing capacity	As per site condition			
4.7	Numbers of foundation bolts	6 nos	8 nos		
4.8	PCD of foundation bolts	440 mm (min.)	550 mm (min.)	600 mm (min.)	
4.9	Type of foundation bolt	Tor steel			
4.10	Bolt diameter / length	25mm dia / 750 mm	32mm dia / 1325 mm	40mm dia / 1375 mm	
5	Lantern Carriage				
5.1	Diameter of Carriage Ring	Suitable to carry up to 4 nos. floodlights	1200 mm	1200 mm	
5.2	Construction	MS Channels / Tube, Hot dip galvanized	Channels 75X40X4mm thick	Channels 75X40X4mm thick	
5.3	Number of joints	As per manufacturer's standard design (2 segments as per CI no.4.5)	3 segments (2 segments as per CI no.4.5)	3 segments (2 segments as per CI no.4.5)	
5.4	Buffer arrangement between carriage and mast	Rubber padded guide ring provided			
5.5	Load carrying capacity	500 kg	750 kg	750 kg	
5.6	Total weight of assembly with	as per design			

Sl. No.	Particulars	Data by purchaser		Data by seller
	fitting			
6	Winch			
6.1	Make of winch			
6.2	Number of drums/ winch	Double drum		
6.5	Gear Ratio			
6.3	Capacity	SWL 500 kg	SWL 750 kg	
6.4	Method of operation	Manual / Inbuilt power tool		
6.6	Operating speed			
6.7	Lubricant Arrangement	Permanent oil bath		
6.8	Type of lubricant			
6.9	Material of construction of gear	Phosphorus Bronze / EN 19		
6.10	Tested load per drum	500 kg	750 kg	
6.11	SWL of winch at 410 rpm	500 kg SWL	750 kg SWL	
7	Wire rope			
7.1	Make			
7.2	Grade	AISI 316		
7.3	Number of ropes	3 nos / 5mm (three wire rope)	3 nos / 6 mm (three wire rope)	
7.4	Construction	7./19		
7.5	Diameter of Wire rope	5mm	6mm	
7.6	Factor of safety	Not less than 5	Not less than 6	
7.7	Breaking capacity	Minimum 2350Kgs. X 2		
8	Cable			
8.1	Type	EPR coated PCP sheathed		
8.2	Material	Multicore copper conductor		
8.3	Make	Finolex, torrent, Polycab, KEI, Havells		
8.4	Current carrying capacity	As per IS 9968 (Part - 1), 1998		

Volume – 2 Schedules & Annexure

Schedule C18

Sl. No.	Particulars	Data by purchaser		Data by seller
8.5	conductor size	5CX2.5 sqmm.		
9	Torque limiter			
9.1	Lifting capacity	Upto 500 kg	Upto 750 kg	
9.2	Adjustable / non adjustable	Adjustable		
10	Lantern and Fixture			
10.1	Type Of Lamp	LED		
10.1.1	Wattage	250W		
10.1.2	Make			
10.1.3	Model Number			
10.2	Housing	Single piece gravity die-cast		
10.2.1	Material	Aluminium alloy: LM6		
10.2.2	Ingress protection			
10.2.3	For optical compartment	IP:65/IP:66		
10.2.4	For control gear compartment	IP:54 or better		
10.2.5	Dimensions of lantern	As per design standard		
10.2.6	Weight of lantern with control gear	As per design standard		
10.3	Lamp Cover	Perspex/Toughened glass		
10.3.1	Toughened glass			
10.3.2	Class of glass	AA/SSQ		
10.3.3	Nominal thickness	5mm		
10.3.4	Perspex thickness	2.5mm+/-0.4 mm		
10.4	Material of gasket	Slicon Rubber/ Neoprene		
10.5	Lamp holder	Screw type/three pin type		
10.5.1	Material	Porcelain		
10.6	Ballast	Conventional/Open type/ VI/VPI		
10.6.1	Ballast voltage	240V AC		
10.6.2	Minimum open circuit voltage	198V		
10.6.3	Frequency	50 Hz		
10.6.4	Current output(A), at rated voltage			
10.6.5	Voltage to current ratio () +/-0.5%			
10.6.6	Watt loss (W)	To be specified		

Sl. No.	Particulars	Data by purchaser			Data by seller
10.7	Power factor of lantern	More than 0.95 lag			
10.7.1	Value of capacitor	To be specified			
10.8	Igniter	Three wire			
10.9	Reflector	Anodised/POT			
10.9.1	Angle of tilt of lamp	To be specified			
10.9.2	Downward light output ratio	More than 70%			
10.9.3	Angle of throw	As per clause 5.12.5			
10.9.4	Angle of spread	As per clause 5.12.6			
10.9.5	Luminous intensity in C = 0° plane at $\gamma = 90^\circ$	Less than 10 Cd/klm			
10.9.6	Luminous intensity in C = 0° plane at $\gamma = 80^\circ$	Less than 30 Cd/klm			
10.10	Make of fixture	Bajaj, GE, Philips and CGL			
10.10.1	Nos of fixture provided with high mast	4	5	6	
10.10.2	Type of fixture	Weather proof			
11	Others				
11.1	Make of 24 hour Differential Timer Switch	Legrand/ GE/ Schnider/ L&T			
11.2	Make of 32A TPN MCB	GE/ Hager/ Legrand/ Schnider			
11.3	Make of 32A Contactor	L&T/ Schnider/ GE			
11.4	Earth pit	Two numbers of treated earth pit with each mast			
12	GTP and Drawing Submitted	Yes/No			
13	Type Tests Submitted	Yes/ No			

Volume – 2 Schedules & Annexure

Schedule C18

Sl. No.	Particulars	Data by purchaser	Data by seller
14	Technical Brochure of luminaries submitted	YES / NO	
15	Operation and maintenance manual submitted	YES / NO	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Date : _____

Seal of Company

**SCHEDULE – B19
66 KV ALUMINUM PIPE BUS BAR**

S. No.	Particulars	Unit	Data by Purchaser	Data by Supplier
1	Make			
2	Type			
3	Reference Standard		As per applicable IS/IEC	
4	Type of substation		Outdoor	
5	Bus Bar arrangement		Double Bus	
6	Type of Bus bar		Rigid Bus	
7	Material of Bus bar		Aluminum / Aluminum Alloy	
8	Type of Conductor		Aluminum Pipe	
9	Nominal Diameter	mm	100	
10	Wall thickness	mm		
11	Minimum height of bus bar	M	6.4	
12	Minimum spacing between bus bar	M	2	
13	Bay width	M	7.6	
14	Bus bar configuration		Horizontal	
15	Maximum continuous current at 40 °C rise above ambient temperature	A	2000	
16	Rated Short time withstand current for 3 sec.	kA	31.5	
17	Insulation details			
17.1	Creepage distance	mm/kV	31	
17.2	Basic Insulation level	kV	325	
17.3	Power frequency withstand voltage	kV	140	
17.4	Lightening impulse	μs	1.2/50	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company

Date : _____

OUTDOOR CT

Schedules & Annexure



BSES Rajdhani Power Ltd

PROJECT	General		
Vendor's Name:	M/s Kapco Electric Private Ltd.		
Contact person:	Mr. Siddharth Bainsla		
Address:	A-8, Sector -83, Phase-II, Noida-201305		
Transmittal No.	BRPL-2021-2022-		
Revision No.	00		
Previous Revision Record	Revision No.	Date:	
Date of approval	11.02.2022		
DOCUMENT TITLE: Approval of 66 kV CT(400-200/1-1-1-1A)			
Details		Drwg no.	Dated
GTP & Drawing of 66 kV CT(400-200/1-1-1-1A)			
PURCHASE ORDER NO.		23089403	
QUANTITY			
Supplier Document Review			
Permission to proceed does not constitute acceptance or approval of design, calculation, analysis, test methods or materials developed or selected by supplier and does not relieve supplier from full compliance with contractual obligations.			
	1. Work to Proceed		3. Revise & Resubmit. Work not to proceed
✓	2. Revise & resubmit. Work may proceed subject to incorporation of change indicated		4. Review not required. Work to proceed
Department : Central Engineering Services			
COMMENTS :			
<ol style="list-style-type: none"> Incorporate the observation as mentioned in GTP/Drwgs. Inspection call shall be raised 10 days in advance Painting of equipment id in vendor scope. 			
CHECKED BY		REVIEWED BY	
Amar Deep Singh		Abhinav Srivastava	
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> APPROVED By 41018797 at 12:42 pm, Feb 12, 2022 </div>			

OUTDOOR CT

KAPCO ELECTRIC PRIVATE LIMITED
Schedules & Annexure

A-8, SECTOR-83, NOIDA-201305, U.P., INDIA
TEL.: +91-120-4630200, FAX: +91-120-4630201
E-MAIL: sales@kapco.in



Ref.: KEPL/SK/21-22/708

February 11, 2022

BSES RAJDHANI POWER LIMITED 1st Floor; C-Block, BSES Bhawan Nehru Place Delhi, -110019, DELHI, INDIA	Email Id:- Amar.D.Singh@relianceada.com Contact no.: 9310432202
--	--

Sub.: Submission of GTP & Drawing for approval.
Ref.: Your PO. No. NB/DO1/23089403 dtd. 25.01.2022

Dear Sir,

With reference to the above said Purchase Orders, we are enclosing herewith following revised GTPs & Drawings.

S. No.	Description	Doc./Drg. No.	R. No.
A.	GTP & Drawings of 66KV CT		
1.	Guaranteed Technical Particular of 66 KV Dead Tank CT of Ratio 400-200/1-1-1-1A	KE-GTP66CT01	00
2.	GA Drawing of 66 KV Dead Tank CT of Ratio 400-200/1-1-1-1A	KE-66CT03899	01
3.	Name Plate Drawing of 66 KV Dead Tank CT of Ratio 400-200/1-1-1-1A	KE-66CT03899N	00
4.	Details of Secondary terminal box for 66 KV Dead Tank CT of Ratio 400-200/1-1-1-1A	KE-66CT038995B	00
5.	Sectional Drawing of 66KV Dead Tank CT of Ratio 400-200/1-1-1-1A	KE-66CT038995	00
6.	G.A. DRAWING OF ACSR TWIN ZEBRA TERMINAL CONNECTOR	KE-66CT03899TC	00

We hope above is in order with your requirement and look forward to receive your approval and manufacturing clearance.

Thanking you,
Yours faithfully,
For KAPCO ELECTRIC PVT. LTD.

**APPROVED**

By 41018797 at 12:32 pm, Feb 12, 2022

OUTDOOR CT

Schedules & Annexure

Customer	BSES Rajdhani Power Ltd.		
P.O. No.	NB/D01/23089403 dtd. 25.01.2022		
Manufacture	Kapco Electric Pvt. Ltd. Noida		
Doc. No.	Date	Rev.	Page
KE-GTP66CT-01	31.01.2022	00	1 of 3

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 66KV CT OF RATIO**400-200/1-1-1-1A**

Sr. No.	Description	Data by Purchaser				Data by Supplier			
		Core-1	Core-2	Core-3	Core-4	Core-1	Core-2	Core-3	Core-4
1.	Name of Manufacturer	--				KAPCO ELECTRIC PVT. LTD. NOIDA, UP.			
2.	Address and contact details	--				A-8, Sector-83, Noida-201305 (UP)			
3.	Type	--				Outdoor, Oil cooled, Hermetically sealed, single phase, Dead Tank CT			
4.	Rated nominal voltage	66kV				66kV			
5.	Rated system voltage	72.5kV				72.5kV			
6.	Rated frequency	50Hz.				50Hz.			
7.	Rated primary current	400-200A				400-200A			
8.	Rated secondary current	1A				1A			
9.	Number of cores	Four				Four			
10.		Core-1	Core-2	Core-3	Core-4	Core-1	Core-2	Core-3	Core-4
10.1	Secondary current	1A	1A	1A	1A	1A	1A	1A	1A
10.2	Application	Metering	Protection (O/C & E/F)	Protection (BUS BAR)	Protection (BUS BAR)	Metering	Protection (O/C & E/F)	Protection (BUS BAR)	Protection (BUS BAR)
10.3	Rated output(VA)	30VA	30VA	---	---	30VA	30VA	---	---
10.4	Class of accuracy	0.2s	5P	P5	P5	0.2s	5P	P5	P5
10.5	Instrument security factor	≤5	--	--	--	≤5	--	--	--
10.6	Accuracy limit factor	--	20	--	--	--	20	--	--
10.7	Knee point voltage & corresponding exciting current	---	--	>40(Rct+8)V	>40(Rct+8)V	---	---	>40(Rct+8)V	>40(Rct+8)V

APPROVED

By 41018797 at 12:32 pm, Feb 12, 2022

OUTDOOR CT

Schedules & Annexure

10.8	Magnetizing current at $V_k/2$ (mA)	----	---	<30mA	<30mA	----	----	<30mA	<30mA
10.9	Resistance of the secondary winding at 75 Deg C	---	----	$\leq 8-16.5\Omega$	$\leq 8-16.5\Omega$	----	----	$\leq 4-13\Omega$	$\leq 4-13\Omega$
10.10	Secondary limiting voltage	----	---	---	---	----	----	---	---
11.	Short time thermal rating of primary								
11.1	One second	---		---		----		----	
11.2	Three seconds	31.5kA		31.5kA		31.5KA		31.5KA	
12.	Rated dynamic current of primary	--		--		78.75kA(P)		78.75kA(P)	
13.	Rated continuous thermal current	--		--		120% of rated primary current		120% of rated primary current	
14.	Temp. rise at ambient of 50°C	--		--		--		--	
14.1	Winding	--		--		As per IS-2705/1992		As per IS-2705/1992	
14.2	Oil at the top	--		--		As per IS-2705/1992		As per IS-2705/1992	
14.3	Exposed current carrying parts	--		--		As per IS-2705/1992		As per IS-2705/1992	
15.	One minute power Frequency dry withstand voltage (KV rms)	140kVrms		140kVrms		140kVrms		140kVrms	
16.	One minute power frequency wet withstand voltage (KV rms)	140kVrms		140kVrms		140kVrms		140kVrms	
17.	1.2/50 micro second impulse withstand test voltage	325kVp		325kVp		325kVp		325kVp	
18.	Minimum creepage distance in mm	31mm/kV		31mm/kV		31mm/kV		31mm/kV	
19.	Protective creepage distance in mm	--		--		50% of the total		50% of the total	
20.	Magnetization curve of CT core	--		--		Will be provided at the time of inspection		Will be provided at the time of inspection	
21.	Variation in ratio and phase angle error due to variation in	---		---					
21.1	Voltage by 1 Volt	--		--		Negligible		Negligible	



APPROVED

By 41018797 at 12:41 pm, Feb 12, 2022

OUTDOOR CT

Schedules & Annexure

21.2	Frequency by 1Hz.	--	Negligible
22.	Current density in primary winding		<1.6A/sq.mm

23 . Weight of oil		
24. Total Weight		
25. Mounting Details		
26. Overall Dimensions		
27. Terminal Connector	ACSR Twin Zebra	
28. Provision for oil expansion	SS Bellow/SS Diaphragm	

Fill above details

APPROVED
By 41018797 at 12:41 pm, Feb 12, 2022

OUTDOOR CT

Schedules & Annexure

Provision for oil expansion without breathing shall be SS bellow/diaphragm type.

SRL No	DESCRIPTION	MATERIAL	QTY.
1.0	OIL FILLING OIL PRESSURE RELEASE DEVICE	BRASS	ONE
2.0	NITROGEN FILLING VALVE	BRASS	ONE
3.0	RAIN COVER	MS(HDG)	ONE
4.0	TOP TANK	MS(HDG)	ONE
5.0	PRIMARY TERMINAL	COPPER	TWO
6.0	OIL LEVEL INDICATOR	AINMS	ONE
7.0	A.T BUSHINGS (BSES Approved make)	PORCELAIN	ONE
8.0	MAIN TANK COVER	MS(HDG)	ONE
9.0	LIFTING LUGS	MS(HDG)	FOUR
10.0	SECONDARY TERMINAL BOX	MS(HDG)	ONE
11.0	MAIN TANK	MS(HDG)	ONE
12.0	EARTHING TERMINAL	MS(HDG)	TWO
13.0	MOUNTING ANGLE	MS(HDG)	TWO
14.0	NAME & RATING PLATE, CONWL & WIRING DIAGRAM PLATE	AL-ALUSS	ONE
15.0	OIL DRAIN PLUG	MS	ONE
16.0	OIL-RESISTANT BELLOW	BAKELITE	ONE

****TOTAL HEIGHT OF CT SUBJECT TO CHANGE HEIGHT OF BUSHING SPECIFICATION**

1. CREEPAGE DISTANCE : 2247.5mm (min.)
 2. Short Time Current : 31.5kA for 3 sec.
 3. Surface Finish : Hot Dip Galvanized
 4. MS Thickness: 3.15mm Excluding Top Plate, Tank collar, Bushing Flange
- Thickness : 610gm/sq.mm for 5mm thick and over & 460gm/sq.mm under 5 mm but not less than 3mm
As per IS-4758:1996(Clause No: 6.1.7, 6.1.8-1)

Core	Ratio	Class	Burden	Vk
I	400-200/7A	0.25	30VA	---
II	400-200/7A	SP	30VA	---
III	400-200/7A	PS	---	>40(0.01+8)V
IV	400-200/7A	PS	---	>40(0.01+8)V

All dimensions are in mm

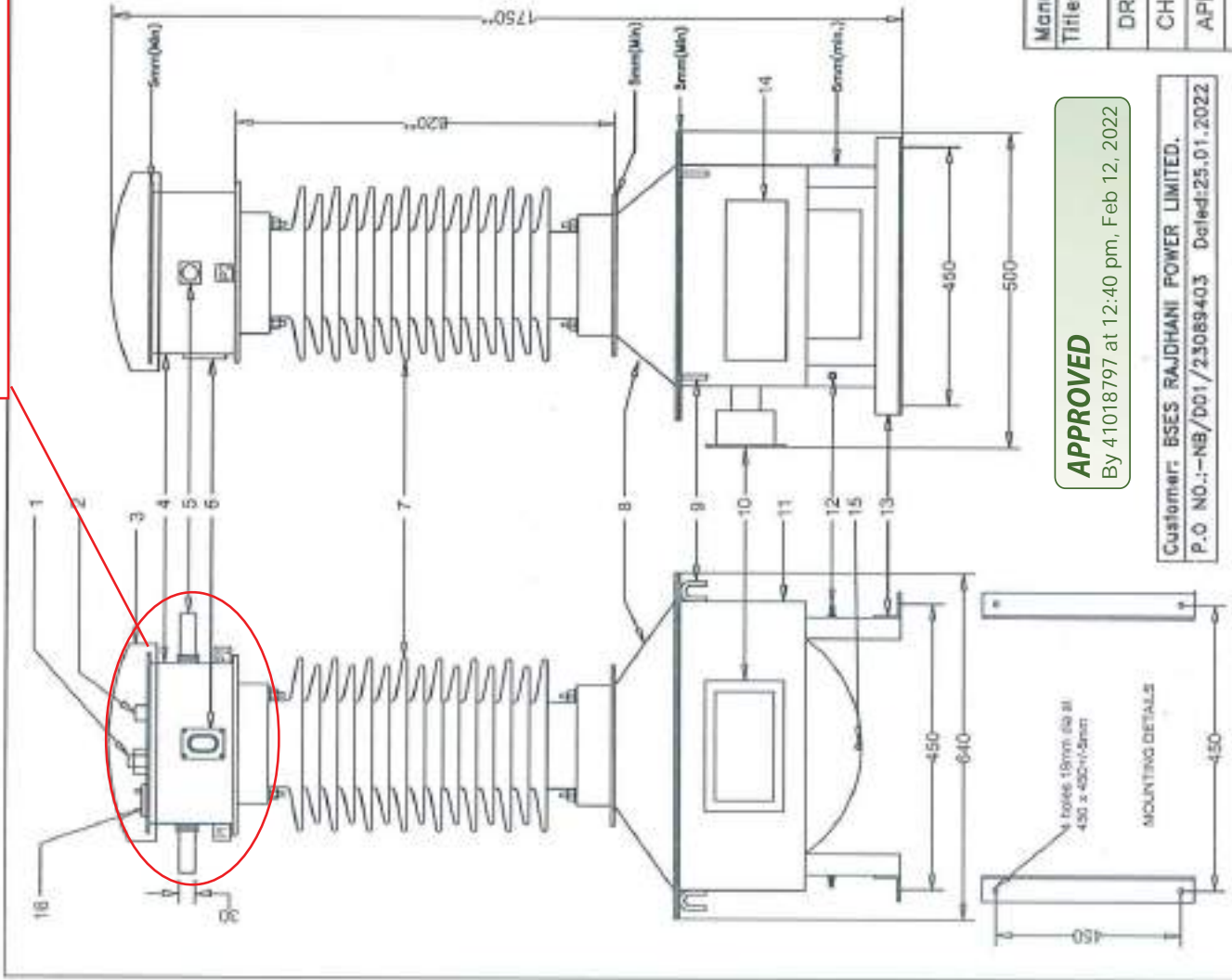
Manufacturer : Kapco Electric Pvt. Ltd.

Title: GA Drawing for 66KV Dead Tank CT
Ratio: 400-200/1-1-1-1A

DRN.	518CHART	TOLERANCE	DATE
CHD.		±10%	11.02.2022
APPD.		SIG. NO.	REV.
SCALE	NTS	KE-66CT03659	01

APPROVED
By 41018797 at 12:40 pm, Feb 12, 2022

Customer: BSES RAJDAHANI POWER LIMITED.
P.O NO.: -NB/DO1/23089403 Dated: 25.01.2022



OUTDOOR CT

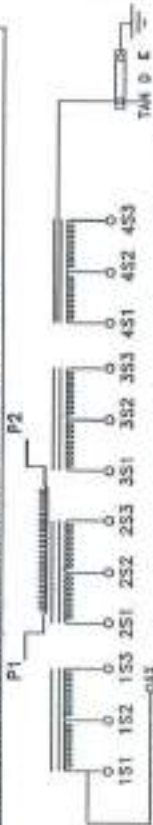
Schedules & Annexure

CURRENT TRANSFORMER

STANDARD	IS-2705/1992	C.T. RATIO	400-200/1-1-1-1A
HIGHEST SYSTEM VOLTAGE	72.5KV	RATED PRIMARY CURRENT	400-200A
INSULATION LEVEL	140KV/325KV(P)	S.T. CURRENT	31.5kA for 3 sec.
FREQUENCY	50 Hz.	RATED THERMAL CURRENT	120% of rated primary current
C.A. DRAWING NO.	KE-66CT03899N	SERIAL No.	KEPL/
Min. CREEPAGE DISTANCE	2247.5mm(min)	QUANTITY OF OIL	45.0 Ltrs. (Approx)
SUITABLE FOR HOT LINE WASHING		TOTAL WEIGHT	225 Kg. (Approx)

CAUTION: 1. SECONDARY TERMINAL MUST BE SHORT CIRCUITED BEFORE THE BURDEN IS DISCONNECTED
 2. TAN DELTA POINT SHOULD BE EARTHED BEFORE ENERGISING.
 3. SHORT TERMINAL AX WITH 1S2 OR 1S3 WHICHEVER IN USE
 AX : AUXILIARY TAPS/COIL USED FOR ACHIEVING THE ISF FOR ALL RATIO

Circuit Diagram



Core	Secondary Selection Ratio: 200/1A	Ratio: 400/1A	Burden	Class of Accuracy	ISF/ALF	Vk of both tap	Max. I _{sc} at V _k /2	Sec Winding R _{ct} at 75C
Core-I	1S1-1S2	1S1-1S3	30VA	0.2s	5S	--	--	--
Core-II	2S1-2S2	2S1-2S3	30VA	5P	20	--	--	--
Core-III	3S1-3S2	3S1-3S3	--	FS	--	≥40(Rat+E)	≤30mA	<4-1.3ohms
Core-IV	4S1-4S2	4S1-4S3	--	FS	--	≥40(Rat+E)	≤30mA	<4-1.3ohms

Customer: BSES RAJDHANI POWER LIMITED.
 P.O NO.: -NB/D01/23089403 Dated: 25.01.2022
 Guarantee Period : 60 Months From the Date of Commissioning
 : 66 Months From the Date of Supply
 Year of Mfg:

MADE IN INDIA
 KAPCO ELECTRIC (P) LTD.

A-8, Sector B3, Noida (UP), Tel: +91-9810247455 (E-mail: sales@kapco.in)

Customer: BSES RAJDHANI POWER LIMITED.
 P.O NO.: -NB/D01/23089403 Dated: 25.01.2022

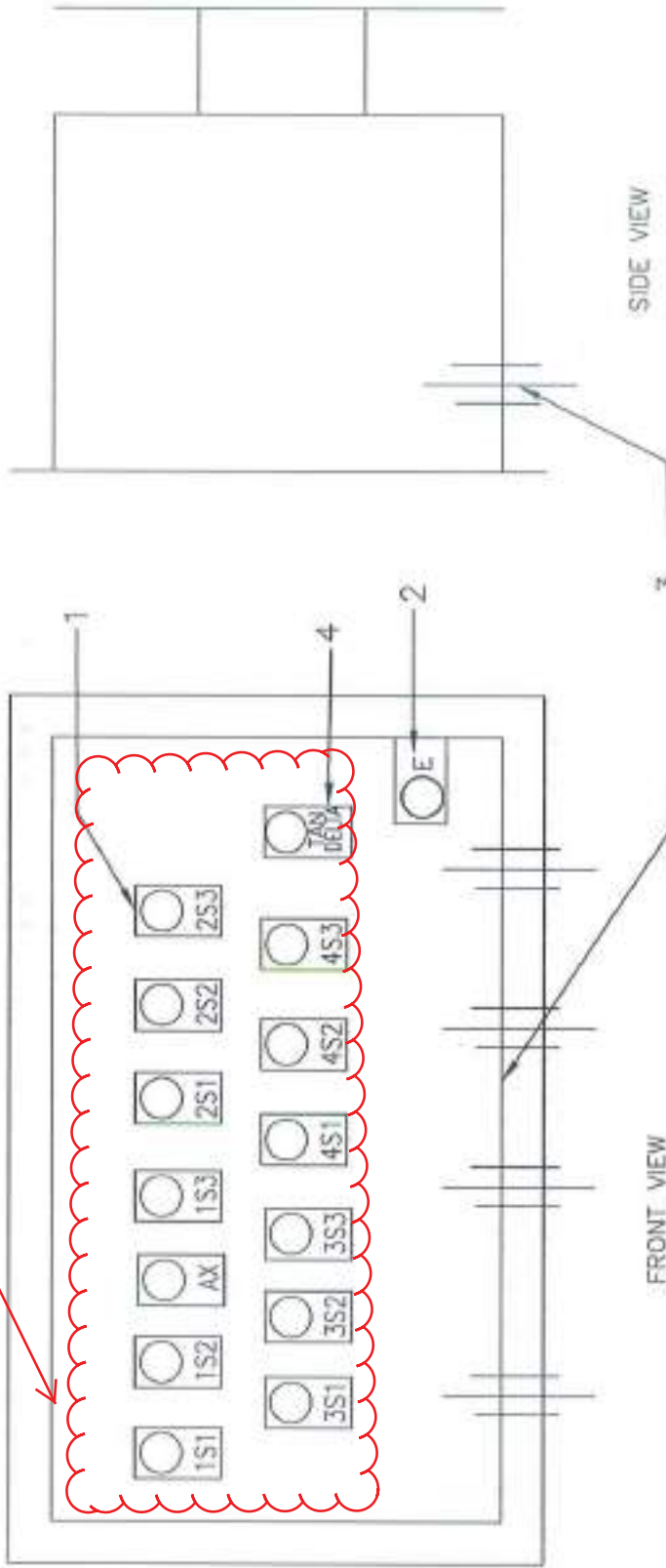
Size: 160 X 150mm
 Material: SS/An. Al Plate
 Marking: Engraved/Punched

APPROVED
 By 41018797 at 12:40 pm, Feb 12, 2022



Manufacturer : Kapco Electric Pvt. Ltd.			
Title: Nama Plate for 55KV Dead Tank CT of Ratio: 400-200/1-1-1-1A			
DRN	BIDHARTH	TOLERANCE	DATE
C.D.		+/-10%	31.01.2022
APPD.		DRG. NO.	REV.
SCALE	NTS	KE-66CT03899N	00

Secondary terminal box connectors shall be stud type (Make- connectwell/ Elmex)



APPROVED
By 41018797 at 12:40 pm, Feb 12, 2022

SECONDARY BOX DETAILS



Secondary Shoring Link

S. No.	Description	Material	Qty.
1	Secondary Terminal	Brass (Ni. Plated)	13 Nos.
2	Earthing Strip	MS(HDG)	1 No.
3	Cable Gland Hole	---	4 No.
4	Tan Delta Terminal(6mm dia)	Brass (Ni. Plated)	1 No.

Degree of Protection:IP-55

Customer: BSES RAJDHANI POWER LIMITED.

P.O NO.:--NB/D01/23089403 Dated:25.01.2022

Manufacturer : Kapco Electric Pvt. Ltd.

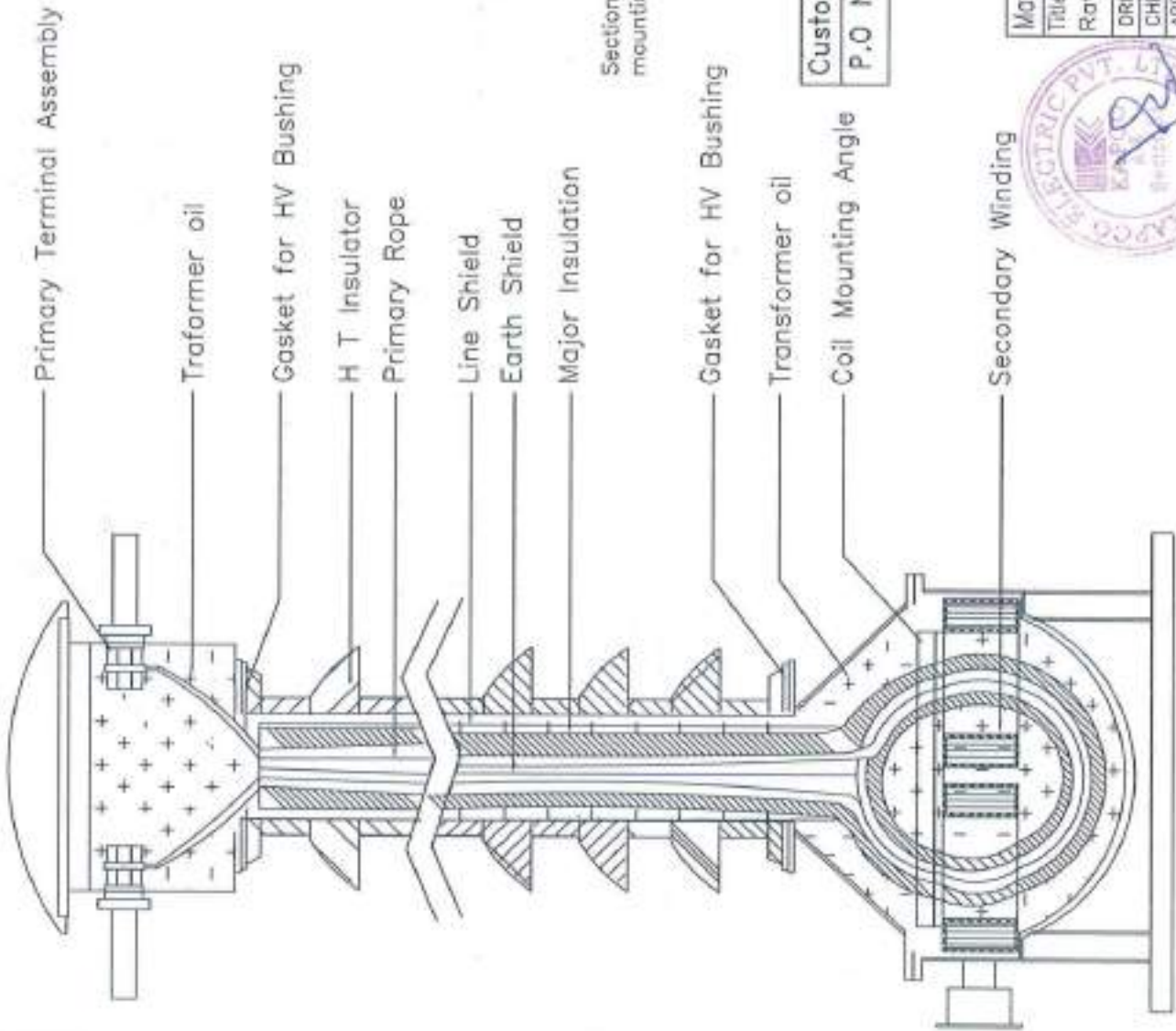
Title: Secondary Box for 66kV dead Tank CT of Ratio: 400-200/1-1-1-1A

DRN.	SIGNATURE	TOLERANCE	DATE
CHD.		+/-10%	31.01.2022
APPD.		DRG. NO.	REV.
SCALE	NTS	KE-66CT03899SB	00



OUTDOOR CT

Schedules & Annexure



Core	Ratio	Class	Burden	Vk
I	400-200/1A	0.2S	30VA	---
II	400-200/1A	5P	30VA	---
III	400-200/1A	5S	---	3-40/(5ct+8)va
IV	400-200/1A	5S	---	3-40/(5ct+8)va

Sectional drawing showing internal arrangement & mounting arrangement of Core / Coil.

APPROVED
By 41018797 at 12:40 pm, Feb 12, 2022

Customer: BSES RAJDHANI POWER LIMITED.
P.O NO.:-NB/D01/23089403 Dated:25.01.2022

All dimensions are in mm

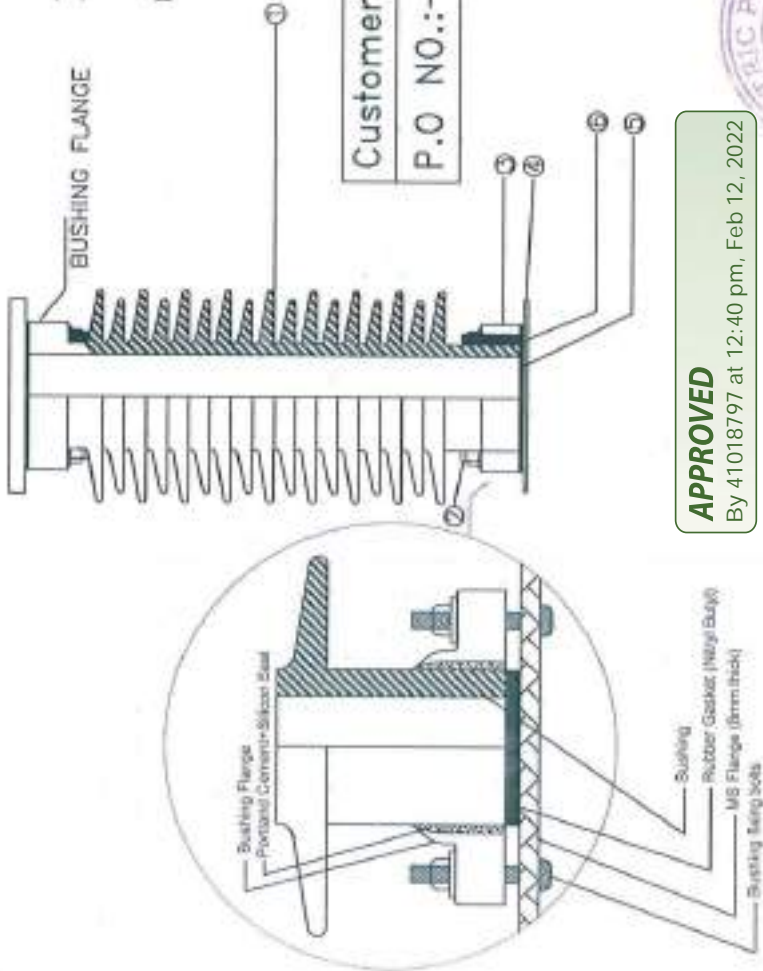


Manufacturer: KAPCO ELECTRIC PRIVATE LIMITED Noide (UP)
Title: Sectional drawing of 66kV Dead Tank Current Transformers
Ratio:400-200/1-1-1-1A

DRN	51202165TH	Tolerance	Date
CHD.		+/-10%	31.01.2022
APPD.		Drawing No.	REV.
Scale	NTS	KE-66CT03899S	00

Schedules & Annexure

1	PORCELAIN BUSHING
2	BOLT WELDED FOR BUSHING FIXING
3	BUSHING FLANGE
4	FLANGE WELDED TO TANK
5	NITRYL BUTYL RUBBER GASKET BETWEEN PORCELAIN TO FLANGE
6	CEMENTED PORTION



- Gaskets shall be in machined grooves.
 - Flange shall be cemented to the bushing

Note:- Nuts & Bolts or screw used for fixation of interfacing porcelain bushing shall be provided on flanges cemented to bushings and not on porcelain.

Customer: BSES RAJDHANI POWER LIMITED.
 P.O NO.:-NB/D01/23089403 Dated:25.01.2022

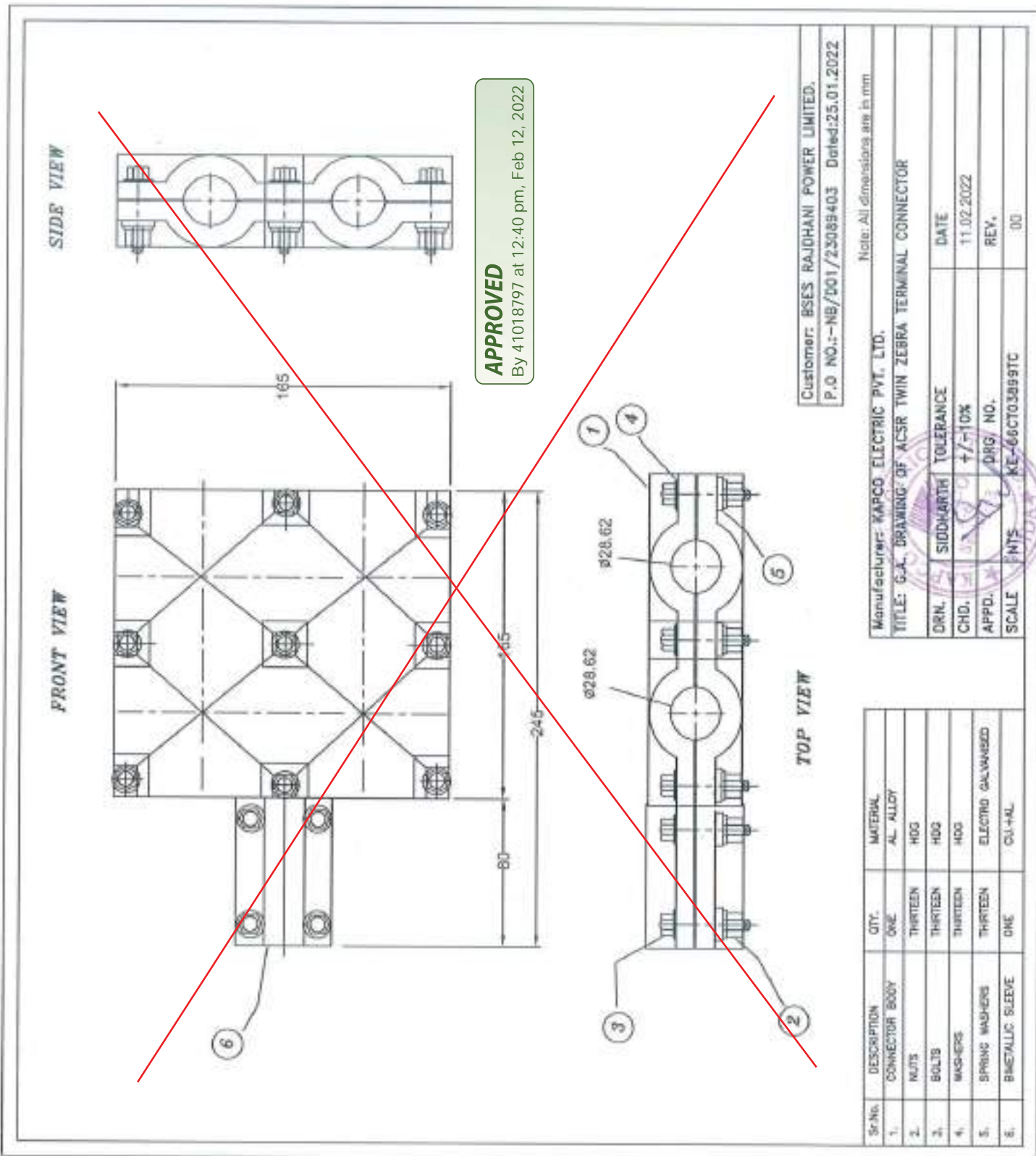
All dimensions are in mm

MANUFACTURER: Kapco Electric Pvt. Ltd.			
Title : Detail Drawing of Bushing for 56KV Dead Tank CT			
Ratio:400-200/1-1-1-1A			
DRN.	SIDDHARTH	TOLERANCE	DATE
CHD.		+/-10%	31.01.2022
APPD.		DRG. NO.	REV.
SCALE	NTS	KE-66CT0389985	00



APPROVED
 By 41018797 at 12:40 pm, Feb 12, 2022

DETAILS OF BUSHING INTERFACE WITH TANK



Customer: BSES RAJDHANI POWER LIMITED.
P.O NO.1-NB/001/23089403 Dated:25.01.2022

Note: All dimensions are in mm

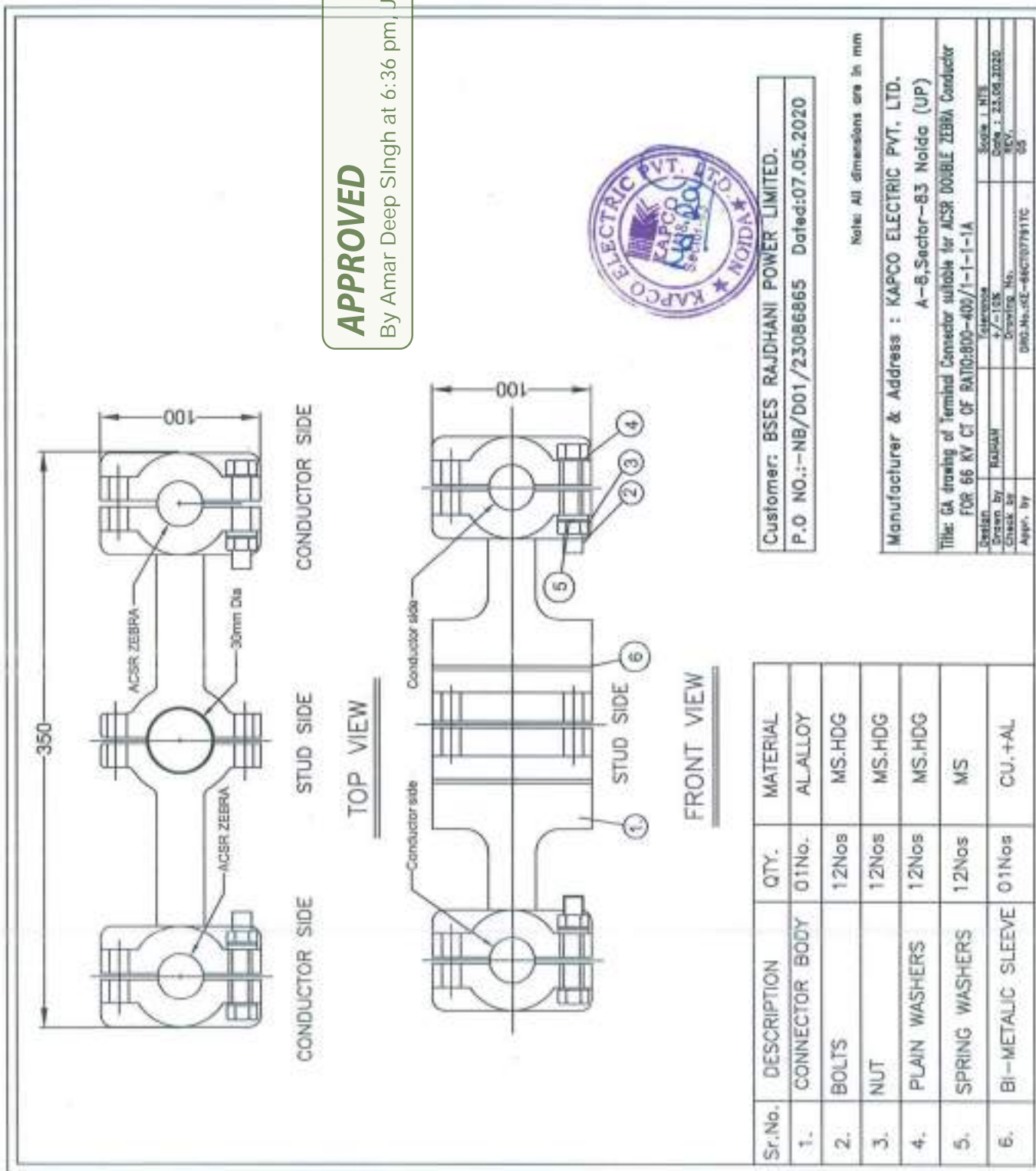
Manufacturer: KAPCO ELECTRIC PVT. LTD.
TITLE: G.A. DRAWING OF AC SR TWIN ZEBRA TERMINAL CONNECTOR

DRN.	SIDDHARTH	TOLERANCE	DATE
CHD.		+/-10%	11.02.2022
APPD.		DRG. NO.	REV.
SCALE	1:1	KE-66CT03B99TC	.00

Sr.No.	DESCRIPTION	QTY.	MATERIAL
1.	CONNECTOR BODY	ONE	AL ALLOY
2.	NUTS	THIRTEEN	H08
3.	BOLTS	THIRTEEN	H08
4.	WASHERS	THIRTEEN	H08
5.	SPRING WASHERS	THIRTEEN	ELECTRO GALVANISED
6.	BI-METALLIC SLEEVE	ONE	CU+AL

APPROVED

By Amar Deep Singh at 6:36 pm, Jul 08, 2020



Customer: BSES RAJDHANI POWER LIMITED.
 P.O NO.:--NB/D01/23086865 Dated:07.05.2020

Note: All dimensions are in mm

Manufacturer & Address : KAPCO ELECTRIC PVT. LTD. A-8, Sector-83 Noida (UP)	
Title: GA drawing of Terminal Connector suitable for ACSR DOUBLE ZEBRA Connector FOR 66 KV CT OF RATIO:800-400/1-1-1-1A	
Scale: 1:100	Scale: 1:100
Drawn by: NARAYAN	Drawn by: NARAYAN
Checked by: [Signature]	Checked by: [Signature]
Appr. by: [Signature]	Appr. by: [Signature]
Date: 07.05.2020	Date: 23.08.2020
DWG No.: KE-86CT07911C	Rev: 05

Sr.No.	DESCRIPTION	QTY.	MATERIAL
1.	CONNECTOR BODY	01Nos.	AL-ALLOY
2.	BOLTS	12Nos	MS.HDG
3.	NUT	12Nos	MS.HDG
4.	PLAIN WASHERS	12Nos	MS.HDG
5.	SPRING WASHERS	12Nos	MS
6.	BI-METALIC SLEEVE	01Nos	CU.+AL

SCHEDULE – C21
CVT

Schedules & Annexure

BSES

BSES Rajdhani Power Ltd

PROJECT			
Vendor's Name:		M/s Mehru Electricals & Mech Engg. Pvt. Ltd.	
Contact person:		Mr. Mandeep Sharma	
Address:		RIICO Industrial Area Bhiwadi -301019	
E-mail id:		sales@mehru.net	
Transmittal No.		BRPL-2021-2022- 662	
Revision No.		00	
Previous Revision Record		Revision No.	Date:
Date of approval		03.01.2022	
DOCUMENT TITLE: Approval of 66 kV CVT			
Details		Drwg no.	Dated
GTP & Drawing of 66 kV CVT			
PURCHASE ORDER NO.		23089324	
QUANTITY		09	
Supplier Document Review			
Permission to proceed does not constitute acceptance or approval of design, calculation, analysis, test methods or materials developed or selected by supplier and does not relieve supplier from full compliance with contractual obligations.			
√	1. Work to Proceed		3. Revise & Resubmit. Work not to proceed
	2. Revise & resubmit. Work may proceed subject to incorporation of change indicated		4. Review not required. Work to proceed
Department : Central Engineering Services			
COMMENTS :			
1. Approval shall be applicable for this PO as per earlier approved 66 KV CVT vide BRPL Transmittal No. BRPL-2020-2021- dated 28.09.2020 PO 23087254.			
2. Inspection call shall be intimated to CES, 10 days in advance.			
CHECKED BY		REVIEWED BY	
Amar Deep Singh		Abhinav Srivastava	

Amar Deep Singh

Abhinav Srivastava
03/1/22



PROJECT	General		
Vendor's Name:	M/s Mehru Electrical and Engineer Pvt Ltd.		
Contact person:	Mr. Mandeep Sharma		
Address:	RIICO Industrial Area Bhiwadi - 301019		
Transmittal No.	BRPL-2020-2021-		
Revision No.	00		
Previous Revision Record	Revision No.	Date:	
Date of approval	28.09.2020		
DOCUMENT TITLE: Approval of 66 kV CVT			
Details		Drwg no.	No. of Sheets
GTP & Drawing of 66 kV CVT			
PURCHASE ORDER NO.	23087254		
QUANTITY	38		
Supplier Document Review			
Permission to proceed does not constitute acceptance or approval of design, calculation, analysis, test methods or materials developed or selected by supplier and does not relieve supplier from full compliance with contractual obligations.			
✓	1. Work to Proceed	3. Revise & Resubmit. Work not to proceed	
	2. Revise & resubmit. Work may proceed subject to incorporation of change indicated	4. Review not required. Work to proceed	
Department : Central Engineering Services			
COMMENTS :			
<ol style="list-style-type: none"> 1. Incorporate the changes as mentioned in GTP/Drwg. 2. Inspection call shall be raised 10 days in advance 3. Painting of equipment id is in vendor scope. 			
CHECKED BY		REVIEWED BY	
Amar Deep Singh		Abhinav Srivastava	

APPROVED

By Amar Deep Singh at 10:38 am, Sep 28, 2020

SCHEDULE - C21
CVT

Schedules & Annexure

S.NO.	DESCRIPTION	QTY	MATL.
1	H.T TERMINAL	1	Copper
2	OIL FILLING PLUG	2	M.S (HDD)
3	OIL LEVEL INDICATOR/PRISMATIC TYPE	2	BRASS/ALU.
4	OIL EXPANSION CHAMBER	1	M.S (HDD)
5	BUSHING CLAMP	2	GI
6	SLIDING	1	PORCELAIN
7	LIFTING HOOD	4	M.S (HDD)
8	SECONDARY TERMINAL BOX	1	M.S (HDD)
9	CHARTING TERMINAL (PLAT) 15x15 THICK	2	M.S (HDD)
10	TANK WITH COVER	1	M.S (HDD)
11	NAME AND RATING PLATE	1	ALU. ANODIZED
12	OIL DRAIN PLUG - Ø2" B.S.P Thread	1	M.S (HDD)
13	BELLOW	1	G.I
14	DOME / RAIN COVER	1	G.I
15	PRESSURE RELEASE DEVICE	1	Alloy

Should use steel bellow or dia ph program type

WEIGHT OF OIL 100 LITRES APPROX.
TOTAL WEIGHT 325 Kgs APPROX.
TOTAL CREEPAGE DISTANCE 2250 mm (Min)
PROTECTED CREEPAGE DISTANCE 1125 mm (Min)

APPROVED
By Amar Deep Singh at 10:30 am, Sep 28, 2020

NOTES :-
1. ALL FERROUS PARTS EXPOSED TO THE ATMOSPHERE SHALL BE HOT DIP GALVANIZED (810gms/msq)
2. MAKE OF BUSHING : MODERNABUL/BHEL/WSI/JSI / *Sarda Varna /*
3. HV TERMINAL BUSHING SUITABLE FOR 3" PIPE BUSBAR
It should be suitable for ASCR zebra.

Customer	SIEMENS
Project	SIEMENS
Drawn	SIEMENS
Checked	SIEMENS
Approved	SIEMENS

GENERAL ARRANGEMENT DRAWING FOR 11KV CAPACITIVE VOLTAGE TRANSFORMER

SCALE: 1:1

DATE: 28/09/2020

PROJECT: 11KV-CVT-GA-1008-01

**SCHEDULE – C21
CVT**

Schedules & Annexure

Guaranteed Technical Particulars 66 KV OUT DOOR CAPACITIVE VOLTAGE TRANSFORMER			
S. No.	Description	Data By Purchaser	M/s Mehru Elect. & Mech. Engg.
1	Location of Equipment	Project specific to be filled up	
2	Name of Manufacturer		Mehru Electrical & Mechanical Engg.
3	Address & Contact details		E-1247, Phase-1, (Ext.) Ghatal, RICO Ind. Area, Bhiwadi, Dist. Alwar (Rajasthan) - 301019
4	Type	Single phase, outdoor, dead tank type, oil immersed, self-cooled, hermetically sealed type	Single phase, outdoor, dead tank type, oil immersed, self-cooled, hermetically sealed type
5	Manufacturer Model No		66kV CVT
6	Reference design ambient	50 Deg C	50 Deg C
7	Reference Standard	IS: 3156 (Part 1 to 4)	IS: 3156 (Part 1 to 4)
8	Nominal system voltage	66KV	66KV
9	Highest system voltage	72.5KV	72.5KV
10	Basic insulation level	325KVp	325KVp
11	Power frequency voltage	140KV	140KV
12	Type of cooling	ONAN	ONAN
13	Rated frequency (Hz)	50 Hz	50 Hz
14	Insulation Class	A	A
15	Rated Primary voltage	66KV / $\sqrt{3}$	66KV / $\sqrt{3}$
16	Rated secondary voltage	110V / $\sqrt{3}$	110V / $\sqrt{3}$
17	Number of secondary cores	Two	Two
18	CORE Specifications		
18.1	Core - 1		
18.2	Purpose	Metering	Metering
18.3	Rated Output	50 VA	50 VA
18.4	Class of accuracy	0.2	0.2
18.5	Ratio error	As per IS	As per IS 3156
18.6	Phase angle error	As per IS	As per IS 3156
19	Core - 2		
19.1	Purpose	Protection	Protection
19.2	Rated Output	50 VA	50 VA
19.3	Class of accuracy	3P	3P
19.4	Total Simultaneous Burden		50
19.5	Total Thermal Burden		100
19.6	Ratio error	As per IS	As per IS 3156
19.7	Phase angle error	As per IS	As per IS 3156
20	Rated over voltage factor		
20.1	- Continuous	1.2 times	1.2 times
20.2	- 30 Seconds	1.5 times	1.5 times
21	Capacitor Divider		
21.1	High voltage Capacitor	C1(pf)	6200pf (approx)
21.2	Intermediate Voltage Capacitor	C2(pf)	16500pf (approx)
21.3	Total Equivalent Capacitance	PI	4400pf
21.4	Rated temperature at which above values are indicated.	Deg C	30 Deg C
21.5	Capacitance temperature coefficient		<0.00002(max.) per degree Celsius
21.6	Tan delta value of capacitance		<0.3%
21.7	Carrier frequency coupling	PI	4400pf
21.8	Rated Intermediate Voltage		10kV Approx.
22	Natural frequency of coupling	kHz	> 1MHz
23	Band Width	kHz	40 to 500kHz
24	Series reactance/choke rated voltage & power frequency withstand voltage		5kV
25	Temperature rise above an ambient of 50Deg C at 1.2 times voltage factor for 30 seconds rating		
25.1	- For Winding	Deg C	50°C(max.)
25.2	- For Oil	Deg C	45°C(max.)

APPROVED

By Amar Deep Singh at 10:30 am, Sep 28, 2020

**SCHEDULE – C21
CVT**

Schedules & Annexure

Guaranteed Technical Particulars 66 KV OUT DOOR CAPACITIVE VOLTAGE TRANSFORMER			
S. No.	Description	Data By Purchaser	M/s Mehru Elect. & Mech. Engg.
26	Temperature rise above an ambient of 50Deg C at 1.5 times voltage factor for 30 seconds rating		
26.1	- For Winding	Deg C	50°C(max.)
26.2	- For Oil	Deg C	45°C(max.)
27	One minute power frequency dry& wet withstand voltage of capacitor	140kVrms	140kVrms
28	One minute power frequency withstand voltage of H.F terminal		3kV
29	1,2/50 microsecond impulse withstand test voltage	325 KVp	325 KVp
30	One minute Power frequency withstand voltage on secondary winding	3KV	3kV
31	Corona extinction voltage	kV	Not Applicable
32	Max Radio interference voltage at 1.1xUm/V ³	V	<2500uV
33	Minimum creepage distance in mm	2250 mm	2250 mm
34	Protective creepage distance in mm	1125 mm	1125 mm
35	Partial discharge test	<5 pC	<5 pc
36	Weight of core		Design parameter Cannot be furnished
37	Weight of oil		85kg (Approx.)
38	Total weight		325kg(approx.)
39	Mounting details		ø00±5xø00±5.20Dia Hole
40	Overall dimensions		As Per Drawings

APPROVED

By Amar Deep Singh at 10:30 am, Sep 28, 2020

○

MEHRU CAPACITOR VOLTAGE TRANSFORMER

AS PER TO IEC 44-5/3156-Part 4

MAXIMUM VOLTAGE	72 kV		RATED PRIMARY VOLTAGE	66KV-V3
RATED LINE VOLTAGE	66 kV	Wdg I	RATED SECONDARY VOLTAGE	110 V-V3
Equivalent Capacitance	4400pF (+10%-5%)		SECONDARY CONNECTION	1a -1n
FREQUENCY	50 Hz		BURDEN	50 VA
OVERVOLTAGE FACTOR	1.5 for 30 SECONDS		CLASS	0.2
CONTINUOUS VOLTAGE FACTOR	1.2	Wdg II	RATED SECONDARY VOLTAGE	110 V-V3
SIMULTANEOUS BURDEN	50VA - 50VA		SECONDARY CONNECTION	2a -2n
TEMPERATURE CATEGORY	-10°C to + 50°C		BURDEN	50 VA
INSULATION LEVEL	140/3250(Vrms/kV ₂)		CLASS	3 P
YEAR OF MFD.			THERMAL BURDEN	100 VA
Primary capacitance C1	6200pF (approx.)		TOTAL OIL QTY.	100 Ltrs
Primary capacitance C2	16000pF (approx.)		CAP. OIL QTY.	17 Ltrs
			SERIAL No.	

CAUTION : WHEN HF TERMINAL IS NOT IN USE IT SHOULD BE SHORTED TO EARTH.

CLASS OF INSULATION :- "A"

A - HV TERMINAL

C1 - PRIMARY CAPACITANCE

C2 - SECONDARY CAPACITANCE

HF - HIGH FREQUENCY TERMINAL

L - COMPENSATING REACTOR

F1&F2 - HRC FUSE 16A

Z - G - FERRO- RESONANCE SUPPRESSION CIRCUIT

P - PRIMARY WINDING OF INTERMEDIATE VT

S - SECONDARY WINDING OF INTERMEDIATE VT

Tr - INTERMEDIATE VOLTAGE TRANSFORMER

Total weight of CVT : 325Kgs. approx. Oil qty : 100 lbs approx.
MAX. TEMP. RISE AT 120% EXCITATION AND RATED BURDEN WHEN REFERRED SPEC. HEAT AMBIENT TEPT.

CUSTOMER : BSES Rajdhani Power Limited
 P.O.NO. : NRD01/23087254 Dated 20th August 2020

MADE IN INDIA BY
MEHRU ELECTRICAL AND MECHANICAL ENGINEERS (P) LTD.
 RIICO INDUSTRIAL AREA BHIWADI-301019 (RAJASTHAN)

175

165

APPROVED

By Amar Deep Singh at 10:30 am, Sep 28, 2020

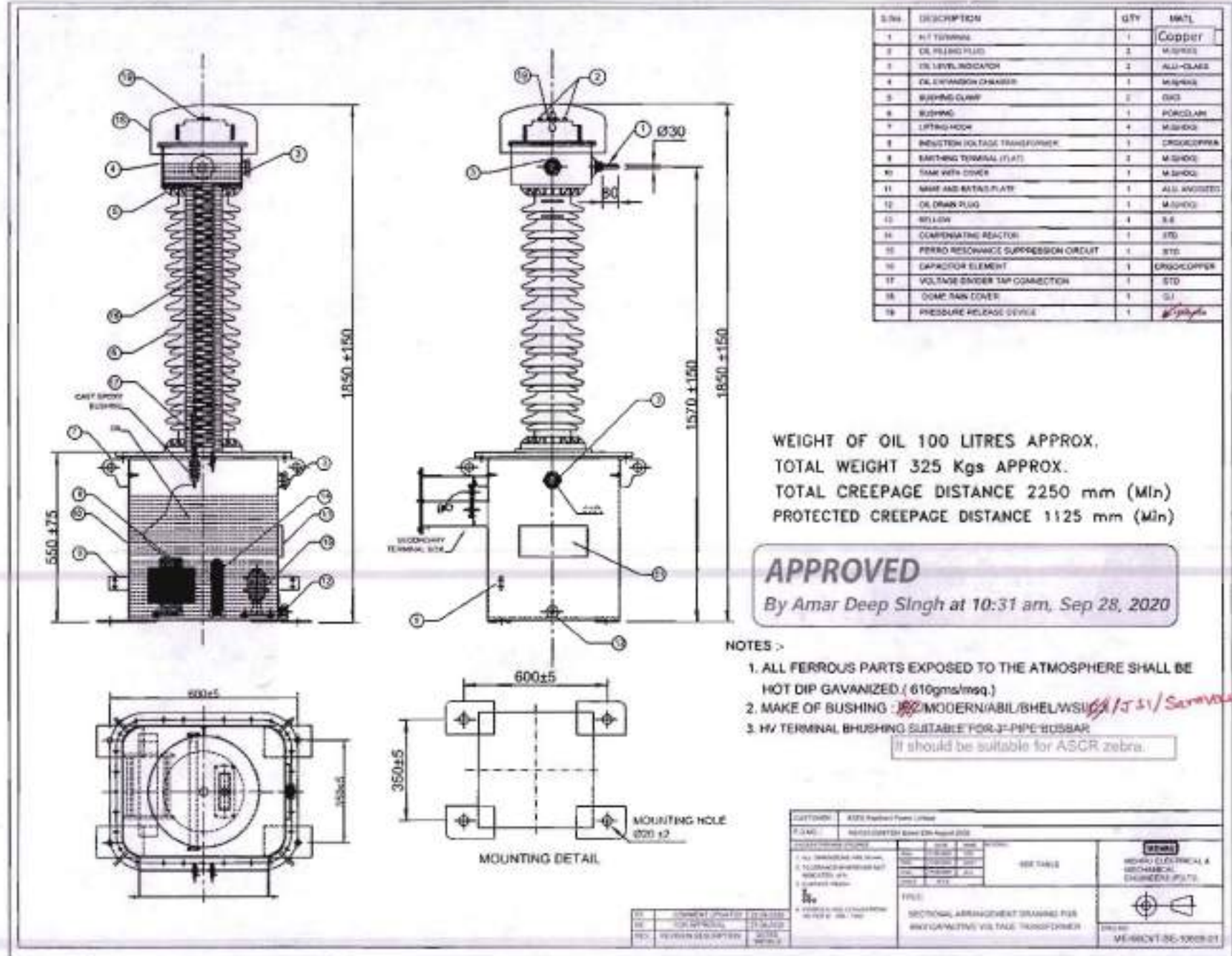
- NOTE :-
1. CAUTION TO BE MARKED IN RED COLOR,
 2. MIN. THICKNESS OF RATING PLATE :- 1.2 mm
 3. MATERIAL :- ALU. ANODISED.
 4. ALL DIMENSIONS IN mm
 5. DIMENSIONAL TOLERANCE ± 5 %

* Pl include PO No.

CUSTOMER : BSES Rajdhani Power Limited		P.O.NO. : NRD01/23087254 Dated 20th August 2020	
UNDER OPERATIVE SPECIES 1. ALL DIMENSIONS ARE IN mm. 2. TOLERANCE WHEREVER NOT INDICATED: ±5% 3. SURFACE FINISH 4. SYMBOLS AND CONVENTIONS AS PER IS: 8001 - 1982		DATE: 21.09.2020 TIME: 11:00 AM SCALE: N.T.S.	MATERIAL: ALU. ANODISED TITLE: NAME PLATE DRAWING FOR 66KV CAPACITIVE VOLTAGE TRANSFORMER
			MEHRU ELECTRICAL & MECHANICAL ENGINEERS (P) LTD.
			DRG NO: ME-66CVT-NP-10608-01

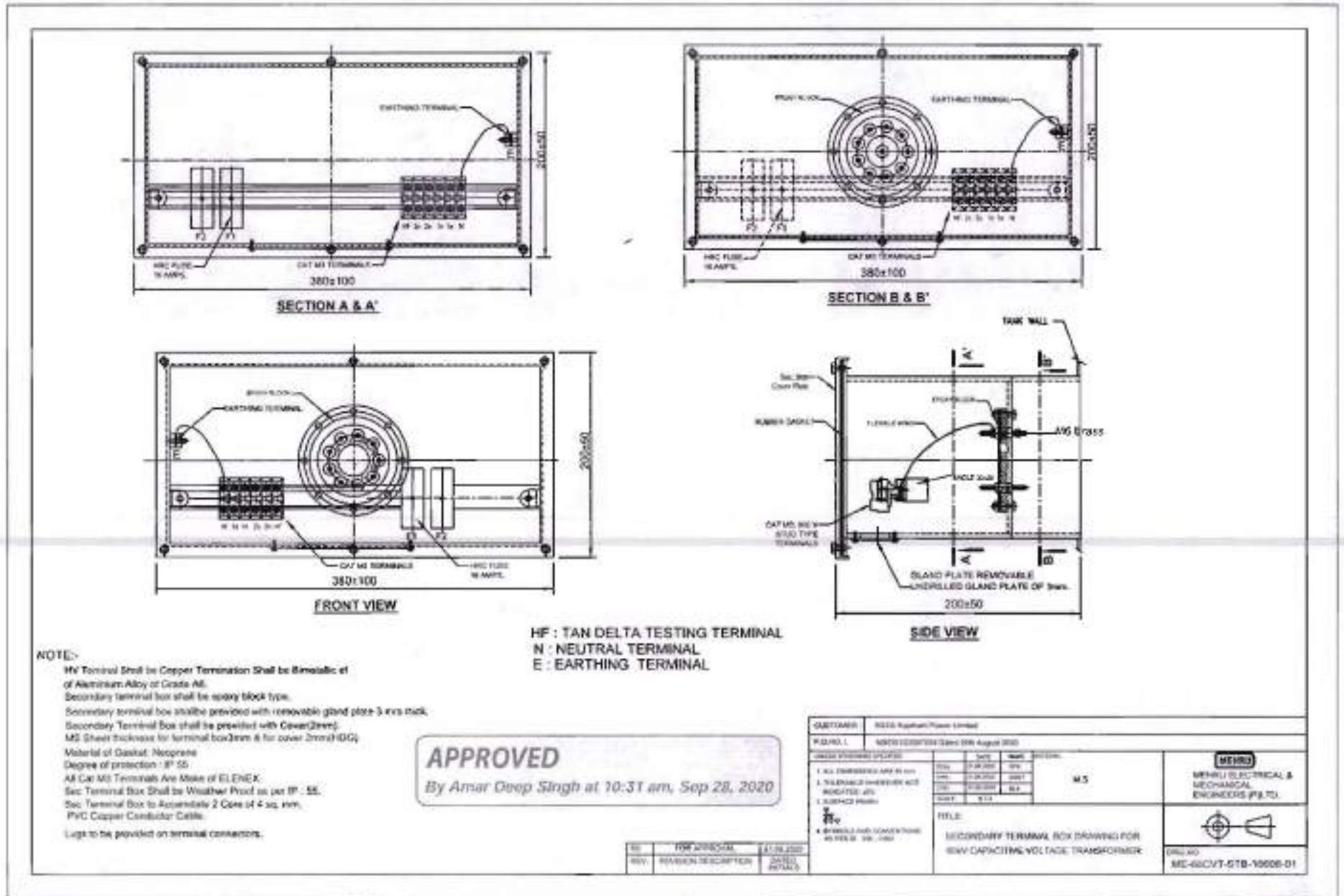
SCHEDULE - C21
CVT

Schedules & Annexure



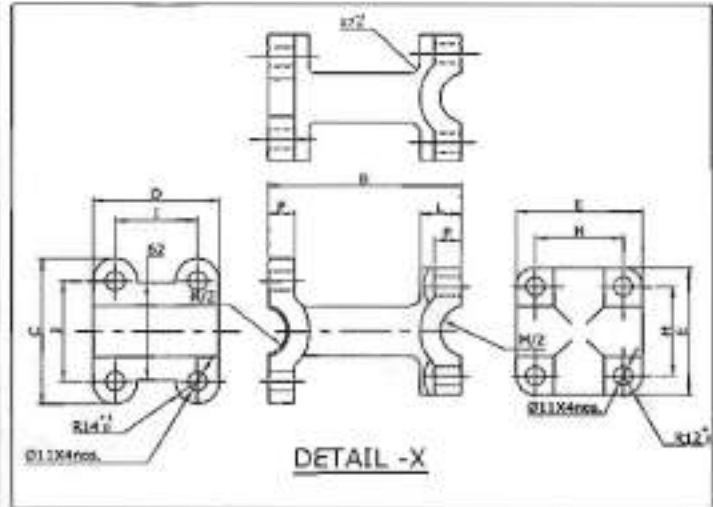
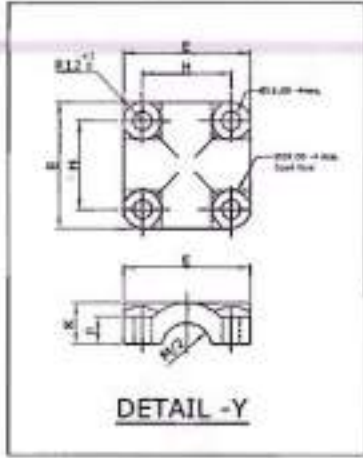
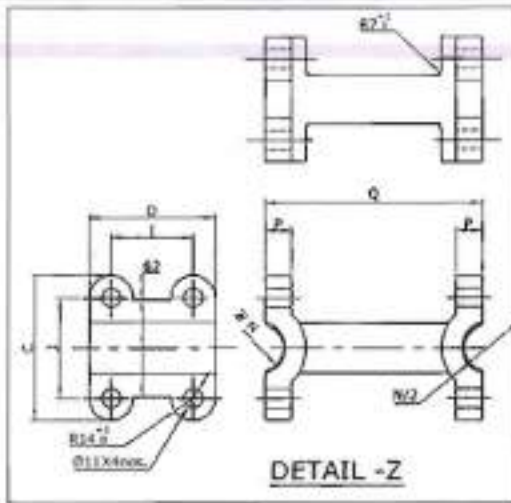
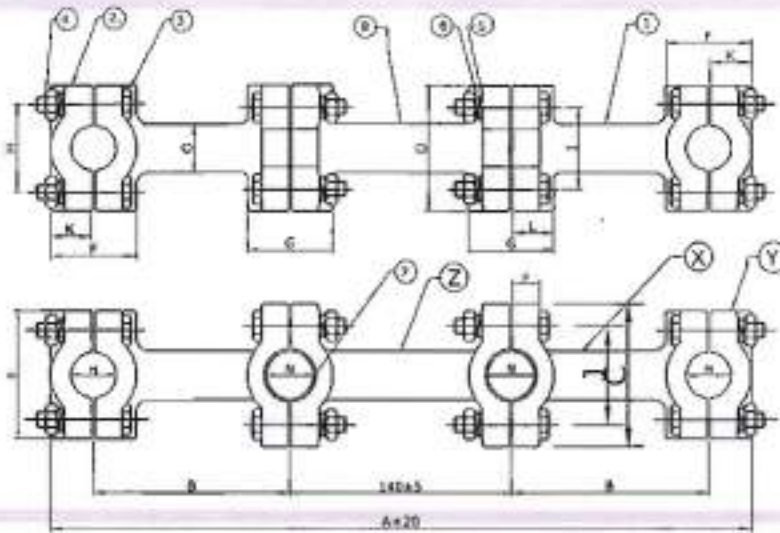
SCHEDULE - C21
CVT

Schedules & Annexure



SCHEDULE - C21
CVT

Schedules & Annexure



- NOTES**
1. ALL DIMENSIONS ARE IN mm.
 2. ALL SHARP CORNERS ROUNDED OFF.
 3. MANUFACTURING TOLERANCE $\pm 3\%$.
 4. MINIMUM THICKNESS 10mm.
 5. CURRENT DENSITY 1.2 A/50. mm.
 6. MAX. TEMP. RISE 35DEG.C ABOVE AMBIENT OF 50 DEG.C.
 7. DRAWING NOT TO SCALE.
 8. CONFIRMS TO IS 5561 (1970).
 9. GENERAL TOLERANCE $\pm 3\%$.
 10. APPROX WEIGHT 3.5kg.
 11. BOLT TIGHTENING TORQUE 35Nm.

S. NO.	ITEM DESCRIPTION	QTY.	MATERIAL
1.	CONNECTOR BODY 1	2.	ALUMINIUM
2.	CLAMPING PIECE	2.	ALUMINIUM
3.	M10 BOLT	12.	MS
4.	NUT	12.	MS
5.	PLAIN WASHER	12.	MS
6.	SPRING WASHER	12.	MS
7.	SLEEVE	1.	MS
8.	CONNECTOR BODY 2	1.	ALUMINIUM

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
440	125	90	80	80SQ	54	38	56SQ	52	62	26	26	Ø28.62	Ø30	Ø32	16	140



APPROVED
By Amar Deep Singh at 10:49 pm, Aug 28, 2020

NO.	FOR APPROVAL	DATE
1.	DESIGNER	23.08.2020
2.	REVISION DESCRIPTION	DATE

<p>DESIGN CHECKED BY: _____</p> <p>DATE: _____</p> <p>SCALE: 1:1</p>	<p>DATE: _____</p> <p>SCALE: 1:1</p>	<p>NAME: A. ALLOY</p> <p>MEHRU ELECTRICAL AND MECHANICAL ENGINEERS PUNE (INDIA)</p> <p>SCALE: N.T.S.</p> <p>DRAWING NO: ME-66CT-TC-10384-01</p>
<p>TITLE: TERMINAL CONNECTOR FOR TWIN ZEBRA CONDUCTOR Ø28.62 WITH 48mm TERMINAL</p>		

BSES

BSES Rajdhani Power Ltd

PROJECT		General	
Name of Vendor		M/s Mehru Electrical and Mechanical Engineers Private Limited	
Contact person:		Mr Rishi	
Transmittal No.		BRPL-2018-2019-491	
Revision No.		R0	
Date of approval		27.11.2018	
DOCUMENT TITLE: Drawing Approval of 66 kV PT (4 Core) Details—1) Complete GTP and drawing of 66 kV PT 2) Terminal Connector for 66 kV PT 3) Rating and Circuit Diagram Plate			
PURCHASE NO.		NB/D01/23084435,	
Quantity		As per PO	
Supplier Document Review			
Permission to proceed does not constitute acceptance or approval of design, calculation, analysis, test methods or materials developed or selected by supplier and does not relieve supplier from full compliance with contractual obligations.			
<input checked="" type="checkbox"/>	1. Work to Proceed	<input type="checkbox"/>	3. Revise & Resubmit. Work not to proceed
<input type="checkbox"/>	2. Revise & resubmit. Work may proceed subject to incorporation of change indicated	<input type="checkbox"/>	4. Review not required. Work to proceed
Department : Central Engineering Services			
COMMENTS : 1) Inspection Call shall be raised 10 Days in advance 2) Painting of Equipment ID shall be in Vendors scope and ID shall be provided by BSES.			
PREPARED BY		APPROVED BY	
NAME	SIGN	NAME	SIGN
Renu Bala		Abhinav Srivastava	 27/11/18

GURANTEED TECHNICAL PARTICULARS FOR 66 KV PT		
Sr.n.	Description	Data By Supplier
1	Location of Equipment	
2	Name of Manufacturer	Mehru India
3	Address & Contact details	E-1247 RIICO Ind. Area, Phase-1, Phase-1, Bhiwadi-301019
4	Type	Outdoor, Oil Cooled, Single Phase, Single Pole Insulated, Electromagnetic type, Voltage Transformer <i>Dead Tank PT</i>
5	Manufacturer Model No	66 kV PT
6	Reference design ambient temperature	50 Deg C
7	Reference Standard	IS: 3156 (Part1)
8	Nominal system voltage	66KV
9	Highest system voltage	72.5KV
10	Basic Insulation level	325KVp
11	Power frequency voltage	140KV
12	Type of cooling	Oil cooled
13	Rated frequency (Hz)	50 Hz
14	Insulation Class	A
15	Rated Primary voltage	66KV / $\sqrt{3}$
16	Rated secondary voltage	110V / $\sqrt{3}$
17	Number of secondary cores	Four
18	CORE Specifications	
18.1	Core - 1, 3 & Core-4	Core - 1, 3 & Core-4
18.2	Purpose	Metering
18.3	Rated Output	50 VA
18.4	Class of accuracy	0.2
18.5	Ratio error	Within limit as per IS 3156-1992
18.6	Phase angle error	Within limit as per IS 3156-1992
19	Core - 2	Core-2
19.1	Purpose	Protection
19.2	Rated Output	50 VA
19.3	Class of accuracy	3P
19.4	Ratio error	Within limit as per IS 3156-1992
19.5	Phase angle error	Within limit as per IS 3156-1992
20	Rated over voltage factor	
20.1	Continuous	1.2 times
20.2	- 30 Seconds	1.5 times

Transmittal No.	Date: 02/11/18	By: <i>[Signature]</i>
ACTION LEGEND		
1. Work to proceed		
2. Revise and Resubmit. Work to proceed subject to incorporation/resolution of indicated comments		
3. Revise and Resubmit. Work NOT to proceed		
4. Review not required. Work to proceed		
BRPL - CES		

21	Temperature rise above an ambient of 50Deg C at 1.2 times voltage factor for 30 seconds rating	
21.1	For Winding	50 Deg C
21.2	For Oil	40 Deg C
22	Temperature rise above an ambient of 50Deg C at 1.5 times voltage factor for 30 seconds rating	
22.1	For Winding	50 Deg C
22.2	For Oil	40 Deg C
23	One minute power frequency dry withstand voltage for 66 kV PT (KV rms)	140 kV
24	One minute power frequency wet withstand voltage for 66 kV PT (KV rms)	140 kV
25	1.2/50 microsecond impulse withstand test voltage for 66 KV PT (KV rms)	325 KVp
26	One minute Power frequency withstand voltage on secondary winding	3KV
27	Minimum creepage distance in mm for 66KV PT	2250 mm
28	Protective creepage distance in mm for 66KV PT	50% of total creepage
29	Partial discharge test, whether will be carried out Yes / No	Yes
30	Weight of core	As per Drawing enclosed
31	Weight of oil	40 Liters
32	Total weight	250 Kg
33	Mounting details	437±5 X 437 ±5
34	Overall dimensions	1600 ±100 mm
35	Terminal connector	Drawing enclosed

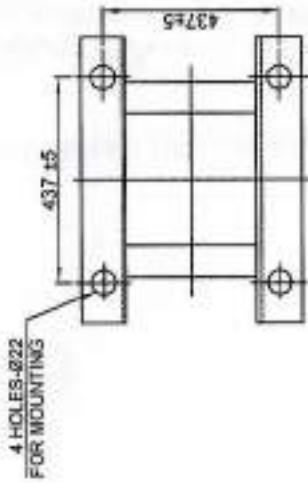


401 02-11-18

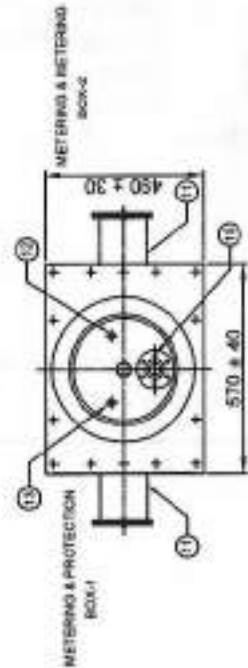
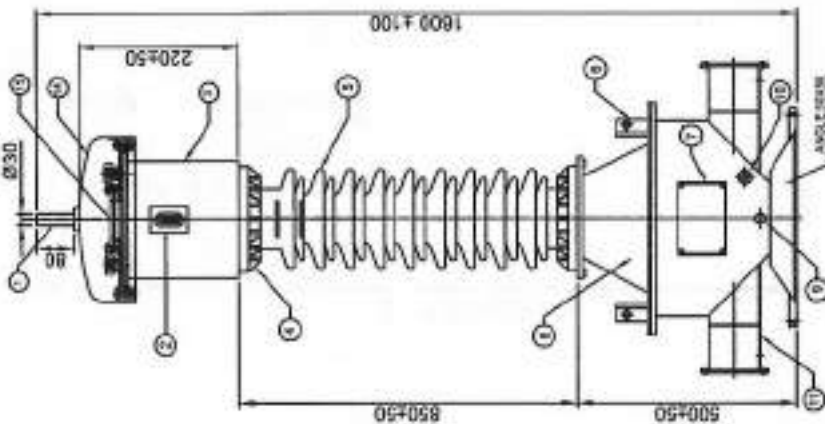
Transmittal No.	Date:	By: <i>Tej</i>
ACTION LEGEND		
1. Work to proceed		
2. Revise and Resubmit. Work to proceed subject to incorporation/resolution of indicated comments		
3. Revise and Resubmit. Work NOT to proceed		
4. Review not required. Work to proceed.		
BRPL - CES		

Copper Silver
Applied

S.No.	DESCRIPTION	QTY	MATL
1	P.T TERMINAL	1	ALUMIUM
2	OIL LEVEL INDICATOR	1	ALUMIUM
3	OIL EXPANSION CHAMBER	1	M.S.
4	BUSHING CLAMP	2	G.I
5	BUSHING (IEC, ABB, ASEA, (Medium))	1	PORCELAIN
6	LIFTING LUG	4	M.S.
7	NAME AND RATING PLATE	1	ALUMIUM
8	TANK WITH COVER	1	M.E.
9	OIL DRAIN PLUG	1	M.E.
10	EARTHING TERMINAL	2	S.S.
11	SECONDARY & EARTHING TERMINAL BOX	2	M.S.
12	NITROGEN VALVE	1	BRASS
13	OIL FILLING PLUG	1	M.E.
14	DOME	1	G.I.
15	PRESSURE RELEASE DEVICE	1	ALUMIUM



MOUNTING DETAILS



NOTES :-

1. MAKE OF BUSHING : IEC/MODERN/ABIL/WIS/HEL/C-JI
 2. ALL FERROUS PARTS EXPOSED TO THE ATMOSPHERE SHALL BE HOT DIP GALVANISED (610GM/SQ.mm.)
- 0.5% Cr
- * TOTAL CREEPAGE DISTANCE 2248mm MIN.
 - * OIL QUANTITY 40LTRS.(36Kgs) APPROX.
 - * TOTAL WEIGHT 250 Kg. APPROX.

2-7-11-18

101

ACTION LEGEND

1. WORK TO BE COMPLETED BY DATE 20/07/2018

2. WORK TO BE COMPLETED BY DATE 20/07/2018

3. WORK TO BE COMPLETED BY DATE 20/07/2018

4. WORK TO BE COMPLETED BY DATE 20/07/2018

5. WORK TO BE COMPLETED BY DATE 20/07/2018

6. WORK TO BE COMPLETED BY DATE 20/07/2018

7. WORK TO BE COMPLETED BY DATE 20/07/2018

8. WORK TO BE COMPLETED BY DATE 20/07/2018

9. WORK TO BE COMPLETED BY DATE 20/07/2018

10. WORK TO BE COMPLETED BY DATE 20/07/2018

11. WORK TO BE COMPLETED BY DATE 20/07/2018

12. WORK TO BE COMPLETED BY DATE 20/07/2018

13. WORK TO BE COMPLETED BY DATE 20/07/2018

14. WORK TO BE COMPLETED BY DATE 20/07/2018

15. WORK TO BE COMPLETED BY DATE 20/07/2018

16. WORK TO BE COMPLETED BY DATE 20/07/2018

17. WORK TO BE COMPLETED BY DATE 20/07/2018

18. WORK TO BE COMPLETED BY DATE 20/07/2018

19. WORK TO BE COMPLETED BY DATE 20/07/2018

20. WORK TO BE COMPLETED BY DATE 20/07/2018

DATE	NAME	NATURE OF TREATMENT
11.08.2018	S.S.	
11.08.2018	SP	
11.08.2018	S.S.	
11.08.2018	S.S.	
11.08.2018	S.S.	

SEE TABLE

GENERAL ARRANGEMENT DRAWING
FOR 66 KV POTENTIAL TRANSFORMER.

INSULATORS SPECIES:
1. ALL DIMENSIONS IN MM
2. TOLERANCE UNLESS NOT INDICATED AS
3. SURFACE FINISH

SYMBOLS AND CONDITIONS AS PER IS 88-1:1982

REV.	REVISION/DESCRIPTION	DATE	INITIALS
R1	COMMENT UPDATED	28.02.2018	
R2	FOR APPROVAL	05.03.2018	

DATE	NAME	NATURE OF TREATMENT
11.08.2018	S.S.	
11.08.2018	SP	
11.08.2018	S.S.	
11.08.2018	S.S.	
11.08.2018	S.S.	

DATE	NAME	NATURE OF TREATMENT
11.08.2018	S.S.	
11.08.2018	SP	
11.08.2018	S.S.	
11.08.2018	S.S.	
11.08.2018	S.S.	



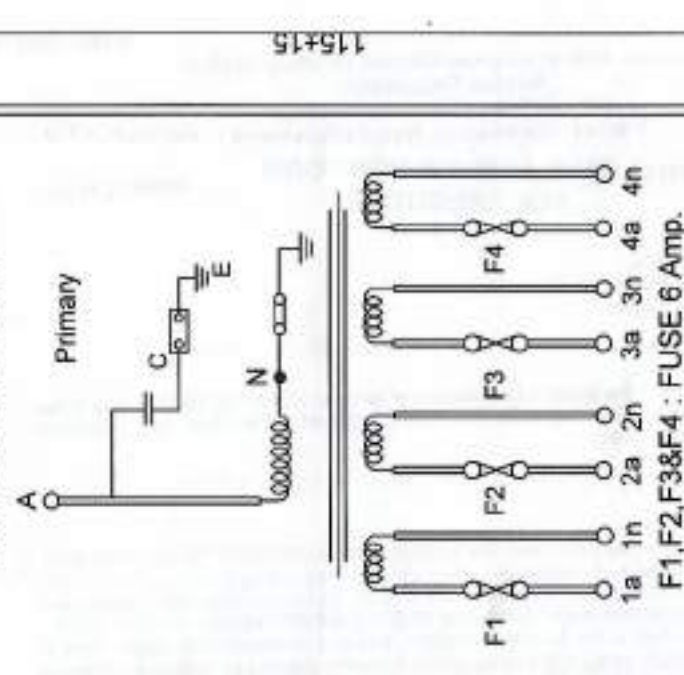
MEHRU VOLTAGE TRANSFORMER

SR.No.		REF.STD.	IS 3156/1992
TYPE	Outdoor Oil Cooled	RATIO	66 kV / √3
Highest System Voltage	72.5 kV	BURDEN	110V/√3 - 110V/√3 - 110V/√3 - 110V/√3
PHASE	Single	CLASS	50VA - 50VA - 50VA - 50VA
Insulation level	140/325 kV	Simultaneous Burden	0.2 - 3P - 0.2 - 0.2
Thermal Burden	200 VA	Type	50VA - 50VA - 50VA - 50VA
Frequency	50 HZ	TIME CONT. & TIME FOR	Earthed 30 Sec
Voltage Factor	1.2	YEAR OF MFG.	2018

Warranty:- 66 months from the date of supply or 60 month from the date of commissioning whichever is earlier.
 * TOTAL CREEPAGE DISTANCE 2248mm MIN. * TOTAL WEIGHT 250 Kg. APPROX.
 * OIL QUANTITY 40 LTRS. (36Kgs)/APPROX.

MADE IN INDIA BY:
MEHRU ELECTRICAL AND MECHANICAL ENGINEERS (P) LTD.
 E-1247 RIICO INDUSTRIAL AREA , PHASE I , EXT GHATAL , BHIWADI-301 019

SUITABLE FOR HOT LINE WASHING
 CONNECTION DIAGRAM



F1, F2, F3 & F4 : FUSE 6 Amp.
 CAUTION : DONOT REMOVE EARTH WHEN HV IS LIVE

195±20

TRIP 10/1
 By: *[Signature]*
 Date: *[Date]*

ACTION LEGEND

1. Work to proceed. With **WATERPROOF** NAME PLATE : ANODIZED ALUMINUM
2. Errors and Resubmit. With **WATERPROOF** NAME PLATE : ANODIZED ALUMINUM
3. Revise and Resubmit. With **WATERPROOF** NAME PLATE : ANODIZED ALUMINUM
4. Review not required. With **WATERPROOF** NAME PLATE : ANODIZED ALUMINUM

NOTES:
 1. Thickness: 1.2 MM
 2. Material: ALU. ANODIZED
 3. Finish: BRPL - GEG

DATE	NAME	WATERPROOF	FINISH
02.08.2018	SPS		
02.08.2018	SP		
02.08.2018	RLS		
SCALE	N.T.S		
TITLE	NAME PLATE DRAWING FOR 66 KV POTENTIAL TRANSFORMER.		

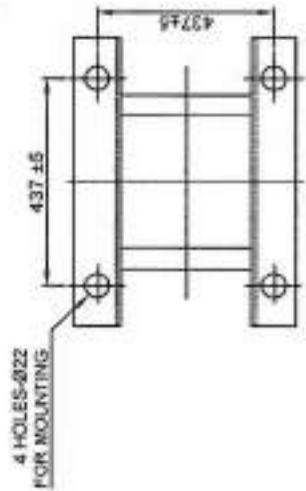
REV.	COMMENT/UPDATED FOR APPROVAL	DATE
R1		02.08.2018
R2		02.08.2018
R3		

MEHRU ELECTRICAL & MECHANICAL ENGINEERS (P) LTD.

DRG NO
 ME-66PT-NP-8579-01/R1

Copper Silver
Plated

S.No.	DESCRIPTION	QTY	MATL.
1	HT TERMINAL	1	ALUMINIUM
2	OIL LEVEL INDICATOR	1	ALU-GLASS
3	OIL EXPANSION CHAMBER	1	M.S.
4	BUSHING CLAMP	3	MS
5	BUSHING	1	PORCELAIN
6	LIFTING LUG	4	M.S.
7	NAME AND RATING PLATE	1	ALU/Anodized
8	TANK WITH COVER	1	M.S.
9	OIL DRAIN PLUG	1	M.S.
10	EARTHING TERMINAL	2	M.S.
11	SECONDARY & EARTHING TERMINAL BOX	2	M.S.
12	NITROGEN VALVE	1	BRASS
13	OIL FILLING PLUG	1	M.S.
14	DOOR	1	G.I.
15	PRESSURE RELEASE DEVICE	1	ALU/Bronze
16	BUSHING GASKET	2	SRBC
17	LT COIL WITH PAPER INSULATION	1	COPPER
18	HT COIL WITH PAPER INSULATION	1	COPPER
19	STACK LAMINATION	1	CSGG



MOUNTING DETAILS

NOTES :-

1. MAKE OF BUSHING : IEC/MODERN/ABIL/WSI/BHE/JC/JI
2. ALL FERROUS PARTS EXPOSED TO THE ATMOSPHERE SHALL BE HOT DIP GALVANISED (610GM/SQ.mm.)

* TOTAL CREEPAGE DISTANCE 2248mm MIN.

* OIL QUANTITY 40L TRS.(36Kgs) APPROX.

* TOTAL WEIGHT 250 Kg. APPROX.

491

22-11-18

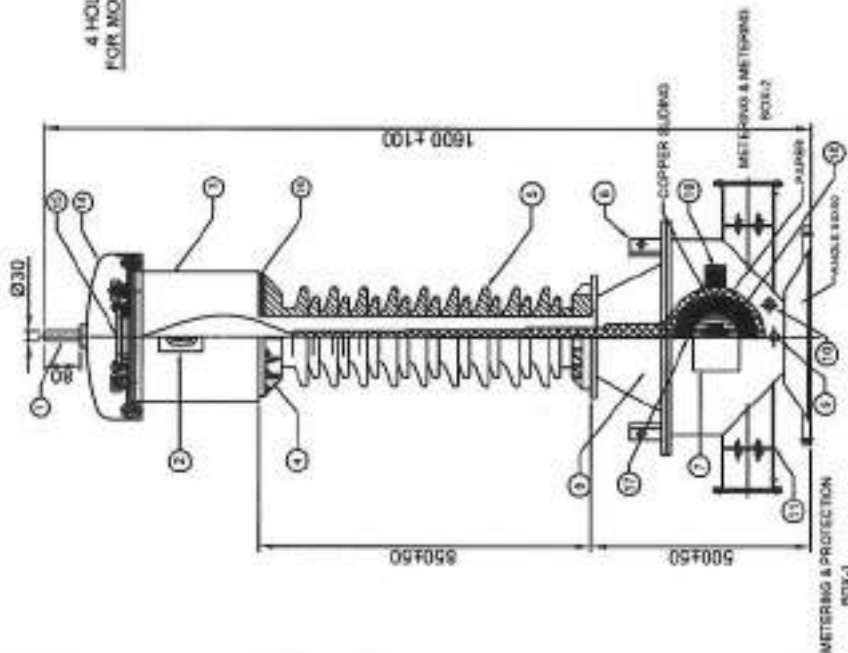
By: PL

Transmittal No.	By
491	PL

ACTION LEGEND

1. Work to proceed
2. Revise and Resubmit. Work to be not subject to incorporation/resubmission of it to client/contractor.
3. Revise and Resubmit. Work to be not subject to incorporation/resubmission of it to client/contractor.
4. Review not required. Work to be not subject to incorporation/resubmission of it to client/contractor.

BRPL - CES



SEE TABLE	
SECTIONAL ARRANGEMENT DRAWING FOR 66 KV POTENTIAL TRANSFORMER.	
DRG.NO ME-66PT-SE-6675-01R1	

UNLESS OTHERWISE SPECIFIED 1. ALL DIMENSIONS IN MM 2. TOLERANCE UNLESS NOT SPECIFIED ARE 3. SURFACE FINISH 4. SYMBOLS AND CONVENTIONS AS PER IS: ISK-1982	DATE: _____ NAME: _____ DESK: _____ SCALE: 1:1 TITLE: SECTIONAL ARRANGEMENT DRAWING FOR 66 KV POTENTIAL TRANSFORMER.
---	--

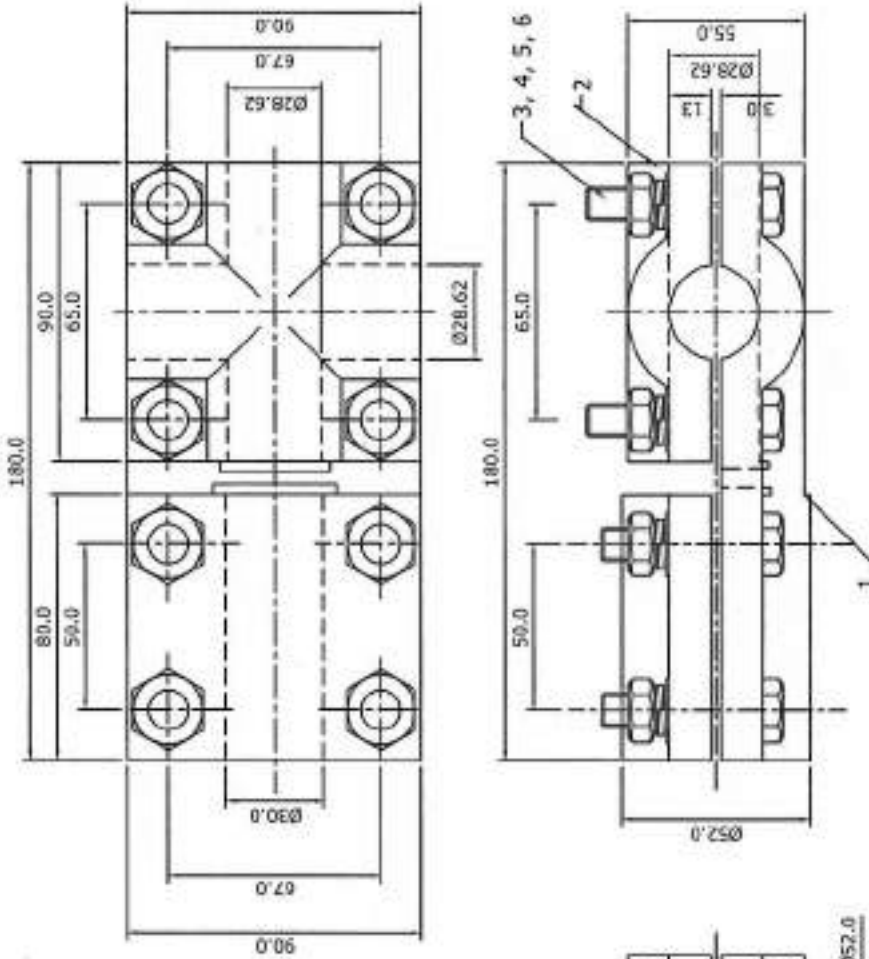
REV.	REVISION/DESCRIPTION	DATE	BY
01	FOR APPROVAL	26.08.2018	
02	COMMENT UPDATED	02.08.2018	

SCHEDULE - 21
OUTDOOR PT

Schedules & Annexure

S. NO.	ITEM DESCRIPTION	QTY.	MATERIAL
1.	CONNECTOR BODY	01.	Alu. Alloy
2.	CLAMPING PIECE	02.	Alu. Alloy
3.	BOLT M10X50 long	08.	GI
4.	NUT	08.	GI
5.	PLAIN WASHER	08.	GI
6.	SPRING WASHER	08.	SS.

110.1
02-11-19
Date: _____ By: _____
ACTION LEGEND
1. Work to proceed. Work to proceed subject to Review and Resubmit. Work to proceed subject to incorporate resolution of indicated comments.
2. Review and Resubmit. Work NOT to proceed.
3. Review and Resubmit. Work to proceed.
4. Review not required. Work to proceed.
BRPL - CES



NOTE :-

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. DIMENSIONS INDICATED ARE SUBJECT TO MFG TOLERANCE $\pm 5\%$
3. ALL SHARP CORNERS SHALL BE ROUNDED OFF TO AVOID CORONA AND RADIO INTERFERENCE.
4. THE TERMINAL CONNECTOR SHALL BE MADE BY PRESSURE DIE CASTED.

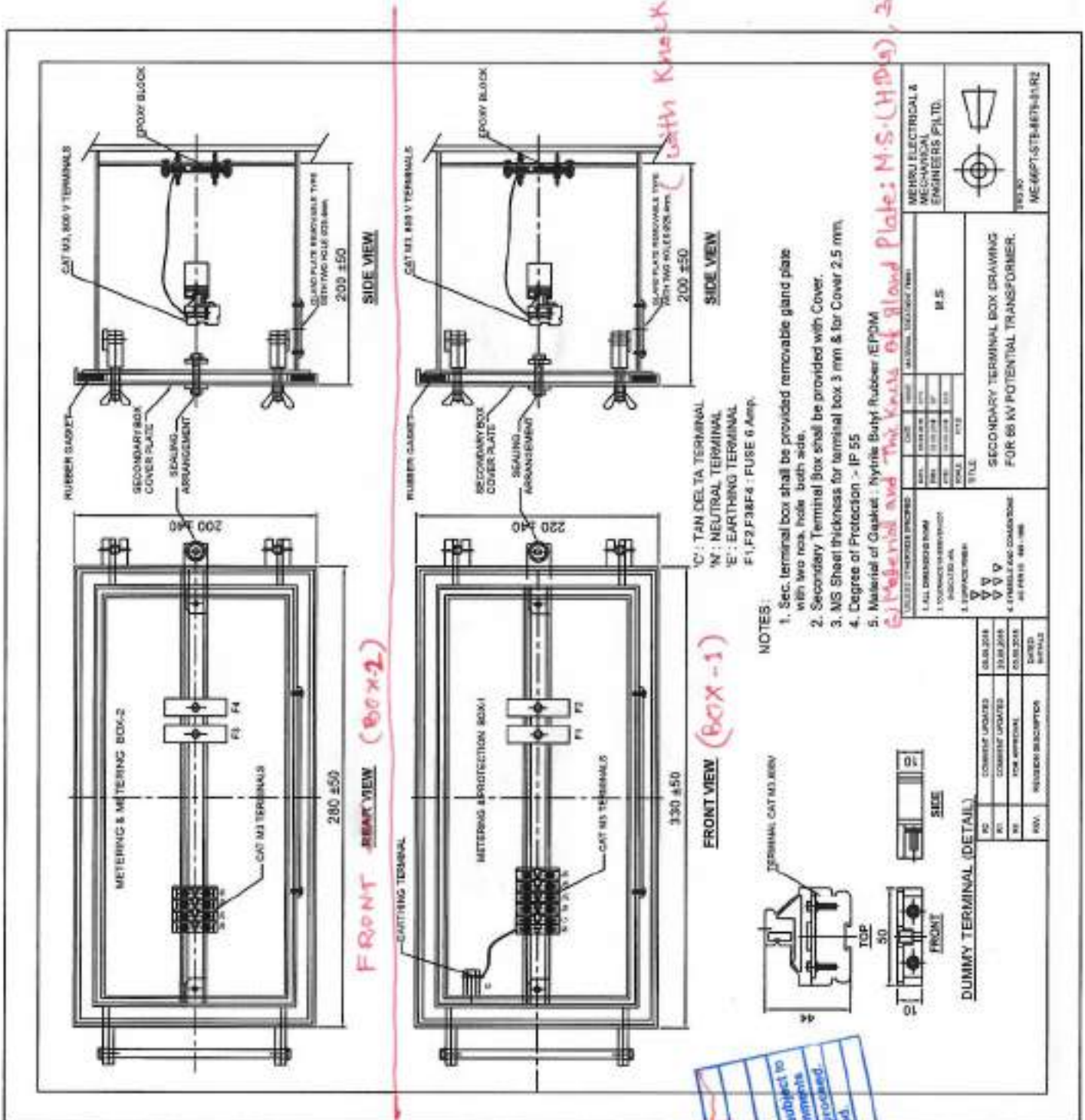
UNLESS OTHERWISE SPECIFIED	DATE	NAME	MATERIAL
1. ALL DIMENSIONS ARE IN MM	02.11.2019	BRPL	ALU. ALLOY
2. TOLERANCE UNLESS NOT INDICATED: $\pm 5\%$	02.11.2019	BRPL	ALU. ALLOY
3. SURFACE FINISH	02.11.2019	BRPL	ALU. ALLOY
4. SYMBOLS AND CONVENTIONS AS PER IS: 456 - 1988	02.11.2019	BRPL	ALU. ALLOY

TITLE : UNIVERSAL ZEBRA CONDUCTOR FOR 30mm TERMINAL OF 66KV POTENTIAL TRANSFORMER

MEHRU ELECTRICAL & MECHANICAL ENGINEERS (P) LTD.

DRG. NO ME-66PT-TC-8679-01

REV.	REVISION DESCRIPTION	DATE	BY
01	FOR APPROVAL	02.11.2019	BRPL
02	REVISION DESCRIPTION		



FRONT REAR VIEW (BOX-2)

FRONT VIEW (BOX-1)

C: TAN DELTA TERMINAL
N: NEUTRAL TERMINAL
E: EARTHING TERMINAL
F1, F2 F38F4 - FUSE 6 Amp.

NOTES:

1. Sec. terminal box shall be provided removable gland plate with two knock holes both side.
2. Secondary Terminal Box shall be provided with Cover.
3. MS Sheet thickness for terminal box 3 mm & for Cover 2.5 mm.
4. Degree of Protection - IP 55
5. Material of Gasket - Nitrile Butyl Rubber / EPDM

G. Material and Thickness of Gland Plate: M.S. (HDG), 2mm thick

1101
27.11.14
Date. By: BRPL - CES

ACTION LEGEND

1. Work to proceed
2. Review and Resolution of indicated comments
3. Review and Resubmit. Work to proceed
4. Review not required. Work to proceed

DUMMY TERMINAL (DETAIL)

NO.	REVISION	DATE	DESCRIPTION
01	ISSUED FOR APPROVAL	27/11/14	
02	FOR APPROVAL		
03	FOR APPROVAL		
04	FOR APPROVAL		

SECONDARY TERMINAL BOX DRAWING FOR 85 KV POTENTIAL TRANSFORMER.



REG. NO. ME-66PT-1574-1675-11-R2

SCHEDULE – D
LIST OF INSTALLATIONS

S.No.	Purchaser	Project	PF Ref.	Brief Description	Value	Target Commissioning	Commissioned	Performance	Person to whom reference may be made	Remarks
1	2	3	4	5	6	7	8	9	10	11

Seal of Company

Bidders Name : _____
 Signature : _____
 Name : _____
 Designation : _____
 Date : _____

SCHEDULE – E1

TECHNICAL DEVIATIONS FROM THE SPECIFICATION

(This shall form part of Technical Bid)

All the technical deviation from the tender specification shall be listed out by the Bidder, para by para in this schedule. Deviation taken in covering letter, standard terms and/or body of the Bid but not listed herein will make the Bid liable for rejection as 'Irresponsive'

S.No.	Section/Sub-Section	Part	Para	Deviation	Justification
1	2	3	4	5	6

Certified that above are the only technical deviations from the tender Specification

Name of Firm : _____
Signature of Bidder : _____
Designation : _____
Date : _____

Seal of Company

SCHEDULE – E2

COMMERCIAL DEVIATIONS FROM THE SPECIFICATION

(This shall form part of Technical Bid)

All the commercial deviation from the tender specification shall be listed out by the Bidder, para by para in this schedule. Deviation taken in covering letter, standard terms and/or body of the Bid but not listed herein will make the Bid liable for rejection as 'Irresponsive'.

S.No.	Section/Sub-Section	Part	Para	Deviation	Justification
1	2	3	4	5	6

Certified that above are the only technical deviations from the tender Specification

Name of Firm : _____
Signature of Bidder : _____
Designation : _____
Date : _____

Seal of Company

SCHEDULE – F
DELIVERY TERMS AND CONDITIONS

1	Quoted for all the items & in the manner as called for in Specification	*Yes/No
1.1	If not, furnish details of deviations	
2	Price FOR site delivery basis	
2.1	Freight:	
	1 Applicable rate	* Not included/included
2.2	Transit Insurance including forty five(45) days storage	
	1 Applicable rate	* Not included/included
2.3	Excise duty	
	1 Applicable rate	* Not included/included
2.4	Sales tax	
	1 Applicable rate	* Not included/included
2.5	Are quoted price firm	*Yes/No
3	Delivery from LOI	
3.1	Supply	
3.2	Erection	
3.3	Testing & commissioning	
3.4	Whether penalty clause acceptable	*Yes/No
4	Validity	
5	Terms of payment	
5.1	As per tender specification	*Yes/No
5.2	If not, give details	
6	Guarantee period	
6.1	Is it as per the tender specification	*Yes/No
6.2	If not, state alternative guarantee period acceptable	
7	Earnest money furnished	*Yes/No
8	Agreeable to furnish security deposit as per the tender specification	*Yes/No
8.1		*Yes/No
9	Agreeable to furnish performance Bank as per the tender specification	*Yes/No
10	Correspondence, drawings, test certificates, instruction manuals, BAR/PERT charts progress reports etc. shall be furnished in number of copies as per distribution schedule attached to the tender specification	*Yes
11	Agreeable to approval of above documents in our (4) weeks from date of receipt as per tender specification	Yes
12	Agreeable to commercial as well as technical terms & conditions of the tender specification, unless listed deviations are accepted	Yes
13	Commencing & completion of submission of drawings from LOI	

Seal of Company

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Date : _____

SCHEDULE – G

SCHEDULE OF TEST

(This shall form part of Technical Bid)

Tests as per the relevant Indian Standard except as modified and/or as additionally called for in the tender specification shall be performed. Detailed list of the type test certificates enclosed for the various equipments offered shall be listed in the schedule.

S.No.	Type of test	Equipment	Description
1	2	3	4

1.0 TYPE TESTS

2.0 TESTS
– DURING MANUFACTURE

3.0 ROUTINE TESTS
– ON COMPLETION OF MANUFACTURE

Name of Firm : _____

Signature of Bidder : _____

Designation : _____

Date : _____

Seal of Company

SCHEDULE – H
LIST OF INSTRUMENTS, TESTING EQUIPMENTS, TOOLS AND TACKLES
FOR ERECTION AND MAINTANANCE

(This shall form part of Technical Bid)

S.No.	Description	Capacity	Quantity	Delivery
(1)	(2)	(3)	(4)	(5)

1.0 INSTRUMENTS, TESTING EQUIPMENT, TOLLS & TACKLES FOR ERECTION
(To be taken back by the Bidder after completion of job)

2.0 INSTRUMENTS, TESTING EQUIPMENT, TOOLS & TACKLES FOR MAINTENANCE
(To be taken back by the Bidder after completion of job)

3.0 SPECIAL INSTRUMENTS, TSTING EQUIPMENT, TOOLS & TACKLES FOR ERECTION
(To be taken back by the Bidder after completion of job)

4.0 SPECIAL INSTRUMENTS, TSTING EQUIPMENT, TOOLS & TACKLES FOR MAINTENANCE
(To be taken back by the Bidder after completion of job)

Name of Firm : _____

Signature of Bidder : _____

Designation : _____

Date : _____

Seal of Company

SCHEDULE – I

SCHEDULE OF RECOMMENDED SPARES

Bidder shall offer the prices for spares for destination, rate of taxes & duties to be considered shall be indicated.

S.No.	Description	Quantity	Unit Price	Total Price
1	2	3	4	5

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company

Date : _____

SCHEDULE – J
DECLARATION

(This shall form part of Technical Bid)

I, _____ certify that all the typed data & information pertaining to the subject tender specification are correct & are true representation of the equipment covered by our formal Bid No _____ dated _____.

I hereby, certify that I am duly authorized representative of the Bidder whose name appears above my signature.

Bidders Name : _____

Authorized Representative
Signature : _____

Authorized Representative
Name (Typed) : _____

Authorized Representative
Designation : _____

Seal of Company Date : _____

Bidder's Intent : The bidder hereby agrees to fully comply with the requirements & intents of the subject tender specification for the price(s) indicated

Authorized Representative
Signature : _____

Annexure-O

Technical specification for New Grids 24x7 O&M support

Scope:

24x7 (8 Hours per shift) O&M support for equipment supplied by bidder after Handing over of Grid by Vendor to BRPL

O&M Shall cover following

Operation:

- Handling equipment with training (on job) to BRPL staff.
- Knowledge of sequence of operation (bidder to provide flow chart for the same in laminated form so that the same may be pasted on grid notice board).
- Competency level in electrical as well as mechanical operations.

Breakdown:

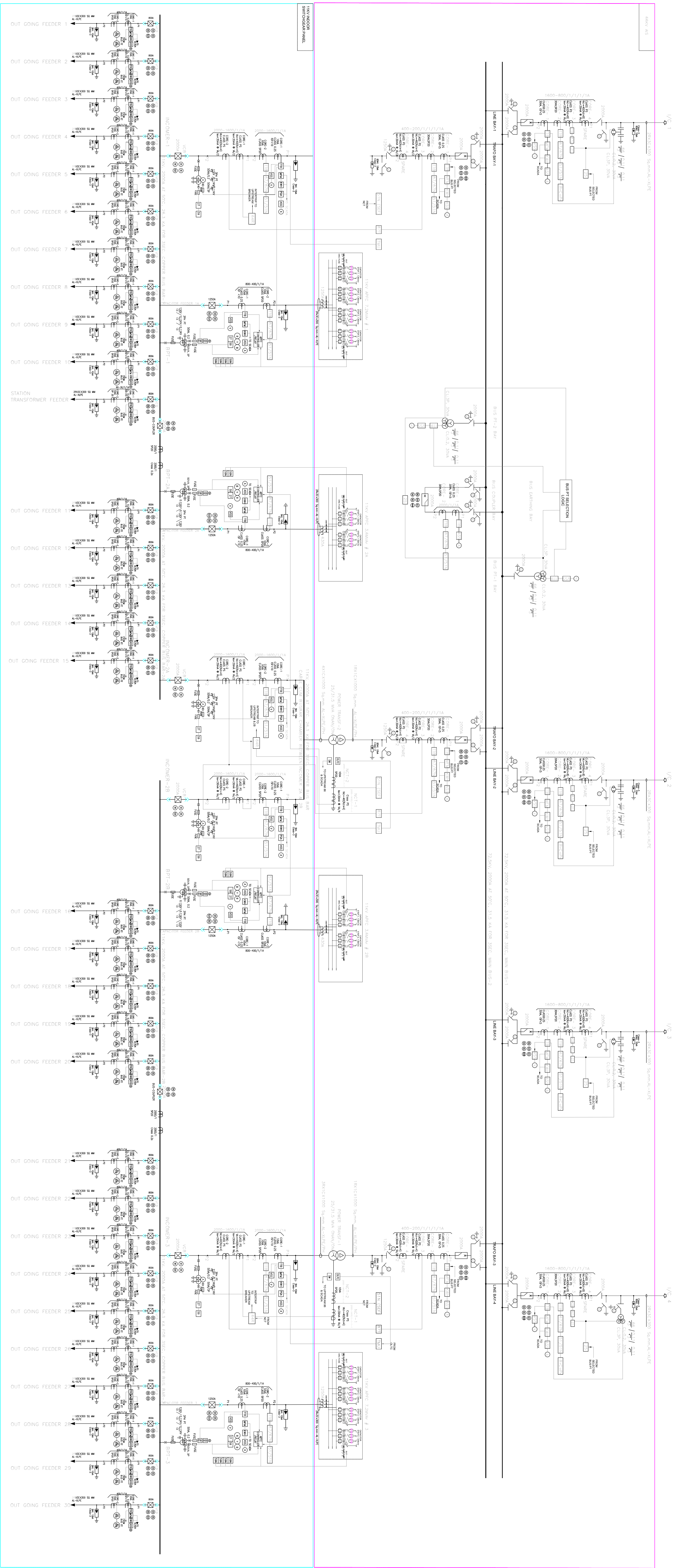
- Attending any breakdown in equipment supplied and replacement of faulty parts (within 10-12 hrs).
- Presence in experienced engineer during entire restoration sequence till equipment get energized.

General Guidance:

- Work force required to attend the outages – built a QRT (quick response team to attend breakdown during that tenure).
- Tools tackles and spares necessary for attending outage.- 1 set of special tools to be incorporated in tech doc to be handed over to user during HOTO.
- Skill level suitable to carry out the operation for 66kV/33kV.

Manpower Requirement:

- One Operator (Minimum ITI qualified), one Skilled worker and one reliever shall be assigned per shift.
- Qualification documents of Manpower assigned shall be submitted to BRPL for approval.



LEGEND

	POWER CIRCUIT		SFT CIRCUIT BREAKER
	CONTROL CIRCUIT		MULTI FUNCTION METER
	BUSBAR		POWER QUALITY ANALYSER
	LIGHTNING ARRESTOR		ENERGY METER
	3 POSITION MOTORISED ISOLATOR WITH EARTH		AMMETER
	POTENTIAL TRANSFORMER		VOLTAGE SELECTOR
	MOTORISED EARTH SWITCH		VOLTMETER
	CURRENT TRANSFORMER		TEST TERMINAL BLOCK
			DIRECTIONAL FAULT PROTECTION
			OVERCURRENT & EARTH FAULT PROTECTION
			DISTANCE PROTECTION
			SFT CHECK RELAY
			RESTRICTED EARTH FAULT PROTECTION
			4 POSITION & RESISTOR ON O/L/T
			POWER TRANSFORMER, HV AND LV, WITH PROTECTION AND SUPERVISION
			MUTUAL IMPEDANCE PROTECTION
			EARTH FAULT PROTECTION
			SFT PROTECTION
			SFT BACKUP PROTECTION
			SFT BACKUP PROTECTION
			SFT BACKUP PROTECTION
			SFT BACKUP PROTECTION
			SFT BACKUP PROTECTION

REV. NO.	DESCRIPTION	DATE	PREP. BY	CHKD. BY	APP. BY	DATE	SCALE	DWG No.:	SHEET	REV. VER
00	FIRST DRAWING	06.06.16	US	AS	AS	30.06.22	NTS	BRPL-CP-DEB-B-0001	1	00 01

Note:
 1. This drawing is tentative and for tender purpose only.
 2. Refer tender specification for further details.

BSES
BSES Rajdhani Power Limited

BSES BHAWAN
Nehru Place, New Delhi - 110017

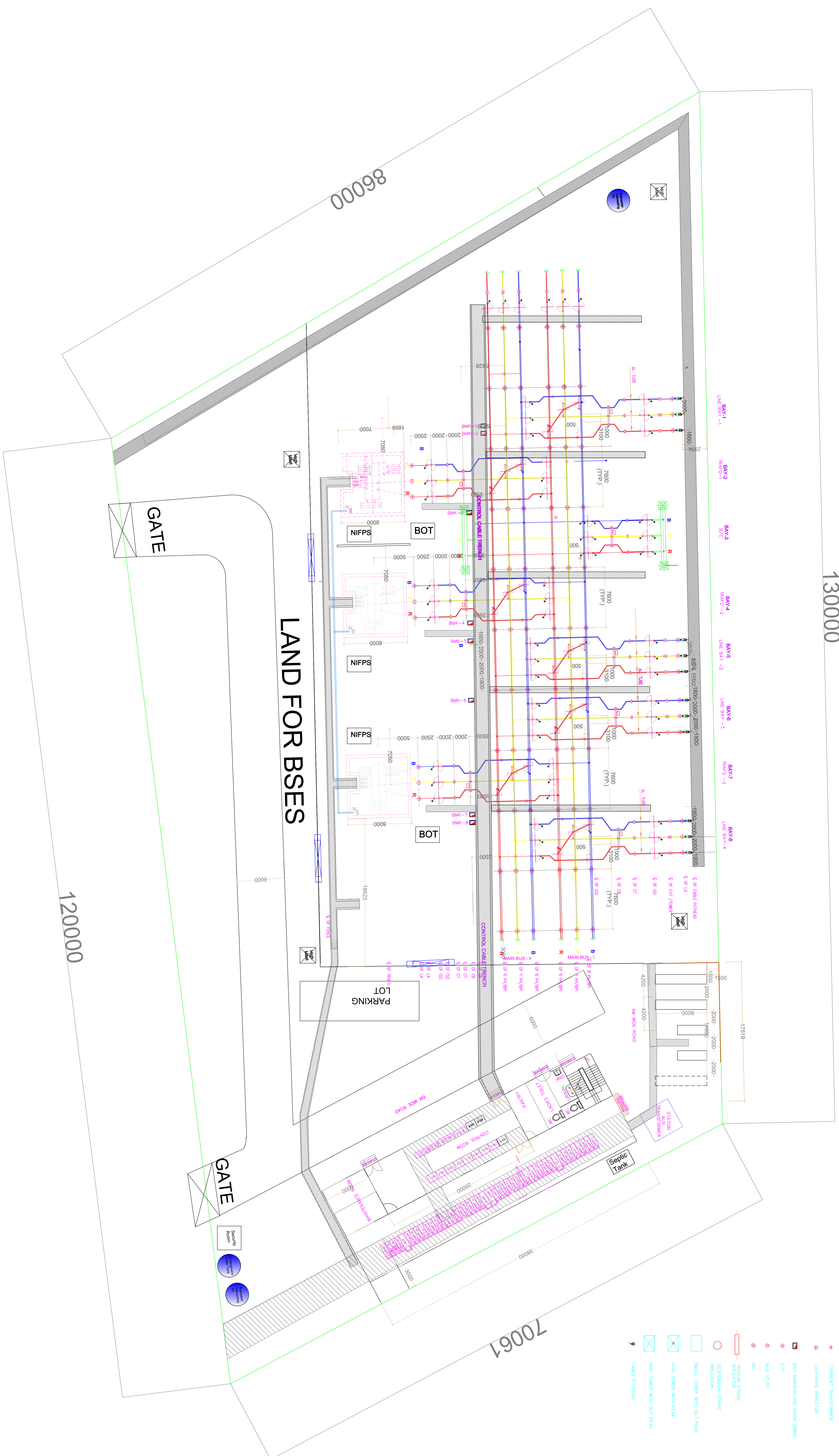
TITLE:
SIDD OF 2X31.5MVA 66/11KV BAKKARWALA GRID

DRAWN BY: SK
CHECKED BY: J/S
DATE: 30.06.22
SCALE: NTS

DWG No.:-
BRPL-CP-DEB-B-0001

SHEET 1 OF 1

THE LAYOUT IS TENTATIVE AND FOR TENDER PURPOSE ONLY



- LEGEND:-
- R-Ph AL PIPE BUSBAR
 - Y-Ph AL PIPE BUSBAR
 - B-Ph AL PIPE BUSBAR
 - GND GRP PIPE BUSBAR
 - 66KV ISOLATOR WITH/OUT EARTH SWITCH
 - 66KV ISOLATOR WITH ONE EARTH SWITCH
 - 66KV ISOLATOR WITH TWO EARTH SWITCH
 - CURRENT TRANSFORMER
 - LIGHTNING ARRESTOR
 - BAY MISCELLANEOUS MISC (B/M)
 - CVT
 - BUS V/P/PT
 - BH
 - TENSION STRING
 - SUSPENSION STRING
 - INSULATOR
 - SMALL TOWER WITH OUT PEAK
 - HIGH TOWER WITH PEAK
 - HIGH TOWER WITH OUT PEAK
 - CABLE FORMING