ODISHA POWER TRANSMISSION CORPORATION LIMITED

VOL-II
(SECTION-II)

PACKAGE -26/2021-22:
Engineering, Supply, Erection and Commissioning of "Construction of 02 nos. of 33kV Bays along with 01 no. of 33kV Bay swapping at 220/33kV Grid Sub-station Govindpalli for evacuation of Power from 18 MW SHEP of Sri Avantika Power Project Pvt. Ltd. under EHT (C) Division, Jaypore on "Turnkey CONTRACT BASIS" under Deposit Work.
.

GUARANTEED TECHNICAL PARTICULARS

NOTICE INVITING TENDER-NIT NO. -26/2021-22
TENDER SPECIFICATION NO
Sr. G.M- CPC-TENDER- PACKAGE- 26/2021-22

GUARANTEED TECHNICAL PARTICULARS

(TO BE FILLED AND SUBMITTED BY BIDDERS WITH THE TECHNICAL BID)

GUARANTEED TECHNICAL PARTICULARS

IVT AND CVT

GUARANTEED TECHNICAL PARTICULARS.

Sl. No	**Description.**	**220KV IVT**	**132KV IVT**	**33KV IVT**	**400 KV /220KV CVT**	**132KV CVT**
		3P/0.2 Accuracy Class	**3P/0.2 Accuracy Class**	**0.2 Accuracy Class**	**3P/3P/0.2 Accuracy Class.**	**3P/3P/0.2 Accuracy Class.**
1	Bidder's name and address.					
2	Name and address of the Manufacturer.					
3	Manufacturer's type and designation.					
4	Standards applicable.					
5	Type of IVT/CVT					
6	Rated primary voltage (kv).					
7	Rated secondary voltage (volts).					
7.1	Winding-I.					
7.2	Winding-II.					
7.3	Winding-III.					
8	Rated frequency [HZ].					
9	Rated burden:- Protection Winding Protection Winding Metering Winding					
10	Number of secondary windings.					
11	Accuracy class.					
[I]	[protection] Winding					
[II]	[metering] Winding					
12	Rated voltage factor for continuous operation at rated frequency.					
13	Rated voltage factor for 30 seconds at rated frequency.					
14	One minute dry and wet power frequency withstand					

Sl. No	Description.	220KV IVT	132KV IVT	33KV IVT	400 KV /220KV CVT	132KV CVT
		3P/0.2 Accuracy Class	3P/0.2 Accuracy Class	0.2 Accuracy Class	3P/3P/0.2 Accuracy Class.	3P/3P/0.2 Accuracy Class.
	voltage for primary side [kv] rms.					
15	One minute power frequency withstand voltage for secondary winding [kv] rms.					
16	1.2/50 micro- second impulse withstand test voltage for primary side					
17	Temperature rise over an ambient temperature of 50°C					
[a]	With 1.2 times rated primary voltage at rated frequency and at rated burdens. [I] Winding [°C] [II] Oil [°C] [III] Other parts [°C]					
[b]	With 1.5 times rated primary voltage for 30 seconds at rated frequency and at rated burdens. [I] Winding [°C] [II] Oil [°C] [III] Other parts [°C]					
18	Class of insulation.					
19	Total creepage distance in (mm)					
20	Maximum radio interference voltage at 1.1 times maximum line to ground voltage (micro volts)					
21	Corona inception and extinction voltage (kv) rms					
22	Partial discharge level (piccocoulombs)					

Sl. No	Description.	220KV IVT	132KV IVT	33KV IVT	400 KV /220KV CVT	132KV CVT
		3P/0.2 Accuracy Class	3P/0.2 Accuracy Class	0.2 Accuracy Class	3P/3P/0.2 Accuracy Class.	3P/3P/0.2 Accuracy Class.
23	Primary.[For 220KV, 132KV & 33KV IVT] (a) No. of primary turns (b) Material of primary (c) Size of the primary conductor bare/insulated. (d) Cross sectional area of primary conductor (sq.mm) (e) Current density adopted for primary winding(A/sq.mm) (f) Type of primary winding. (g) Name of the insulating materials used for primary conductor. (h) Weight of primary winding.					
24	Secondary. [For 220KV, 132KV & 33KV IVT] (a)No. of secondary turns (b) Material of secondary © Size of the secondary conductor bare /insulated. (d)Cross sectional area of secondary conductor (mm2) (e)Current density adopted for secondary winding(A/mm2) (f)Type of secondary winding (g)Name of the insulating materials used for secondary conductor. (h)Weight of secondary winding.					
25.	Core. [For 220KV, 132KV & 33KV IVT] (a)Shape of the core (b)Material and grade of the core laminations (c)Thickness of the core lamination (mm) (d)Maximum flux density					

Sl. No	Description.	220KV IVT	132KV IVT	33KV IVT	400 KV /220KV CVT	132KV CVT
		3P/0.2 Accuracy Class	3P/0.2 Accuracy Class	0.2 Accuracy Class	3P/3P/0.2 Accuracy Class.	3P/3P/0.2 Accuracy Class.
	adopted (Tesla) (e)Net iron area of the core (f)Watt loss/kg. for the core materials at the operating flux density(W/kg) (g) Total weight of the core(kg) (h)Whether B-H curve for core material enclosed? (i)Whether specific loss vrs. Flux density curve enclosed ?					
26	INSULATION. .[For 220KV, 132KV & 33KV IVT] (a) Insulation between core and secondaries. (b) Insulation between secondaries. © Insulation between secondary and primary. (d) Insulation between primary .and core.					
27	DIMENSIONS OF CORE AND WINDINGS. .[For 220KV, 132KV & 33KV IVT] (a)Diameter of the core (mm) (b)Inner diameter of the secondary windings(mm) (c) Outer diameter of the secondary windings (mm) (d) Inner diameter of the primary winding(mm) (e) Outer diameter of the primary winding(mm) (f) Minimum clearance from primary winding to tank(mm) (g) Minimum clearance from secondary winding to tank(mm)					
28.	Percentage voltage ratio (error)/phase displacement (min.)at 100% rated burden	, .				

Sl. No	Description.	220KV IVT	132KV IVT	33KV IVT	400 KV /220KV CVT	132KV CVT
		3P/0.2 Accuracy Class	3P/0.2 Accuracy Class	0.2 Accuracy Class	3P/3P/0.2 Accuracy Class.	3P/3P/0.2 Accuracy Class.
	at 0.8PF lagging for measuring winding. (a) 80% of rated voltage at frequency:- (b) 120% of rated voltage at frequency:- (c) Accuracy of standard PT to be used. during determination of errors (0.05 or better.					
29.	Percentage Voltage ratio /phase displacement (min.)at 25% rated burden at 0.8PF lagging for measuring winding. (a) 80% of rated voltage at rated frequency:- (b) 120% of rated voltage at rated frequency:-	.				
30.	Percentage voltage (ratio)error /phase displacement (min.) at 100% rated burden at 0.8PF lagging for protection winding (a)5% of rated voltage. (b)1.2 times rated voltage (c)1.5 times rated voltage (d) 2% of rated voltage..					
31.	Percentage voltage (ratio) error /phase displacement (min) at 25% of rated burden at 0.8PF lagging for protection winding (a)5% of rated voltage (b)1.2 times rated voltage. ©1.5 times rated voltage. (d) 2% of rated voltage.					
32.	Whether IVT/CVT is suitable for horizontal transportation.					
33.	Quantity of oil per IVT/ CVT (Ltrs/kg)					
34.	Standard to which oil conforms.					

Sl. No	Description.	220KV IVT	132KV IVT	33KV IVT	400 KV /220KV CVT	132KV CVT
		3P/0.2 Accuracy Class	3P/0.2 Accuracy Class	0.2 Accuracy Class	3P/3P/0.2 Accuracy Class.	3P/3P/0.2 Accuracy Class.
35.	Characteristic of oil(Prior to filling)					
35.1.	Breakdown voltage (kv-rms)					
35.2.	Dielectric dissipation constant tan delta)					
35.3	Water content(PPM)					
35.4	Gas content(PPM)					
35.5	Interfacial tension at 27 degree C(N/m)					
35.6	Specific resistance.					
35.6.1	At 90 deg.C(ohm-cm)					
35.6.2	At 27 deg.C(ohm-cm)					
36.	Whether IVTS are hermetically sealed ? If so how ?					
37.	Total Weight (kg)					
38.	Transport weight (kg)					
39.	Dimensional details.					
40	Whether IVT characteristic curves enclosed?					
41.	TANK AND SECONDARY TERMINAL BOX.					
41.1	Material of the IVT/ CVT tank					
41.2	Material of the secondary terminal box.					
41.3	Thickness of the IVT/ CVT tank material.					
41.4	Thickness of the secondary terminal box material.					
41.5	Zinc coating of IVT/ CVT tank(g/sq.m)					
41.6	Zinc coating of the secondary terminal box (g/sq.m)					
41.7	Weather proof rating of secondary terminal box.					
41.8	Weight of tank fitting and other accessories.					
	TERMINAL CONNECTORS					
01.	Manufacturer's name					

Sl. No	Description.	220KV IVT	132KV IVT	33KV IVT	400 KV /220KV CVT	132KV CVT
		3P/0.2 Accuracy Class	3P/0.2 Accuracy Class	0.2 Accuracy Class	3P/3P/0.2 Accuracy Class.	3P/3P/0.2 Accuracy Class.
02.	Applicable standards.,					
03.	Type.					
04.	Material of connector. (a)Clamp body. (b)Bolts and Nuts. (c) Spring Washers					
05.	Rated current.					
06.	(a) Rated terminal load(kg) (b) Factor of safety.					
07.	Minimum thickness of any part(mm)					
08.	Weight of connector complete with hardware.					
09.	Type test reports as per IS enclosed.					
10.	OGA drawing enclosed.					
	BUSHING/SUPPORT INSULATOR					
01	Manufacturer's name					
02.	Type.					
03.	Applicable standards.					
04	Dimensions: (i)Height(mm) (ii)Diameter(top)(mm) (iii)Diameter(bottom)(mm)					
05	Total creepage distance (mm).					
06.	Rated voltage(KV)(rms)					
07.	Power frequency withstand voltage for (1 minute dry and wet(KV/rms)					
08.	1.2/50 micro-second Impulse withstand voltage (KVP)					
09.	Corona Extinction voltage(kv)					
10.	Weight(kg)					
11.	Maximum allowable span (mm)					
12.	Cantilever strength(kg)					
13.	OGA drawing enclosed.					

ADDITIONAL TECHNICAL REQUIREMENT FOR 400 KV,220KV & 132KV CVT

1. Rated capacitance of the CVT
2. High frequency capacitance for entire carrier frequency range.
3. Equivalent series resistance over the entire frequency.
4. Stray capacitance and stray conductance of the LV terminal over entire carrier frequency range.
5. Capacitance (PF) /Tan delta between:-
   a) HV-HF point
   b) HF point-Ground point of International Transformer.
   c) HV-Ground point of Intermediate Transformer winding.
6. Capacitive reactance of the two parts of the divider i.e. High voltage capacitor, and Intermediate voltage capacitor, connected in parallel.
7. Total Inductive reactance, offered by CVT.
8. Voltage ratio of the capacitor divider.
9. Open circuit Intermediate voltage.
10. Rated open circuit Intermediate voltage.
11. Reference range of temperatures within which the CVT complies with the relevant accuracy requirements.
12. Protective device, in-corporate in the CVT for limiting over voltages and/or to prevent sustained Ferro resonance.
13. Rated voltage of Surge Arrester, connected at the secondary of CVT.

14. Natural frequency of coupling (KHZ).
15. Self tuning frequency of CVT (KHZ).

16. Bandwidth (KHZ).

17. Temperature rise over ambient.

18. One minute power frequency test voltage of secondary winding (KV).

19. One minute power frequency test voltage of H.F. terminal (KV).

20. One minute power frequency test voltage of capacitor (dry & wet) (KV).

21. 1.2/50/micro second Impulse withstand test voltage of capacitor (KVP).

22. 250/2500 micro second switching surge withstand voltage of capacitor (dry & wet).
23. Literature
Whether the followings are enclosed?
23.1 Type Test reports as per IEC 186.

23.2 OGA drawing of CVT and terminal connector.
23.3 Characteristic curves.
23.4 Drawing showing clearance from earthed object.

23.5 Details of Surge Arrester, connected at secondary winding of CVT.
24. ELECTROMAGNENIC UNIT:-
24.1 **CORE**:-
a) Core diameter (mm)
b) Window Weight (mm)
c) Leg centre (mm)
d) Net cross sectional area of iron In the core (mm^2)
e) Core lamination thickness (mm)
f) Type & grade of core.
g) Design flux density at rated voltage. And rated frequency (Tesla)
h) Design flux density at highest system voltage & lowest system frequency (Tesla).
i) Minimum knee point voltage (volts).

24.2 PRIMARY WINDING:-

a) No. of turns.
b) Bare size of conductor
c) Insulated size of conductor.
d) Area of cross section.
e) Current density (A/ mm^2).
f) Conductor material.
g) Class of insulation.
h) Power frequency withstand level. (KV-rms).
i) Impulse withstand level (KVP).

24.3 Secondary Winding	Protection Winding	Protection Winding	Metering Winding.
a) No.of turns			
b) Bare conductor size (mm)			
c) Insulated conductor size (mm)			
d) Cross-sectional area (sq.mm)			
e) Current density (A/ mm^2)			
f) Conductor material.			
g) Class of Insulation.'			
h) Power frequency withstand Level (KV-rms).			

Signature of the Tenderer
with seal and date.

ANNEXURE –B.

CALIBRATION STATUS OF TESTING EQUIPMENTS AND INSTRUMENTS/METERS.

Name of the test.	Meters and equipments required for the correspon di-ng test with range, accuracy, make and Sl. No.	Date of Calibra-tion.	Due date of Cali-bration.	Name of the Cali-brating Agency.	Whether Calibrat-ing Agency is Govt. Approv-ed.	Whether documents relating to Govt. Approval of the cali-brating Agency furnished ?	Whether the meters/ equipment fulfill the accuracy class as per calibration report	Whether the calibrating agency has put any limitation towards the use of the particular meter/equipment. If yes, state the limitations.	Whether green sticker or blue sticker or yellow sticker has been affixed on the body of the particular equipment/meter. State the colour of the affixed sticker.	Inspite of imposed limitations,, whether the particular meter/equipment can still be used ? Justify its use for correspondin g test(s).	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Signature of the tenderer with seal and date.

ANNEXURE-C

CHECK LIST TOWARDS TYPE TEST REPORTS.

Name of the Type Test.	Date of Test.	Name of the Laboratory where the Test has been conducted.	Whether the Laboratory is Government Approved.	Whether the Test reports are valid as per Clause No.8.1 of T.S.	Whether the copy of Test Report in complete shape alongwith drawings etc. furnished or not ?	Whether the Tested I.V.T. fulfills the technical require-ments as per TS.	If the type tested I.V.T does not fulfill the technical requirements as per this specification, whether the bidder agrees to conduct the particular test(s) again at their own cost without any financial liability to OPTCL in the presence of OPTCL's representative within the specified delivery period.	Remark
1	2	3	4	5	6	7	8	9

Signature of the Tenderer with seal and date.

GUARANTEED TECHNICAL PARTICULARS

BATTERY AND BATTERY CHARGER

ANNEXURE – I

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 220V LEAD ACID PLANTE STORAGE BATTERY.

[To be filled in by the bidder]

		350AH/550AH Values/Others
1.	Manufacturer's Name and address alongwith Fax No. & Tele phone No.	
2.	Conforming to standards	
3.	Type and designation as per ISS	
4.	Manufacturer's type and designation	
5.	AH capacity and voltage of the battery at 27 deg.C.	
[a]	At 10 hour rate of discharge.	
[b]	At 5 hours rate of discharge.	
[c]	At 1 hour rate of discharge	
[d]	At 1 minute rate of discharge.	
[e]	At ½ hour rate of discharge.	
6.	Open circuit voltage of each battery cell.	
[a]	Fully charged	
[b]	Floating condition.	
[c]	When completely discharged at.	
[i].	10hr. rate.	
[ii].	5 hour rate	
[iii]	1 hour rate	
[iv]	½ hr. rate	
[v].	1 minute rate	
[vi]	1-second rate.	
7.	Recommended float charging voltage [volts] across the battery terminals.	
8.	Recommended boost charging voltage [volts].	
9.	Time required for boost charging from discharged conditions [in hours]	
10.	Trickle charging Current range/cell	
11.	AH capacity at 10 hour rate at 10 hour rate at room temperatures of :	
[a]	15 deg C.	
[b]	27 deg C.	
[c]	50 deg C.	
12.	CELL DETAILS	
[i].	No. of cells per battery	
[ii].	Total nos. of plates per cell.	
[iii]	No. of positive plates per cell.	

(iv)	Type of positive plate	
(v)	No. of negative plates per cell	
(vi)	Type of negative plate	
(vii)	Surface area of plates in sq. mm.	
(viii)	CONSTRUCTIONAL DETAILS AND DIMENSIONS OF	
(a)	Positive plate	
(b)	Negative plate	
(c)	Material of the container	
(d)	Thickness of the container	
(e)	Overall dimensions of each cell (LxBxH)	
ix.	Weight per Cell (Kg)	
(a)	Active elements-positive	
(b)	Active elements-Negative	
(c)	Container	
(d)	Net dry weight	
(e)	Weight with electrolyte	
x.	Distance between centre of cells where erected.	
xi.	Nominal cell voltage.	
xii.	Internal resistance of each cell at	
(a)	Fully charged condition	
(b)	Fully discharged condition	
(c)	Floating condition	
13.	Type, Thickness and materials of the separators	
14.	Containers	
(a)	Type	
(b)	Material	
(c)	Outside dimensions (LxBxH)	
15.	Cover and its type and material	
16.	Clearance in mm between	
(a)	Top of plates and top of container	
(b)	Bottom of plates and bottom of container	
(c)	Edges of plates and inner surface of container.	
17.	Sediment space (depth) in mm	
18.	ELECTROLYTE	
(a)	Amount of electrolyte and specific	

	gravity at 27 deg. C for first filling.	
(b)	First filling per set with 10% of extra furnished.	
(c)	Electrolyte conforms to standard	
(d)	Rated specific gravity of electrolyte when fully charged at room's temperature of	
(i)	15 deg. C	
(ii)	27 deg. C	
(iii)	50 deg C.	
(e)	Specific gravity of electrolyte at the end of discharge at 10 hour discharge rate.	
(f)	Maximum electrolyte temp. that the cells can withstand without injurious effect.	
(i)	Continuously	
(ii)	For short period	
19.	INTER CELL CONNECTOR	
(a)	Whether Inter-cell connector to be furnished ? (Yes / No)	
(b)	Type of inter-cell connector (bolted or others)	
(c)	Materials of inter cell connector	
20. (a)	Inter row, inter-tier connectors and end take-off furnished ? (Yes / No)	
(b)	Description, size, current rating, type and material.	
21.	RACKS	
(a)	No. of racks per battery	
(b)	No. of cells per rack	
(c)	Type of racks (rows and tiers)	
(d)	Material of the rack	
(e)	Racks provided with	
(i)	Numbering tags for cell	
(ii)	Teak wood clamps for cables	
(f)	Whether anti-acid coating provided ?	
(g)	Description of rack insulators	
(h)	Outline dimensions of racks	
(i)	Net weight of racks	
(j)	Shipping weight	
22.	Recommended rate for charging the	Start Finish

	battery in 8 hours.	
(a)	Current	
(b)	Voltage	
23.	Recommended float charge rate	
24.	Resistance of the battery including inter-connector between the cells in ohms.	
25. (a)	Maximum short circuit current per battery	
(b)	Allowable duration of short circuit	
26.	Short circuit current for a dead short across the battery terminals when	
(a)	Float at 2.1 volts per cell.	
(b)	Boost charge to 2.75 volts per cell.	
27.(a)	Time to full charge at finishing rate only	
(b)	Time to full charge at higher starting rate	
(c)	Time for full charge to charge by two step charging at starting up and finishing rates	
28.	Guaranteed AH efficiency at 10 hour rate of discharge in percent.	
29.	Guaranteed WH efficiency at 10 hour rate of discharge in percent.	
30.	Instructions for filling and initial charging of the battery with finishing and two step charging rates.	
31.	Recommended interval at which battery should be discharged at 10 hour rate and quick charged.	
32.	Recommended floating voltage per cell and the minimum variation.	
33.	Recommended maximum period of storage before the first charge.	
34.	Average life in years	
35.	Guaranteed life of battery in years.	
36.	Estimated life of battery in years.	
37.	Total shipping weight of battery units	
38.	Dimensioned lay-out drawings of the rack and battery to be attached with the tender. (Whether furnished ? Yes /	

	No)	
39.	The following characteristic curves, to be furnished alongwith the tender (whether furnished)	
(a)	Battery discharge curves at various rates between one minute and 10 hour rate. (Yes / No.)	
(b)	Curves showing the relation between the specific gravity and amount of charge in the battery for both charging and discharging conditions. (Yes / No)	
(c)	Curves showing the relation between cell voltage and charging current when charged at	
(i)	Finishing rate (Yes/ No)	
(ii)	High starting rate (Yes/ No)	
(iii)	Two step charging by starting and finishing rate (Yes / No)	
(d)	Curve of internal resistance at the end of various discharge rates (Whether furnished (Yes / No)	

ANNEXURE – II

GUARANTEED TECHNICAL PARTICULARS FOR BATTERY CHARGER (220 V D.C. SYSTEM) SUITABLE FOR SPECIFIED LEAD ACID PLANTE STORAGE BATTERY

(To be filled in by the Bidder)

		Values/ Others	
1.	Manufacturer's Name		
2.	Rated output of the charger		
2.1	Voltage (volts)		
2.2	Current (amps)		
2.3	Power factor		
3.	Short time rating		
4.	Type of cooling		
5.	Hottest stack temperature (^{0}C)		
6.	Charger dimensions		
6.1	Height (mm)		
6.2	Depth (mm)		
6.3	Width (mm)		
6.4	Sheet thickness (mm)		
7.	Charger weight		
8.	Charger rated output current		
8.1	Float charging mode		
8.2	Boost charging mode		
9.	Load limiter current setting range (Trickle mode)		
10.	RECTIFIER TRANSFORMER	Float Charger	Boost Charger
10.1	Make		
10.2	Type		
10.3	Rated KVA		
10.4	Over current impedance (ohms)		

10.5 Input line winding connection
in vector representation

10.6 Rated primary voltage (volts)

10.7 Rated secondary voltage (volts)

10.8 Rated frequency (Hertz.)

10.9 Rated output (amps)

10.10 Turn ratio

10.11 Insulation level

10.12 Impulse withstand test voltage (KVP)

10.13 One minute power frequency over voltage.

(a) Primary winding (KV-rms).

(b) Secondary winding (KV-rms)

10.14 Material of primary winding conductor

10.15 Material of secondary winding conductor

10.16 Size, Cross-sectional area and current density of primary winding conductor.

10.17 Size, cross-sectional area and current density of secondary winding conductor

10.18 No. of turns of primary / phase

10.19 No. of turns of secondary / phase

10.20 Name of the insulating materials used and class

10.21 Core

10.21.I Name of the core material

10.21.II Grade of the core

10.21.III Thickness of core material (mm)

10.22 Maximum temperature rise over an ambient temperature of 50^0C

(a) Primary Winding (^{0}C)
(b) Secondary Winding (^{0}C)
(c) Core (^{0}C)

10.23 standards applicable

11.0 RECTIFIER ASSEMBLY :

11.1 Make

11.2 Type of semi conductor material

11.3 Rated direct current per cell (A)

11.4 Rated direct voltage (V)

11.5 Rated input voltage (V)

11.6 Type of connections of rectifier elements.

11.7 Forward power loss and reverse power loss (watts).

11.8 Forward voltage drop and reverse voltage drop (volts)

11.9 Conversion efficiency (%)

11.10 Rated DC output voltage (V)

11.11 Rated AC input voltage (V)

11.12 Rated output current (A)

11.13 Ripple factor

11.14 Voltage factor

11.15 Current factor

11.16 Maximum temperature rise over an ambient temperature of 50^0C (^{0}C)

11.17 Maximum permissible ambient temperature for guaranteed rating (^{0}C)

11.18 Maximum and minimum permissible humidity rating (%)

11.19 Life expectancy (years)

11.20 Standard(s) applicable

11.21 Characteristic curve of DC output plotted against output current (Whether submitted ?) Yes / No.

12.0 AUTOMATIC VOLTAGE REGULATOR

12.1 manufacturer's name

12.2 Manufacturer's type

12.3 Percentage stabilisation of the rectifier with the help of AVR when

(a) Input voltage changes with ± of its nominal value.

(b) DC output of the rectifier varies from no-load to full load.

12.4 Rated output voltage

12.5 Allowable AC frequency fluctuations

12.6 Voltage setting range

12.7 Response time of automatic voltage regulator

13.0 Manual voltage regular (float mode)

13.1 Type

13.2 Voltage setting range

14.0 Boost charging current setting range

15.0 Boost charging limit setting range

16.0 DIODES

16.1 Manufacturer's name

16.2 Type of circuit

16.3 Method of construction

16.4 Continuous current rating (Amps.)

16.5 Short time current rating (Amps)

16.6 Type of cooling

16.7 Forward power loss and reverse power less (W)

16.8 Life expectancy

16.9 Forward voltage drop on rated current

16.10 Resistance offered for reverse current flow

16.11 Maximum temperature rise over an ambient temperature of 50^0 C.

17.0 CONTACTORS / MOULDED CASE CIRCUIT BREAKERS

17.1 Type

17.2 Make

17.3 Rated voltage (V)

17.4 Rated continuous currents (A)

17.5 Contact material

17.6 Operating coil

17.6.1 Voltage (V)

17.6.2 Voltage range and power for closing and holding

17.6.3 Voltage range and power for drop off.

17.7 Thermal trip rating

17.8 Thermal trip time

17.9 Details of CT if any

17.10 Auxiliary contacts

17.10.1 Number

17.10.2 Current rating

17.11 Characteristics of back-up HRC fuse

18.0 RELAYS :

18.1 Make and type of protective and alarm relays

(a) Thermal overload relay

(b) Input under voltage relay

(c) Single phasing alarm relay

(d) Phase reversal relay

(e) D.C. output over-voltage relay

(f) D.C. output under voltage relay

(g) Charger failure relay

(h) Battery earth fault relay

(i) A.C. input failure relay (for connecting the D.C. load)

(j) Fuse failure relay

(k) Alarm accept relay

18.2 Rated voltage of each of the above

(a) AC/DC
(b) Permissible variation
(c) Frequency

18.3 VA burden of each of the above

18.4 Operating time of each of the above

18.5 Time vs current curves of each of the above.

(to be enclosed alongwith the offer)

18.6 Reset time

18.7 Accuracy

18.8 Setting range

18.9 Reset factor

18.10 Number of contacts

(a) Normally open

(b) Normally closed

18.11 Rating of contacts

(a) Rated Voltage (V)

(b) Rated making and breaking

(c) Continuous rating

18.12 No. of operations

18.13 Operation indicator

19.0 INDICATING LAMPS

19.1 Manufacturer's name

19.2 Type and designation

19.3 Permissible voltage variation

19.4 Rated power consumption (watts).

19.5 Series resistance, if any

20.0 SWITCHES:

20.1 Manufacturer's name

20.2 Ratings

(a) Continuous current

(b) Short circuit – making capacity

(c) Breaking capacity

(d) Voltage

20.3 Operating mechanism details

20.4 Type of visual indication

(a) OFF and ON position

(b) Fuse blow out

21.0 FUSES

(a) Make

(b) Type

(c) Rating (Amps)

(d) Interrupting rating (KA)

22.0 INSTRUMENTS

22.1 Manufacturer's Name

(a) Ammeter

(b) Voltmeter

22.2 Type

(a) Ammeter
(b) Voltmeter

22.3 Standard

(a) Ammeter
(b) Voltmeter

22.4 Scale range

22.4.1 Ammeter

(a) Float charger
(b) Boost charger
(c) Battery float
(d) Battery boost

22.4.2 Volt meter

(a) Input supply
(b) Charger output
(c) Load

22.5 Size of dial

(a) Volt meter
(b) Ammeter

22.6 Accuracy class

(a) Volt meter
(b) Ammeter

22.7 Temperature at which calibrated

22.8 Limit of errors

22.9 Out line dimensions

22.10 Type of mounting

22.11 Selector switch for volt meter (AC & DC)

(a) Make

(b) Rating

23.0 CAPACITOR

23.1 Manufacturer's name

23.2 Type

23.3 Capacitance (Farad)

23.4 Maximum temperature rise over an ambient temperature of 50^0C.

24. Reference float voltage at ambient temperature of 27^0C

25. Whether protection is given for float voltage to Avoid low battery voltage due to sensor or circuit Malfunction. (Yes/ No).

ANNEXURE – IV-A
(For Testing of Battery)
(To be filled in by the bidder)

CALIBRATION STATUS OF TESTING EQUIPMENTS AND INSTRUMENTS/ METERS

Name of the Test	Meters & Equipments required for the corresponding test with range, accuracy, make & Sl. No.	Date of Calibr-ation	Due date of Calibration	Name of the Calibratig Agency	Whether Calibrating Agency is Govt. approved	Whether documents relating to Govt. approval of the calibrating Agency furnished	Whether the meters/ equipments fulfil the accuracy class as per calibration report.	Whether the calibrating agency has put any limitation towards the use of the particular meter/ equipment. If yes, state the limitations	Whether the calibrating agency has put any limitation towards the use of the particular meter/equip-ment/ meter. State the colour of the affixed sticker	Inspite of imposed limitations. Whether the particular meter / equipment can still be used ? Justify its use for corresponding test(s)	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Signature of the tenderer with seal & date

ANNEXURE – IV-B
(For Testing of Battery Charger)

CALIBRATION STATUS OF TESTING EQUIPMENTS AND INSTRUMENTS/ METERS

Name of the Test	Meters & Equipments required for the corresponding test with range, accuracy, make & Sl. No.	Date of Calibr-ation	Due date of Calibration	Name of the Calibratig Agency	Whether Calibrating Agency is Govt. approved	Whether documents relating to Govt. approval of the calibrating Agency furnished	Whether the meters/ equipments fulfil the accuracy class as per calibration report.	Whether the calibrating agency has put any limitation towards the use of the particular meter/ equipment. If yes state the limitations	Whether the calibrating agency has put any limitation towards the use of the particular meter/equip-ment/ meter. State the colour of the affixed sticker	Inspite of imposed limitations. Whether the particular meter / equipment can still be used ? Justify its use for corresponding test(s)	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Signature of the tenderer with seal & date

ANNEXURE V – A
CHECK LIST TOWARDS TYPE TEST REPORTS FOR BATTERY

Name of the Type Test	Date of Test	Name of the Laboratory where the Test has been conducted	Whether the Laboratory is Government approved	Whether the Test report is valid as per Spn.	Whether the Test report in complete shape alongwith drawings etc. furnished or not ?	Whether the type tested Plante lead acid battery fulfills the technical requirements as per TS	If the type tested battery does not fulfill the technical requirements as per this specification, whether the bidder agrees to conduct he particular type test again at their own cost without any financial liability to OPTCL in the presence of OPTCL's representative within the specified delivery period	Remarks
1	2	3	4	5	6	7	8	9

Signature of the tenderer with seal & date

ANNEXURE V – B
CHECK LIST TOWARDS TYPE TEST REPORTS FOR BATTERY CHARGER

Name of the Type Test	Date of Test	Name of the Laboratory where the Test has been conducted	Whether the Laboratory is Government approved	Whether the Test report is valid as per Spn.	Whether the Test report in complete shape alongwith drawings etc. furnished or not ?	Whether the type tested battery charger fulfills the technical requirements as per TS	If the type tested battery charger does not fulfill the technical requirements as per this specification, whether the bidder agrees to conduct he particular type test again at their own cost without any financial liability to OPTCL in the presence of OPTCL's representative within the specified delivery period	Remarks
1	2	3	4	5	6	7	8	9

Signature of the tenderer with seal & date.

GUARANTEED TECHNICAL PARTICULARS

FOR

SF6 AND VACUUM CIRCUIT BREAKERS

GUARANTEED TECHNICAL PARTICULARS FOR CIRCUIT BREAKERS

For **420 KV,245 KV & 145 KV SF6** CB

1. (a) Maker's name and country of manufacture

(b) Manufacturer's type Designation

1. Applicable technical standards

2. (a) Rated voltage(kV)

(b) Rated frequency(Hz)

4. Number of Poles

5. Class

6. Rated normal current

(a) Under site conditions(Amps)

(b) Rated (Amps)

7. (a) Rated short circuit breaking current

(i) Rms value of AC component of rated short circuit current (KA)

(ii) Percentage DC component
(iii) Assymetrical Breaking Current at Highest System Voltage
(iv) Certificate or report no

(iii) Oscillogram no.

(b) Rated short circuit making current (KA peak)

(i) At Higher rated Voltage
(ii) At Lower rated Voltage

(c) (i) Maximum Breaking capacity Under Phase Opposition(KAP)

(iii) Max Pole discrepancy(ms)
(iv) Max arc duration & Corresponding current under lockout pressure

8. First pole to clear factor

9. Rated transient recovery voltage for terminal faults

(kV peak)

10. Rated characteristics for short line faults.

11. Rated operating sequence

12. Rated duration of short circuit(Sec.)

13. Rated out of phase making & breaking current (kA)

14. (a) Opening time (ms)

    (i) Maximum Opening time under any condition

    (ii) With limiting Voltage & Pressure.

    (b) Arcing time (ms)

    (i) At 100% rated breaking current (ms)

    (ii) At 50% rated breaking current (ms)

    (iii) At 25% rated breaking current (ms)

    (iv) At 10% rated breaking current (ms)

    (v) Maximum arcing time at lowest fault current (ms).

    (c) Break Time (ms)

    (i) At 100% rated breaking current (ms)

    (ii) At 50% rated breaking current (ms)

    (iii) At 25% rated breaking current (ms)

    (iv) At 10% rated breaking current (ms)

    (v) Maximum break time at lowest fault current (ms).

    (v) Maximum Total Break Time under any duty condition For any current up to rated breaking current with limiting condition of Voltage & Pressure(ms)

    (d) Closing time (ms)

    (e) Minimum dead time for 3 phase reclosing

    (f) Maximum Close Open Time under any condition

With limiting Voltage & Pressure.

(g) Minimum Time Interval between each make/ Break Operation.

15. Rated line charging breaking current (kA)

16. Rated small inductive breaking current (kA)

17. (i)Max. rise of temperature over ambient for
current rating under sl. 6.
(ii)Max. rise of temperature for
Main contacts over design ambient temperature of 50deg C.

18. Interrupting capacity based on duty cycle as per sl. 11.
(a) AC ;component (kA)
(b) Percentage DC component.

19. Latching current (kA)

20. No. of breaks in series per pole.

21. Length of contact travel (mm)

22. Total length of break per pole (mm)

23. Rate of contact travel:
(a) At tripping (metres/sec.)
(b) At closing (metres/sec.)

24. Type of devices, if any, used to obtain
uniform voltage distribution between breaks.

25. Recovery voltage distribution between breaks in percent of rated voltage.

(a) Single line to ground fault

(b) Interruption on short lines.

(c) Switching off an unloaded, transformer

26. (i) Type of main contact.

(ii) Number of auxiliary contacts per pole for normal operation(NO & NC)
(iii)Number of auxiliary contacts per pole provided for Owner's use(NO & NC)
(iv)Current rating of Auxiliary contacts

27. Type of arcing-contacts and/or arc control device

28. Material of contacts:

i. Main
ii. Arcing
iii. Whether contacts are silver plated
iv. Thickness of silver coating mm
v. Contact pressure, kg/sq. mm.

29. Insulation level of the breaker:

(a) 1 minute power frequency withstand voltage kV rms(Dry & Wet)

(i) Between live terminals & Ground
(ii) Between terminals with Breaker contacts open

(b) Switching surge withstand test Voltage kV (peak)

- To earth

- Across open contacts

(c) Lightning impulse withstand test voltage, kV(peak)

- To earth

- Across open contacts

(d) Max. dynamic power frequency over voltage withstand kV (peak)

30. i) RIV level (Max)

ii) Corona inception voltage (kV rms)

iii) Corona extinction voltage (kV rms)

31. Minimum clearances

(a) Between phases (live parts)(mm)

(b) Between live parts and earth (mm)

(c) Total Creepage Distance (i) To ground

(ii) Between Terminals

32. Whether the circuit breaker is fixed trip or trip free

33. Method of closing

(a) Normal

(b) Emergency

34. Type of closing mechanism

35. (a) Normal voltage of closing

(b) Pick up range (volts DC)

36. (a) Power at normal voltage of closing mechanism (watts)

(b) Power at 85% of normal voltage of closing mechanism(watts)

(c) No of closing coils in operation

37. Type of tripping mechanism

Number of Tripping Coil

38. (A) Normal voltage of tripping coils(volts)

(a) Power at normal voltage for Tripping coils (watts)

(b) Power at 70% normal voltage for Tripping coils (watts).

(c) No. of tripping coils in operation

(d) Pick up range (V DC)

(B) Number of close open operation

(i) possible after failure of AC supply to motor

(ii) Time required for motor to charge the closing spring(Sec)

(iii) Wheather indication of spring charged condition will be provided in control cabinet.

39. Arc duration at 100% (ms)

40. Interruption capacity:

a) Opening

Arcing time no. of loops and time including resistor current duration (cycle)

Resistor current duration (cycle)

Total length of the arc (mm)

Max. length of the arc (mm)

Total interrupting time measured from instant of trip coil energisation to arc extinction of resistor current (cycles)

b) Closing time measured from instant of application of power to closing device upto arcing contacts touchings (cycles)

41. Critical current (current giving the longest arc

when a break takes place) (kA)

a) Recovery voltage when circuit breaker tested at 100% rated breaking capacity (kV inst.)

b) Rate of rise of restriking voltage at breaking

i) for 30% breaking capacity (kV/microsecs.)

ii) for 100% breaking capacity (kV/microsecs.)

c) Maximum over-voltage factor of the circuit breaker when switching off.

i) Unloaded transformers

ii) Loaded transformer

iii)Open circuited lines

42. When switching of synchronous systems:
(a) Max. current (kA)
(b) Max. contacts of 1 pole (kV)

43. No. of openings the circuit breaker is capable of performing without inspection, replacement of contacts or other main parts.

(a) at 50% rated current
(b) at 100% rated current
(c) at current corresponding to 50% rated breaking capacity.
(d) at current corresponding to 100% rated breaking capacity.

44. (A)a) W eight of complete circuit breaker (Kg).

b) Impact loading for foundation design, to include deed load plus impact value on opening at

maximum interrupting ratings, in terms of equivalent static load (Kg.)

c) Overall dimensions:

Height (mm)

Width (mm)

Length (mm)

(B)- Type & Material of Gasket used to ensure gas tight joints for

(i)Metal to Metal Joint

(ii) Metal to Porcelain Joints

(C) Type & Make of

a) Density Monitor

b)Pressure Gauge

(D) Density Monitor Setting

a) Lock Out
b) Alarm

45. Porcelain:

a) Make
b) Type
c) Descriptive pamphlet no.
d) Weight (kg.)
e) Transport dimensions (mm)
f) Height above floor, required to remove porcelain (mm).
g) Insulation class
h) One minute power frequency withstand, kV (rms) (dry & wet)
i) Flash over voltage (kV)
j) Lightning impulse withstand voltage kV (peak) (dry & wet)
k) Switching surge withstand voltage kV (peak) (wet)
l) Corona discharge voltage (kV rms)
m) Creepage distance, total protected (mm)
n) Permissible safe cantilever loading on installed porcelain (Kg.m)

46. (i)Rated pressure of SF6 gas in the circuit breaker (Kg/sq.cm)

(ii) Rated Pressure of SF6 in operating Chamber(kg/cm2) at 20deg C

(iii) Limits of Pressure of extinguishing medium

47. Rated pressure of SF6 gas in the gas cylinders (Kg/sq.cm)

48. (i)Quantity of SF6 gas required per single pole unit (Kg.) at rated Pressure & at 20 deg C

(ii) Guaranteed Maximum Leakage rate per Year.

49. Quantity of SF6 gas per cylinder (Kg.)

Standard to which SF6 Gas Complies.

50. (i) Weight of empty cylinder (Kg.)
(ii) Wheather Breakers are dispatched filled with SF6 Gas or filled at site.

51. Quantity of absorbent required per pole (Kg.)
52. Recommended interval for renewal of absorbent in case of outdoor circuit breakers operating in tropical conditions.

53. Chemical composition of absorbent
54. Quantity of absorbent covered in the scope of supply (including spare quantities)

55. Limits of gas pressure for pressure operation of circuit breaker – (Kg/sq.cm)
56. Pressure and temperature at which the temperature compensated gas pressure switch will
a. give alarm (Kg/sq.cm., deg. C)
b. cut off (Kg/sq.cm. deg. C)
57. Name of SF6 supplier and country of origin.
58. Quantity of SF6 gas supplied for
a. Actual use in breakers (Kg.)
b. As spare (Kg.)
59. Chemical composition of gas:
a. Qty. of air by weight (ppm)
b. Qty. of H_20 by weight (ppm)
c. Qty. of CF_4 by weight (ppm)
d. Qty. of free acid by weight (ppm)
e. Density
f. Oil Content
g. Resistivity

60. Motor For Circuit Breaker

a) Manufacture's name & address
b) Eqipment driven by motor or not.
c) Motor Type
d) Country of Origin
e) Type of Duty
f) Type of Enclosure & Method of Cooling
g) Applicable Standard to which motor confirms
h) Type of mounting
i) Direction of rotations as viewed from non driving end.
j) Standard Continuous rating at 50deg C
k) Rated Voltage
l) Rated Speed at rated Voltage & Frequency(rpm).
m) Full Load current at rated voltage & frequency.
n) Power Factor at rated load.
o) Rating of the Motor.
p) Time for fully charging the closing spring

61. Control Cabinet

(a) Material of enclosure
(b) Thickness of sheet steel
(c) Painting for control cubicle
(d) Paint shade
(e) Degree of protection
(f) Dimension
(g) Material of gasket

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 36 KV CIRCUIT BREAKERS

1. Name of Manufacturer.
2. Manufacturer's type designation.
3. Rated Voltage. - KV
4. Maximum (continuous) service rated Voltage - KV
5. Normal current rating.

a) Under normal conditions.

b) Under site conditions.

6. Short time current rating for seconds (rms)
7. Maximum temperature rise over ambient. -°C
8. Breaking capacity.

a) Symmetrical. KVA

b) Assymmetrical. MVA

9. Making capacity. KA
10. Total break time in ms.

a) at 10% rated interrupting capacity - MS

b) at rated interrupting capacity - MS

11. Arcing time. - M.S.

12. Make time. - M.S.

13. Minimum reclosing time at full rated - M.S.
Interrupting MVA from the instant ofTrip coil energisation.

14. Minimum dead time for 3 phase reclosing.- M.S.

15. Whether restricting free. - Yes/No

16. One minute dry power frequency Withstanding test voltage (KV rms)
Between line terminal and ground objects. - KV rms.

Between terminal with breaker contacts open. -KV rms.

17. 1.2/50micros full wave impulse withstand test voltage for the two cases above.

i) Between line terminal & grounded objects. -KV(Peak)

ii) Between terminal with breaker Contacts open. -

18. **Busing or Insulators :**

i) Type of bushing. -

ii) Dry 1 minute power frequency withstand test voltage. - KV rms

iii) Dry flashover value. - KV rms.

iv) Wet flashover value. - KV rms.

V) 1.2/50 impulse withstand - KV(Peak)

vi) Creepage distance. - mm

vii) Puncture value of bushing. - KV

viii) Weight of bushing. - Kg.

19. Minimum clearance in air.

i) Between phases. - mm

ii) Live parts to earth. - mm

iii) Live parts to ground level - mm

iv) Between live parts & grounded object. - mm

20. Number of poles of circuit breaker.

21. Number of breaks per phase.

22. Total length of break per phase.

23. Type of main contacts.

24. Type of Aux. Contacts.

25. Materials of auxiliary contacts.

26. Contacts silver plated or not.

27. Thickness of silver plating.

28. Contact pressure.

29. Voltage distribution between breaker.

30. Type of device if any, used to limit the rate of rise or restricting voltage.

31. Voltage grading device if any used.

32. Number of auxiliary contacts provided.

i) Those closed when breaker is closed.

ii) These open when breaker is closed.

iii) Those adjustable with respect to the position of main contacts.

33. Type of operating mechanism.

i) Openring

ii) Closing.

34. Control circuit voltage.

35. Power required for trip coil - Watts at 220V D.C.

36. Power required for close coil At 220V D.C. - Watts

37. Frequency at which contacts are To be replaced.

38. Nos. of terminal connector.

39. Steel support structure galvanized - Whether With foundation – Nuts & Bolts to be provided yes or no

40. Type test certificate Furnished - Yes/No

41. Circuit Breaker weight. - Kg.

42. Quantity. - Nos.

GUARANTEED TECHNICAL PARTICULARS

FOR

CURRENT TRANSFORMER

GUARANTEED TECHNICAL PARTICULARS FOR CURRENT TRANSFORMER TO BE FILLED BY THE BIDDER.

Sl. No.	Description	33KV		132KV				220 KV	400 KV
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
1.	Bidder's name and address								
2.	Name and address of the Manufacturer								
3.	Manufacture's type designation								
4.	Standards applicable								
5.	Rated frequency (HZ)								
6.	Rated Voltage (KV)								
7.0	Rated current (A)								
7.1	Rated continuous current (A)								
7.2	Rated extended primary current (A)								
8.	Short time thermal current withstand for stipulated time duration (KA)								
9.	Dynamic current withstand (KAP)								
10.	1.2/50 μs impulse withstand voltage (KVP)								
11.	One minute dry and wet power frequency withstand voltage (KV-rms)								
12.	No. of cores per CT								

Sl. No.	Description	**33KV**		**132KV**				**220 KV**	**400 KV**
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
13.	Transformation Ratio								
14.	No. of secondary turns								
15.	Rated output at all ratios for metering core (VA)								
16.	Accuracy class								
17.	Minimum Knee point voltage at different taps for all 'PS' class cores (V)								
18.	Secondary winding resistance at different taps for all cores (Ω) (75^0C)								
19.0	Maximum exciting current at all ratios (for all PS class cores)								
19.1	100% KPV (Knee point voltage) (mA)								
19.2	25% KPV (Knee point voltage) (mA)								
19.3	20% KPV (Knee point voltage) (mA)								
19.4	10% KPV (Knee point voltage)(mA)								
20.	Instrument security factor at different ratios.								
21.	Radio interference voltage at 1.1 $V_r / 3^{1/2}$ at 1.0 MHZ (Micro volts)								
22.	Whether auxiliary CT provided for metering winding								
23.	Corona extinction voltage (KV								

Sl. No.	Description	33KV		132KV				220 KV	400 KV
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
	rms)								
24.	Partal discharge level (PC)								
25.	Total creepage distance (mm)								
26.	Primary								
26.1	No. of primary turns								
26.2	Material and cross-section of primary (mm^2)								
26.3	Type of primary								
27.	Whether CT is suitable for transportation horizontally.								
28.	Percentage current (ratio) error and phase displacement in minutes at rated burden and at								
28.1	5% rated current								
28.2	10% rated current								
28.3	20% rated current								
28.4	120% rated current								
29.	Percentage current (ratio) error and phase displacement in minutes at 25% rated burden and								
29.1	At 5% rated current								
29.2	At 10% rated current								
29.3	At 20% rated current								
29.4	At 120% rated current								
30.	Quantity of oil per CT (Litres)								
31.	Standard to which oil conforms generally.								
32.	Characteristics of oil (prior to								

Sl. No.	Description	33KV		132KV				220 KV	400 KV
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
	filling)								
32.1	Breakdown voltage (KVrms)								
32.2	Dielectric dissipation constant (tan delta)								
32.3	Water content (ppm)								
32.4	Gas content								
32.5	Interfacial tension at 27^0C (N/m)								
32.6	Specific resistance								
32.6.1	At 90^0C (Ωcm)								
32.6.2	At 27^0 C (Ωcm)								
33.	Whether current transformers are hermetically sealed. If so, how ?								
34.	Total weight (Kg)								
35.	Transport weight (Kg)								
36.1	Temperature rise over an ambient temperature of 50^0C for continuous operation at rated continuous thermal current.								
36.1	Winding								
36.2	Oil								
36.3	External surface of the core, metallic parts in contact with or adjacent to insulation.								
37	Whether CT characteristic curves enclosed.								
37.1	Ratio and phase angle curve								
37.2	Magnetisation curves								

Sl. No.	Description	33KV		132KV				220 KV	400 KV
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
37.3	Ratio correction factor curves.								
38.	DATA ON PRIMARY WINDING								
38.1	Rated primary current (A)								
38.2	No. of conductors in one turn								
38.3	No. of turns of primary								
38.4	Material of the primary conductors								
38.5	Size of the primary conductor (Bare/ Insulated (mm x mm)								
38.6	Cross-sectional area of each conductor (mm^2)								
38.7	Total cross-sectional area of primary winding (mm^2) conductors								
38.8	Current density(A/mm^2)								
	(i) At highest ratio								
	(ii) At intermediate ratio								
	(iii) At lowest ratio								
38.9	Short circuit current densiry (A/mm^2)								
	(i) At highest ratio								
	(ii) At intermediate ratio								
	(iii) At lowest ratio								
38.10	Ampere-turn of Primary (AT)								
	(i) At highest ratio								
	(ii)At intermediate ratio								
	(iii) At lowest ratio								
38.11	Length of primary conductor								

Sl. No.	Description	33KV		132KV				220 KV	400 KV
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
	(m)								
38.12	Weight of primary winding (kg.)								
39.	CORE								
39.1	Material and grade of the core								
39.2	Thickness of core (mm)								
39.3	Net Iron cross-sectional area of core (mm^2)								
39.3.1	Core-1								
39.3.2	Core – 2								
39.3.3	Core – 3								
39.3.4	Core – 4								
39.3.5	Core – 5								
39.4	Mean magnetic path length (cm)								
39.4.1	Core – 1								
39.4.2	Core – 2								
39.4.3	Core – 3								
39.4.4	Core – 4								
39.4.5	Core – 5								
39.5	Whether B-H curve for the core material, used, furnished ? (B-wb/m^2, H-AT/cm)								
39.6	Whether specific loss vs. flux density graph for the core material used furnished ?								
39.7	Axial length of core (mm)								
39.7.1	Core – 1								
39.7.2	Core – 2								

Sl. No.	Description	33KV		132KV				220 KV	400 KV
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
39.7.3	Core – 3								
39.7.4	Core – 4								
39.7.5	Core – 5								
39.8	Inside diameter / outside diameter of the cores (mm)								
39.8.1	Core – 1								
39.8.2	Core – 2								
39.8.3	Core – 3								
39.8.4	Core – 4								
39.8.5	Core – 5								
39.9	Weight of the core (kg)								
39.9.1	Core – 1								
39.9.2	Core – 2								
39.9.3	Core – 3								
39.9.4	Core – 4								
39.9.5	Core – 5								
40.	SECONDARY WINDINGS								
40.1	Rated secondary current (A)								
40.2	Material of the secondary windings								
40.3.	Size of the secondary conductor [Bare / Insulated] [mm]								
40.3.1	Core – 1								
40.3.2	Core – 2								
40.3.3	Core – 3								
40.3.4	Core – 4								

Sl. No.	Description	33KV		132KV				220 KV	400 KV
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
40.3.5	Core – 5								
40.4	Cross sectional area of the secondary conductor (mm^2)								
40.4.1	Core – 1								
40.4.2	Core – 2								
40.4.3	Core –3								
40.4.4	Core – 4								
40.4.5	Core – 5								
40.5	Current density of secondary windings (A/mm^2)								
40.5.1	Core – 1								
40.5.2	Core – 2								
40.5.3	Core – 3								
40.5.4	Core – 4								
40.5.5	Core – 5								
40.6	No. of secondary turns								
40.6.1	Core – 1								
40.6.2	Core – 2								
40.6.3	Core – 3								
40.6.4	Core – 4								
40.6.5	Core – 5								
40.7	No. of layers								
40.7.1	Core – 1								
40.7.2	Core – 2								
40.7.3	Core – 3								
40.7.4	Core – 4								
40.7.5	Core – 5								

Sl. No.	Description	33KV		132KV				220 KV	400 KV
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
40.8	No. of turns / layer								
40.8.1	Core – 1								
40.8.2	Core – 2								
40.8.3	Core – 3								
40.8.4	Core – 4								
40.8.5	Core – 5								
40.9	Average length / turn of secondary windings (mm)								
40.9.1	Core – 1								
40.9.2	Core – 2								
40.9.3	Core – 3								
40.9.4	Core – 4								
40.9.5	Core – 5								
40.10	Resistance of the conductor used for secondary winding per meter length at 75^0C (Ω/M)								
40.11	Weight of secondary windings (kg)								
40.11.1	Core – 1								
40.11.2	Core – 2								
40.11.3	Core – 3								
40.11.4	Core – 4								
40.11.5	Core – 5								
41	INSULATION								
41.1	Name and class of insulating material between core and secondary winding.								
41.2	Name/s of Insulating materials								

Sl. No.	Description	33KV		132KV				220 KV	400 KV
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
	between secondary winding and primary windings.								
41.3	Insulating materials used to achieve grading of capacitance.								
42.	DIAMETER OF WINDINGS								
42.1	Inside / outside diameter of secondary windings (mm)								
42.1.1	Inside / outside diameter of secondary windings (mm)								
42.1.1	Core – 1								
42.1.2	Core – 2								
42.1.3	Core – 3								
42.1.4	Core – 4								
42.1.5	Core – 5								
42.2	Inside / outsde diameters of primary winding (mm)								
42.3	Minimum clearance from tank (mm)								
42.4	Minimum clearance from secondary to tank (mm)								
43.	TANK AND SECONDARY TERMINAL BOX								
43.1	Material of the CT tank								
43.2	Material of the CT secondary terminal box								
43.3	Thickness of CT tank material (mm)								
43.4	Thickness of CT secondary terminal box material (mm)								

Sl. No.	Description	33KV		132KV				220 KV	400 KV
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
43.5	Zinc coating of the CT tank (gm/m^2) as per relevant upto date ISS								
43.6	Zinc coating of the CT secondary terminal box (gm/m^2) as per the relevant upto date ISS.								
43.7	Ingress protection rating of the secondary terminal box.								
43.8	Weight of the tank, fittings and other accessories (kg)								
44.	TERMINAL CONNECTOR								
44.1	Manufacturer's name								
44.2	Applicable standard								
44.3	Type								
44.4	Material of connector								
44.4.1	Clamp body								
44.4.2	Bolts and Nuts								
44.4.3	Spring washers								
44.5	Rated current (Amp)								
44.6	Rated terminal load (Kg)								
44.7	Factor of safety								
44.8	Minimum thickness of any part (mm)								
44.9	Weight of clamp complete with hardwares (kg)								
44.10	Type test reports as per IS enclosed								
44.11	OGA drawing enclosed								

Sl. No.	Description	33KV		132KV				220 KV	400 KV
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
45.	INSULATOR								
45.1	Manufacturer's name								
45.2	Type								
45.3	Applicable standards								
45.4	Height (mm)								
45.5	Diameter (top) (mm)								
45.7	Total creepage distance (mm)								
45.8.	Rated voltage (KV)								
45.9	Power frequency withstand voltage for 1 min. dry and wet. (KV – rms)								
45.10	1.2/50 micro-sec impulse withstand voltage (KVP)								
45.11	Corona extinction vollage (KV)								
45.12	Weight (Kg)								
45.13	Maximum allowable span (mm)								
45.14	Cantilever strength (Kg)								
45.15	The drawing enclosed.								
46.	Dielectric dissipation factor at 245/1.732KV (for 220KV C.T) and 145/1.732 KV (for 132 kv C.T.) at ambient temperature.								
47.	Accuracy class of standard C.T. to be used towards determination of ratio errors and phase angle errors for								

Sl. No.	Description	**33KV**		**132KV**				**220 KV**	**400 KV**
		a)400-200-100A /1-1-1A	b) 800-400-200A/ 1-1-1A	a) 800-400-200A/ 1-1-1-1A	b)600-300-150A/ 1-1-1-1A	c) 400-200-100A / 1-1-1-1A	d)400-200A/ 1-1-1-1A	1200-600-300A/ 1-1-1-1-1A	2000-1000-500A/ 1-1-1-1-1 A
	metering cores.								

GUARANTEED TECHNICAL PARTICULARS

FOR

CONTROL CABLE & POWER CABLE

1100V Cable (PVC & XLPE CONTROL & POWER CABLE)

The Contractor must complete a schedule for each size of cable supplied

ITEM NO.	DESCRIPTION	UNITS	BIDDERS OFFER
1	Standards to which the cable conforms	IS-1554/IEC 502	
2	Catalogue Number	-	

3	Conductor Material	-	
4	Conductor Strands	Number	
5	Conductor Shape	-	
6	Conductor cross sectional area	mm^2	
7	Outer Diameter of Conductor	mm	
8	Number of Cores	—	
9	Reduced neutral conductor cross sectional area	mm^2	
10	Insulation Material	-	
11	Minimum thickness of insulation	mm	
12	Nominal thickness of insulation	mm	
13	Outer Diameter over insulation	mm	
14	Nominal thickness of inner sheathing	mm	
15	Sheath Material	-	
16	Type of armouring	—	
17	Number and diameter/size of armour wires/strips	No/mm	
18	Minimum outersheath thickness	mm	
19	Nominal outersheath thickness	mm	
20	Overall diameter of cable	mm	
21	Minimum Bending Radius	mm	

ITEM NO.	DESCRIPTION	UNITS	BIDDERS OFFER
22	Cable identification per Clause 9	-	
23	Rated Voltage per IEC 502/IS - 1554	kV	
24	Conductor DC resistance per km at 20°C	ohm/km	

25	Conductor AC resistance per km at 20°C and 50Hz	ohm/km	
26	Maximum continuous rating of cable in the conditions outlined in Clause 4: System Conditions	A	
27	Minimum insulation resistance per km at 90°C	Mohm/km	
28	Maximum permissible continuous conductor temperature	°C	
29	Maximum permissible continuous outersheath temperature	°C	
30	DC test voltage for 15 mins. after installation	kV	
31	Delivery length per drum	m	
32	Weight of conductor per km	kg/km	
33	Weight of cable per km	kg/km	
34	Gross weight of full cable drum	kg	
35	Outer diameter of the cable drum	mm	
36	Width of cable drum	mm	
37	Maximum permissible cable pulling tension	kg	
38	Maximum permissible cable side wall pressure	kg	
39	Manufacturers Name	-	
40	Country of Origin	-	

GUARANTEED TECHNICAL PARTICULARS

FOR

CONDUCTOR, EARTH WIRE, INSULATORS

GUARANTEED TECHNICAL PARTICULARS OF CONDUCTOR

ACSR CONDUCTOR: **MOOSE** **ZEBRA** **PANTHOR**

Sl. No.	Description
1.	Code Word

2. Maker's name address and Country.
   a) Aluminum rods
   b) Steel Wire/rods
   c) Complete conductor
3. Stranding and wire diameter
   a) Aluminum.
   b) Steel.
4. Standard nominal copper area in sq. mm
5. Calculated equivalent aluminum area in sq. mm
6. Actual aluminum area in sq. mm.
7. Standard area of cross section in sq. mm.
   a) Aluminum strand
   b) Steel strand
   c) Conductor
8. Diameter of complete conductor in mm.
9. Minimum ultimate tensile stress of strand, in Kg/sq. mm. Before stranding and after stranding for
   a) Aluminum strand.
   b) Steel strand
10. Guaranteed ultimate tensile strength of conductor in Kg.
11. Minimum breaking load in Kg. Before stranding and after stranding for
   a) Aluminum strand.
   b) Steel strand.

12. Purity of aluminum rods.
13. Zinc coating of steel strand.
    a) Uniformity of coating
       number and/duration of dips.
    b) Minimum weight of coating gm/sq. mm.
14. Weight in Kg. per K.M.
    a) Aluminum.
    b) Steel.
    c) Conductor.
15. Resistance in ohms per Km. at 20° c.
16. Continuous maximum current
    rating of conductor in still
    air at 45° C ambient temperature,
    considering temp. rise of 50°C.
17. Modulus of elasticity of :
    Conductor.
18. Co-efficient of linear expansion
       per degree centigrade of.
    a) Aluminum strand.
    b) Steel Strand.
    c) Conductor.
19. Percentage of carbon in
    steel wire.
20. Standard length of each
    peace in Km.
21. Initial and final sags and
    tension and stringing charts,
    whether furnished.
22. Tolerance, if any on standard length.
23. Number of standard length
    in one reel.

24. Dimensions of the reel in cms.

25. Weight of the Conductor
in one reel in Kg.

26. Weight of the reel in Kg.

27. Gross weight of the reel
including weight of the conductor.

28. Wheather the conductor will be manufactured
as per the relevant Indian Standard Specification
& as per Section-IV 'Technical specification' of this specification.

29. Wheather the conductor will be Tested
as per the relevant Indian Standard Specification
& as per Section-IV 'Technical specification' of this specification.
(Cause-12 of Section –IV of Technical Specification)

29. Other particulars, if any.

GUARANTEED TECHNICAL PARTICULARS OF THE GALVANIZED STEEL G.I. EARTH WIRE

SL No.	DESCRIPTION		**'7/3.15 mm**	**'7/3.66 mm**
1.	Maker's name, address and country			
2.	Percentage of carbon content of the steel wire.			
3.	Particular of steel strands			
	a) Number of strands.			
	b) Diameter	Mm		
	c) Standard sectional area	Sq.mm		
	d) Minimum ultimate tensile strength.	N/mm2		
	e) Minimum breaking land			
	f) Final stress in steel wires	N/mm2 KN/mm2		
4.	(a) Uniformity of coating of number and duration of dips.	Minutes Number of dips.		
	1.			
	2.			
	b) Minimum weight of coating	GM/m2		
5.	Standard overall diameter of ground wire.	Sq.mm		
6.	Area of cross section of ground wire.	Mm		
7.	Guaranteed ultimate tensile strength of ground wire.	N/mm2		
8.	Maximum working tension	N/mm2		
9.	Resistance in ohms per KM at 20^0C.			
10.	Standard length of ground wire.	Km.		
11.	Modulus of elasticity of ground wire.	Kg / cm2 Final Initial		
12.	Co-efficient of linear expansion.			
13.	Zinc coating :-			
	a) Number of one minute dip			
	b) Number of half minute dip.			
	c) Quality of zinc			
14.	Weight of coating on wire			
15.	Process of galvanising			

GUARANTEED TECHNICAL PARTICULARS FOR INSULATORS

(SEPARATE SHEETS MAY BE FILLED IN FOR EACH VOLTAGE RATING & DIFFERENT KN RATING)

Sl. No.	Description.	Single Suspension	Double suspension	Single Tension	Double Tension.
1.	2.	3.	4.	5.	6.
1.	Makers name and address and country.				
2.	Size and designation of Ball and socket and standard to which if will conform mm.				
3.	No. of insulator discs per string.				
4.	Outside dia of the disc. Mm				
5.	Spacing – mm				
6.	Creepage distance of the single disc –mm				
7.	Electro-mechanical strength of single disc. Kg.				
8.	Withstand voltage of single disc.				
8.1	Power frequency: a) Dry-kV (rms) b) Wet-kV (rms				
8.2	Impulse voltage 1.2/50 micro second. a) Positive-kV (peak) b) Negative-kV (peak)				
9.	Withstand				

Sl. No.	Description.	Single Suspension	Double suspension	Single Tension	Double Tension.
	voltage for the complete string.				
9.1	Power frequency:				
	a) Dry-kV (rms)	With and without corona			
	b) Wet kV (rms)	ang.			
9.2	Lighting impulse voltage 1.2/50 micro second.				
	a) Positive kV(peak)	-do-			
	b) Negative Kv(Peak)				
9.3	Switching surge voltage 250/2500 micro second (for 400KV only)	-do-			
	a) Dry-kV (rms)				
	b) Wet kV (rms)				
10.	Flashover voltage for the disc.				
10.1	Power frequency:				
	a) Dry-kV (rms)				
	b) Wet kV (rms)				
10.2	Lighting impulse voltage 1.2/50 micro second.				
	a) Positive kV(peak)				
	b) Negative Kv(Peak)				
11.	Flashover				

Sl. No.	Description.	Single Suspension	Double suspension	Single Tension	Double Tension.
	voltage for the complete string.				
11.1	Power frequency:				
	a) Dry-kV (rms)	With and without corona ring.			
	b) Wet kV (rms)				
11.2	Lighting impulse voltage 1.2/50 micro second.				
	a) Positive kV(peak)				
	b) Negative Kv(Peak)				

GUARANTEED TECHNICAL PARTICULARS

FOR

ISOLATORS

GUARANTEED TECHNICAL PARTICULARS FOR DISCONNECTOR

(ISOLATORS)

(To be filled in separately for Disconnectors of different voltage classes and types)

400 KV	220 KV	132 KV	33 KV

1. Type / installation

2. Manufacturer's Name and
Country of manufacure

3. standard/s according to which
the isolator are manufactured

4. Maximum design voltage at which
the isolator can operate (kv)

5. frequency (Hz)

6. Rated Voltage (kv)

7. Max. current that can be safely interrupted by the isolator
Inductive (A & % PF)
Capacitive (A & % PF)

8. Continuous current rating (Amps)

9. Rated short time current

(i) For 3 second (KA rms)

(ii) Rated peak short time current (kVp)

10. Current density at the minimum cross-section of

a) Moving blade (Amps/Sq.mm)

b) Terminal pad

c) Contacts

d) Terminal Connector

11. Max. temp rise of current carrying parts when carrying rated current continuously. (deg. C)

12. factor for specified site conditions.

13. Derating Insulation levels.

i) Impulse withstand voltage (kV peak)

a) Phase to Earth

b) Across isolating Distance

ii) Switching surge withstand voltage (kV peak)

(a) Phase to Earth

(b) Across isolating Distance

iii) Power frequency withstand voltage (kV rms)

(a) Phase to Earth

(b) Across isolating distance

iv) Radio interference voltage at 1.1 times maximum line to ground voltage (micro volts)

v) Corona inception voltage (kV rms)

vi) Corona extinction voltage (KV rms)

14. Minimum clearance in air:

i) Between poles (mm)

ii) Between live parts and earth (mm)

iii) Between live part when switch is open

(a) On the same pole (mm)

(b) Between adjacent poles (mm)

15. Rated mechanical terminal load

a) Load along the terminal connector side (kg)

ii) Load across the terminal connector side(kg)

16. Torque required to operate the switch in Kg. m.

14. Contact zone

(i) Horizontal deflection (mm)

(ii) Vertical deflection (mm)

(iii) Total amplitude of longitudinal movement w.r.t. conductor supporting fixing contact (mm)

15. Design and Construction

i) No. of Insulators per pole

ii) Contacts

a) Material and grade

b) Cross-sectional area in sq.mm

i) Moving Blades

a) Material and grade

b) Cross sectional area

ii) Contact Support

a) Material and size of channel / block

b) Material and size of plate

iii) Rain hood – Material grade and size

iv) Turn and twist mechanism

a) Material and size of clamps

b) Material and size of springs

c) Whether springs are encased

v) Nuts and Bolts.

a) Size, material and grade in live parts.

b) Size material and grade in other parts

viii) Insulator base plate

Material and size of plate below insulators

ix) Bearings.

a) Material and size of housing

b) No. of bearings, location and size

x) Tandem pipe

a) Size class and no. of pipes

b) Size of shackle, screw

c) No. of bearings / bush and its material and size

xi) Type of inter lock

xii) Down pipe size and class

xiii) Type of universal / swivel joint

a) Between bearing and down pipe

b) Between down pipe and operating mechanism

xiv) Operating mechanism

a) Control cabinet

Material and thickness

Degree of protection

Type size and no. of cable glands

Whether removable gland plate provided.

b) Make type, rating and qty. of motors per isolator

Gears

Limit switches

Contactors

Over load relay

Single phase preventor

Auxiliary switch

Terminal blocks

Insuiator wires

HRC fuses

Pole discrepancy relay

Timer

Space Heater

Interlocks

xv) Insulators

a) Type

b) No. of units per insulator stack.

c) Rating of insulator (kV)

d) Height of each insulator stack (mm)

e) Bolt circle diameter (mm)

f) Tensile strength (kg)

g) Compressive strengh

h) Torsional strength (kg. m)

i) Cantilver strength upright (kg)

j) Power frequency dry flash over voltage (kV) rms

k) Power frequency wet flash over voltage (kV) rms

l) Power frequency puncture voltage (kV) rms

m) Impulse flash over voltage (positive wave) (kV) peak

n) Impulse withstand voltage (kV) peak

o) Power frequency withstand voltage (kV) rms

p) Visual discharge voltage level (kV) rms

q) Creepage distance

Total (mm)

Protected (mm)

r) Dry arcing distance (mm)

xvi) Base

a) Size of steel sections used

b) Overall size

c) Total weight

xvii) Terminal connectors

a) Clamp Body

Alloy Composition

Plating if any

Area at min. cross section

b)Bolts and nuts size

Alloy composition

Tensile strength

c)Type of washers used

d)Materials of braids

e)Temperature rise when carrying rated current at 50 deg. C ambient (deg.C)

f)Weight of each type of clamp (kg)

List of bought out items.

Sl. No.	Particulars of components	Qty.	Rating	Make	Type

19.0 List of test certificates (Type and routine)

20.0 List of drawings furnished.

GUARANTEED TECHNICAL PARTICULARS

FOR

SURGE ARRESTORS

GUARANTEED TECHNICAL PARTICULARS

Sl No.	Description	**390 KV**	**216 KV**	**120 KV**	**30 KV**
1	Bidder's Name and Address.				
2	Manufacturer's Name.				
3	Manufacturer's type designation.				
4	Applicable standards.				
5	Arrester class and type.				
6	Rated Arrester Voltage (KV rms).				
7	Maximum continuous operating voltages (MCOV) at design ambient temperature (KV-rms).				
8	Nominal discharge current (8/20 micro second wave) (KA).				
9	Minimum discharge capability referred to rated voltage at minimum of discharge characteristics (KJ/KV).				
10	Line discharge class as per IEC.				
11	Maximum switching surge residual voltage at 1 KA (KVP) for 390KV,216KV, 120KV and for 30KV at 500A.				
12	Maximum switching surge residual voltage at 1 KA for 216 KV.				
13	Maximum residual voltage for 8/20 micro-second current wave.				
	(a) At 50 % nominal discharge current.				
	(b) At 100 % nominal discharge current.				
	(c) At 200 % nominal discharge current.				
14	Maximum residual voltage with 1 micro-second current wave at 10 KAP (KVP).				
15	One minute power frequency (dry) & (wet) withstand voltage of arrester (KV-rms).				
16	Impulse withstand test voltage of arrester housing with 1.2/50 micro-second wave (KVP).				
17	High current short duration (4/10 micro-second impulse wave) (KAP).				
18	Low current long duration (KAP).				
19	Reference voltage and corresponding				

	reference current of arrester (KV)(mA).				
20	Maximum internal leakage current by its rms or peak value and both resistive and capacitive component separately at				
	(a) COV (resistive/capacitive) (mA).				
	(b) 1.1 COV (resistive/capacitive) (mA).				
	(c) COV at 150°C (resistive/capacitive) (mA).				
	(d) Reference voltage (resistive/capacitive)(mA).				
21	Pressure relief class.				
22	Are the protection levels affected by pollution of external insulation.				
23	Energy absorption capability per operation of the arrester, during a switching surge discharge (KJ).				
24	Maximum amount of energy that may be despatched into the arrester during discharge assuming that discharge takes place within 1 minute period and state the switching surge current (KJ/KA).				
25	Internal pressure required to operate pressure relief device as a percentage of burst pressure of porcelain (KJ) & %.				
26	Dynamic over-voltage withstand capability (KV-rms).				
	(a) For 0.1 Second.				
	(b) For 1 Second.				
	(c) For 10 Seconds.				
	(d) For 100 Seconds.				
27	Minimum prospective symmetrical fault current (KA).				
28	Rejection rate of ZnO blocks during manufacturing and operation for the past three years (%) separately.				
	(a) 2004-2005.				
	(b) 2005-2006.				
	(c) 2006-2007.				
29	**ZnO DISC DATA.**				
	(a) Rated voltage of ZnO disc. (KV-rms).				

	(b) No. of ZnO discs in a unit (Nos.)				
	(c) No. of units of arrester (Nos.)				
	(d) Height/thickness of ZnO discs (mm).				
	(e) Diameter of ZnO disc (mm).				
30	**EXTERNAL INSULATION.**				
	(a) Type.				
	(b) Applicable standard.				
	(c)(i) Lightning Impulse withstand test voltage of housing with 1.2/50 micro sec. Wave (KVP).				
	(ii) Wet switching impulse test voltage (KVP)				
	(d) One minute power frequency withstand voltage of arrester housing KV rms.				
	[i] Dry.				
	[ii] Wet.				
	(e) Total creepage distance of arrester housing (mm).				
	(f) Cantilever strength of complete arrester (Kg-m).				
31	**OVER ALL DIMENSIONS**.				
	(a) Overall Height (mm).				
	(b) Height upto top of terminal pad from mounting plane (mm).				
	(c) Material of terminal pad.				
	(d) Size of terminal pad (mm).				
	(e) Mounting dimensions and diameter of mounting holes (mm).				
	(f) Diameter of insulator (mm).				
	(g) Total weight of complete arrester (Kg.)				
32	**TERMINAL CONNECTOR.**				
	(a) Manufacturer's Name.				
	(b) Applicable standards.				
	(c) Type.				
	(d) Material of connector.				
	[i] Clamp body.				
	[ii] Bolts and Nuts.				
	[iii] Spring washers.				
	(e) Rated current (Amps.)				
	(f) Rated terminal load (kg.)				
	(g) Factor of safety.				
	(h) Minimum thickness of any part				

	(mm).				
	(i) Weight of clamp complete with hard ware (kg.)				
	(j) Type test report as per IS enclosed.				
	(k) OGA Drawing enclosed.				
33	**INSULATORS.**				
	(a) Manufacturers Name.				
	(b) Type.				
	(c) Applicable standards.				
	(d) Height (mm).				
	(e) Diameter (top)(mm).				
	(f) Diameter (bottom) (mm).				
	(g) Total creepage distance (mm).				
	(h) Rated voltage (KV – rms).				
	(i) Power frequency withstand voltage for 1 min. dry and wet (KV – rms).				
	(j) 1.2/50 micro - second impulse withstand voltage (KVP)				
	(k) Corona Extinction voltage (KV-rms)				
	(l) Weight (kg.)				
	(m) Maximum allowable span (mm).				
	(n) Cantilever strength (Kg – m).				

GUARANTEED TECHNICAL PARTICULARS

FOR

33/0.433 KV, 315 KVA STATION TRANSFORMER

GUARANTEED TECHNICAL PARTICULARS FOR 33/0.433 KV ,STATION TRANSFORMER:-

1. Name of the manufacturer.

2. Service.

3. KVA Rating:-

a) H.V. Winding. KVA

b) L.V. Winding. KVA

4. Highest system voltage/Nominal voltage.

	a)	**H.V. Winding.**	**KV**
	b)	**L.V.Winding**	**KV**
5.		**Rated frequency.**	**Hz**
6.		**Number of phases.**	
7.		**Connections:-**	
	a)	**H.V. Winding.**	
	b)	**L.V. Winding.**	
8.		**Connection symbol (See IS: 2026 (Part-IV-1977).**	
9.		**Tappings:-**	
	a)	**Range**	
	b)	**Number of steps for high voltages variation.**	
10.		**Reference ambient temperature:-**	
	a)	**Maximum ambient air/temperature.**	**ºC.**
	b)	**Maximum daily average ambient air temperature.**	**ºC.**
	c)	**Maximum yearly average ambient air temperature.**	**ºC.**
	d)	**Minimum ambient air temperature.**	**ºC.**
	e)	**Maximum cooling water temperature.**	**ºC.**
11.		**Type of cooling (See IS-2026 (Part-II)/1977.)**	
12.		**Temperature rise (See 2026 (Part-II)/1977)**	
	a)	**Temperature of oil**	**ºC.**
	b)	**Winding.**	**ºC.**
13.	**i)**	**Total loss at rated nominal voltage at normal tap & rated frequency.**	**KW**

ii) Stray loss at 75ºC.

iii) % Regulation.

14. (A) Component losses.

a) No-load loss at rated nominal voltage and normal frequency. **KW**

b) Load loss at rated current and rated frequency at normal tapping at 75ºC. & at extreme taps.

(B) Resistance at normal tap & at 75ºC.

i) H.V.

ii) L.V.

15. Impedance voltage & percentage Impedance at full rated current at 75ºC. for the

a) Normal tap.

b) Lowest tap position

c) Highest tap position.

16. Reactance at rated current and rated frequency. **Percentage.**

17. No load current at rated nominal voltage and rated frequency and at 50%, 75%, 100%, 110% & 121% voltage & at rated frequency.

18. Insulation level (See IS-2026 (Part-III/1977).

a) Separate source power frequency voltage withstand

i) H.V. Winding **KV rms.**

ii) L.V. Winding. **KV rms.**

b) Induced over voltage withstand.

i) H.V. Winding. **KV rms.**

ii) L.V. Winding. **KV rms.**

c) Full wave lighting impulse withstand voltage

with time vrs. peak voltage characteristic curves.

i) H.V. Winding. KV Peak.

ii) L.V. Winding. KV Peak.

d) P.I. value.

19. Efficiencies at 75ºC at unity power factor.

a) At full load. Percent
b) At ¾ full load -do-
c) At ½ full load -do-
d) At 120% of full load.

20. Regulation at full load at 75ºC

a) At unity power factor. -do-
b) At 0.8 power factor loading & lagging. -do-

21. Equipment for ONAN cooling.

a) State.
i) No.of Radiators on main tank.
ii) Make & type
Total radiating surface
iv) Thickness of radiator fins
v) Clear distance between fins
vi) Width of radiator fins

22. Number of coolers or cooler banks per transformer

23. Rating of each cooler or cooler bank.

24. Terminal arrangement.

a) High voltage.
b) Low voltage.
c) Neutral.

25. Approximate masses:-

a) Core Kg.
b) Winding. Kg.
c) Tank, fittings & accessories. (Name of accessories to be mentioned). Kg.
d) Oil. Kg.

e) Core coil assembly **Kg.**

f) radiators **Kg.**

g) Total mass **Kg.**

26. a)Approximate quantity of oil required for first filling. **Ltrs.**

b)Name of the manufacturer of oil used

27. Approximate tank dimensions for over all dimensions.

a) Length **mm**

b) Breadth. **mm**

c) Height. **mm**

d) Thickness of main tank cover plate, side & bottom plate. **mm**

e) Tank inside & outside dimension. Length/breadth/height. No. of tubes in each rediator. Tube length in copper, thickness & dia. Each side tubes (Nos.). **mm**

28. Despatch details.

a) Approximate mass of heaviest package. **Kg.**

b) Approximate dimensions of largest package.

i) Length. **mm**

ii) Breadth. **mm**

iii) Height. **mm**

29. Un-tanking height. **mm**

30. <u>Additional technical particulars</u>.

i) (a) i. Maximum flux density at highest system voltage & 48.5 c/s frequency. **Tesla or Wo/m^2.**

ii) Maximum flux density at rated system voltage & rated frequency.

(b) Maximum current density in windings. **Amps/Sq.Cm**

(c)	**Size of conductor used.**	**HV/LV**
	High voltage.	
	Low voltage.	
ii)	**Efficiency at 75ºC and 0.8 P.F. lagging**	
	At full load.	**Percent.**
	At ¾ full load	**-do-**
	At ½ full load	**-do-**
	Over loading capacity & efficiency.	
iii)	**Load at which maximum efficiency occurs.**	**-do-**
iv)	**Maximum efficiency.**	**Percent.**
v)	**Impulse level with 1/50 Micro.S. Wave.**	
High voltage		**KV**
Low voltage		**KV**
vi)	**No-load loss at 110% rated nominal**	
	voltage and rated frequency.	**KV**
vii)	**No load current at 110% & 121% of nominal**	
	voltage & rated frequency.	**Percentage.**
viii)	**Type of winding.**	
	High voltage.	
	Low voltage.	
	No. of turns of H.V.	
	No. of turns of L.V.	
ix)	**Insulation materials.**	
	Turn insulation high voltage.	
	Turn insulation low voltage.	
	Insulation core to low voltage.	
	Insulation high voltage to low voltage.	
x)	**Clearance:-**	
	Minimum clearance between phases.	
	a) In oil.	**mm**
	b) Out of oil.	**mm**
Maximum clearance high voltage to		
tank in oil.		**mm**

Minimum clearance high voltage to earth in oil. **mm**

xi) Minimum clearance height for lifting core & windings from rank. **mm.**

31. CORE **:-**

(i) Core materials used. (grade & thickness).

(ii) Loss in watts/Kg. of core materials corresponding to desired flux densities. **(Watts/Kg. curve to be furnished along with the bid.).**

(iii) EMF per turn

(iv) Core circumcircle dia (d).

(v) No. of core bolt holes per phase.

(vi) Dia of each core bolt holes in mm.

(vii) Net iron section (cm^2). **Limb/Yoke.**

(viii) Weight (Kg.)

(ix) Total GI (Kg.)

(X) Total (KW).

No. of steps.	**1**	**2**	**3**	**4**
Stack in mm.				
Width of core in mm.				
Stacking factor of core.				

32.(a) WINDING :-

Current per phase (Amp.)	**LV**	**HV**	**HV regulating.**
conductor bare (mm) No. of			

conductor insulation (mm).

Conductor section (mm^2)

Current density (A/mm^2)

Turns per phase (T).

Coils per limb.

Arranged.

Turns per coil.

Turns per layer.

Layers per coil.

Winding depth.

Coil dia inside.

Coil dia outside.

Length of mean turns.

Resistance at 75°C,

Total $I^2 R$ including stray at 75°C,

Weight of copper with/without insulations.

(b) Radiators provided (Nos.).

No. of fins provided.

Radiator size in mm (Length x wide x fin Nos.)

Loss to be dissipated by Radiators in KW.

Dissipation per fin at 50°C.

Thermal head in mm.

Radiator area.

33. <u>Oil data</u>:-

1. Quantity for first filling. Ltr.

2. Grade of oil used.

3. Maker's name.

4. BOV at the time of filling.

5. Type of oil.

34. Make of breather and type with capacity of silica gal filled in grams.

35. Inter layer insulation provided in design for:-

1.	**Top and bottom layer.**	**mm**
2.	**In between all layers.**	**mm**
3.	**Details of insulation.**	**mm**
4.	**Whether wedges are provided at 50% turns of the coil.**	

36. Insulation materials.

a)	**For conductors.**	**H.V.**
b)	**For core.**	**L.V.**

37. Particulars of bushings:-

1. **Maker's name.**
2. **Type IS-3347/IS-1180.**
3. **Rating as per I.S.**
4. **Dry flash over voltage**
   KV
5. **We flash over voltage**
   KV.

38. I.R. value at 30°C.

HV/E

LV/E

HV/LV

39. Polarisation Index :-

Measurement of Insulation resistance at 10 minutes/1 minute.

HV/E.

LV/E.

HV/LV.

GUARANTEED TECHNICAL PARTICULARS

FOR

CONTROL & RELAY PANEL

TECHNICAL DATA REQUIREMENTS

CONTROL AND RELAY PANELS
(Bidder's Name) ----------

1. Name and address of Manufacturer of panels 1. ……..
2. Manufacturer's type and designation 2. ……
3. Type of construction (Simplex /duplex) 3. ……

4.	Thickness of sheet steel (i) Front (ii) Back (iii) Sides	4. i) …… ii) …….. iii) ……..
5.	Degree of protection	5. ……..
6.	Name of the manufacturer of relays.	6. ……..
7.	DC voltage of the relays	7. ……
8.	Make and Model of static (o.2 accuracy class) Type) energy meters	8. …….
9.	Confirm whether offered manufacturer of C&R Panels and protective relays have tested Commissioned & they are in successful operation For at least two years in 400 /220/132/33 kV system. For 400/220/132 KV Sub-Station	9……

1).
(A) TYRANSMISSION LINE PROTECTION
Numerical Distance protection Scheme (Main-1)

1.	Name and address of Manufacturer of Relay/panels	1. …….
2.	Manufacturer's type and designation	2. …….
3.	Switched or Non-switched type (is It with separate measurements for Single/three phase faults)	3. …….
4.	Setting range of off set feature	4……
5.	Whether the relay is having self Monitoring feature.	5. ……..
6.	Whether relays is compatible for PLCC equipment and can be used for Permissive Under reach/over reach /Blocking scheme etc.	6. ……
7.	Suitable for single and three phase Trip?	7. ……..
8.	Type of shaped characteristic	8. ……..
9.	Whether it is communicable to other relays of different manufacturer. Also mention the communicating protocol.	9.....
10.	Features like broken conductor,SOTF,Distance to fault locater & other features as per Tech Spec	10.....

are available or not.

11. No of tripping contacts with making 11. ……
Capacity of 30 amp for 0.2 seconds.

12. In case 16 contacts as per above 12. ……..
Clause are not available with the distance relay
Offered, type tripping relays being offered.

13. Maximum operating time for at 50% of the 13. ……..
Reach setting of 2 ohms and 10/20 ohms
(with CVT) including all trip relays, if any
(Bidder is required to enclose isochronic
Curve with CVT on line)
a) at SIR=4 a) …….
b) at SIR=15, (3 phase faults) b) ……..
c) at SIR=15 (other faults) c) …….

14. IDMT earthy fault relay meeting Normal 14.....
Inverse Characteristics as per IEC 60253
Is being offered as built in feature for 400/220/132 KV lines.

15. If no, type of IDMT relay being offered 15.....

16. Built in feature offered with the relay (YES/NO) 16.....
a) Disturbance recorder a) ……
b) Fault locater b) ……
c) Over voltage (one stage only) c) ……
d) Auto recluse along with Dead line d) …….
e) Charging and check synchronizing. e) …….

17. Indicate the no. of Binary Input & Out put contacts 17.....

(B) Numerical Distance protection Scheme (Main-2)

1. Name and address of Manufacturer 1. ……
2. Manufacturer's type and designation 2. ……
3. Switched or Non-switched type (is 3. ……
it with separate measurements for
Single/three phase faults)
4. Setting range of off set feature. 4……
5. Whether the relay is compatible for PLCC 5. ……
Equipment and can be used for permissive
Under reach/over reach/Blocking scheme etc.
6. Suitable for single and three phase Trip 6. ……
7. Type of shaped characteristic 7. …….
8. No of tripping contacts with making 8. ……
Capacity of 30 amp for 0.2 seconds.

9. In case 16 contacts as per above Clause are not Available with the distance relay Offered, type of tripping relays being offered. 9. ……..

10. Maximum operating time for at 50% of the Reach setting of 2 ohms and 10/20 ohms (with CVT) including all trip relays, if any (Bidder is required to enclose isochronic Curve with CVT on line) 10. ……..
    a) at SIR=4 a) …….
    b) at SIR=15, (3 phase faults) b) ……..
    c) at SIR=15 (other faults) c) …….

11. Built in feature offered with the relay (YES/NO)
    a) Disturbance recorder a) …….
    b) Fault locator b) …….
    c) Over voltage (one stage only) c) …….
    d) Auto recluse along with Dead line Charging and check synchronizing. d) …….

(C) BACKUP DIRECTIONAL OVER CURRENT AND EARTH FAULT PROTECTION SCHEME(Numerical)

1. Name and address of Manufacturer 1. …….
2. Manufacturer's type and designation 2. …….
3. Three over current and one E/F elements Are whether independent or composite unit 3. ……..
4. Type of relay (Numerical) 4. …….
5. Directional sensitivity. 5. ……..
6. Whether characteristics conform to IEC 255-3 6. ……..
7. Over current unit setting range inverse time 7……
8. Earth fault unit setting range inverse time 8. ……..
9. VT Fuse failure relay/ feature included For alarm. 9. …….
10. Whether it is communicable to other relays of different manufacturer. Also mention the communicating protocol. 10.....

(D) LINE OVER VOLOTAGE PROTECTION RELAY

1. Name and address of Manufacturer. 1. …….
2. Manufacturer's type and designation 2. …….

3. Type of relay (Electromechanical/static/Numerical)3. ……..

4. Operation indicator provided? 4. …….

5. Operating time 5. …….

6. Resetting time 6. …….

7. Whether monitors all three phases? 7. ……..

8. Built in feature of Main/Main 2 distance Relay is offered. If so, which stage is Offered as built in 8. …….

(E) DISTANCE TO FAUALT LOCATOR

1. Name and address of Manufacturer of panels 1. …….

2. Manufacturer's type and designation 2. …….

3. Built in feature of Main/Main 2 distance Relay is offered 3. …….

4. Maximum registering time 4. …….

5. Whether direct display unit provided? 5. …….

6. Whether both phase to phase fault and Phase to earth fault measuring units included? 6. ……..

7. Whether-On-Line type 7. ……....

8. Accuracy for the typical conditions defined Under technical specification. 8. ……..

(F) DISTURBANCE RECORDER

a. Acquisition unit.

1. Name and address of Manufacturer . 1. …….

2. Manufacturer's type and designation 2. …….

3. No. of analogue channels 3. ……..

4. No. of digital recording channels. 4. …….

5. Built in feature of Main 1/ Main 2 distances. Relay is offered. 5. ……..

6. Pre-fault memory (milli seconds) 6. …….

7. Post fault memory (seconds) 7. …….

8. Total storage memory is seconds. 8. …….

9. Sampling Frequency. 9. …….

10.	Resolution of the event channels (ms)	10. ……..
11.	Time display present?	11. ……
12.	Data out put in COMTRADE is available.	12. ……

b. Evaluation Unit.

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	No. of acquisition unit that can be connected` To one evaluation unit.	3.
4.	Technical parameters of evaluation unit	4.
	A. Processor and speed.	A.
	B. RAM and hard disk capacity.	B.
	C. Additional facilities.	C.
	D. Details of printer.	D.
5.	Details of power supply arrangement for Acquisition unit (including printer).	5.

(G) AUTO RECLOSE RELAY

1.	Name and address of Manufacturer.	1……
2.	Manufacturer's type and designation.	2. …….
3.	Electromechanical/ static /numerical.	3……
4.	Auto re closure relay along with Dead line charging And check synchronizing relay (For 132 KV Lines) offered as a part of distance relay.	4.
5.	Built in feature of Main 1/ Main 2 distances.	5. ……..
	Relay is offered.	
6.	Suitable for single and three phase?	5. ……..
7.	Single phase dead time setting Range.	6. ……
8.	Three phase dead time setting range.	7. …….
9.	Reclaim time setting range.	8……

2.)

TRANSFORMER PROTECTION

a) Differential relay.

1.	Name and address of Manufacturer	1. …….

2.	Manufacturer's type and designation	2……
3.	Second harmonic restraint provided.	3. …….
4.	Whether three instantaneous units provided	4. …….
5.	Operating current setting range.	5……..
6.	Bias setting range,.	6. ……..
7.	Operating time at 5X setting current.	7. ……..
8.	Resetting time.	8. …….
9.	How ratio / phase angle corrections are being done (inter posting transformer/ internal feature in the relay)	9. ……
10.	Whether numerical or not	10.....
11.	Fifth Harmonic restraint feature.	11.....
12.	Communication protocol	12.....

b) Restricted Earth Fault Protection

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	Operating time at 2 x setting.	3. ……..
4.	Whether numerical	4.....
5.	Whether suitable for all type of transformer windings or not.	5.....

c) Over Fluxing relays.

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	Whether inverse time operating characteristics	5. …….
4.	Maximum operating time.	6. …….
5.	Accuracy of operating time.	7. …….
6.	Resetting time.	8. …….

d) Directional O/C and E/F relays.

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	Whether Characteristic will confirm to IEC 255-3	3…….
4.	Directional sensitivity.	4……
5.	Over current unit setting range	5. ……..

	a) Inverse time	a) ……
	b) High set	b) …….
6.	Earth fault unit setting range.	7. ……
	a) Inverse time	a) ……
	b) High set	b) ……..
7.	Whether numerical	7.....
8.	Features of disturbance recording	8.....

3)

GENERAL PROTECTION / MONITORING EQUIPMENT

a) Trip Circuit Supervision relay.

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	Whether pre-closing and post closing Supervision provided?	3. ……
4.	Time delay.	4. ……

b) High Speed Trip Relays.

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	Contact rating.	3. ……
	a) Making and carry continuously	a) …….
	b) Make and carry for 0.5 sec.	b)…….
	c) Break.	c) ……..
	i) Resistive load.	I) ……
	ii) Inductive load. (With L/R= 40 milli sec.).	Ii) ……
4.	Operating time at rated voltage (maximum)	4. ……
5.	Resetting time ..	5. …….
6.	Whether supervisory relays included.	6. ……

c) Local breaker back-up protection.

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……

3.	Operating time	3. …….
4.	Resetting time.	4. ……
5.	Setting ranges	5. ……
	a) Current	a) ……..
	b) Time.	b) ……..

4)
BUS BAR PROTECTION

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	Type of relay (Numerical)	3. ……
4.	Principle of operation (Biased.High/Low impedance)	4. …….
5.	Operating time	5. …….
6.	Resetting time.	6. ……..
7.	Resetting ranges. (i) Current. (ii) Time.	7. …….. (i) …….. (ii) ……
8.	Whether will it cause tripping for the differential Current below the load current of heavily Loaded feeder (Bidder shall submit application Check of the same).	8. ……..
9.	Whether LBB protection features available.	9.....
10.	Features of disturbance recording	10.....
11.	Communication protocol	11.....

5)
Meters and Instruments Indicating meters.

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	Operating principle or type of movement.	3. ……..
4.	Range:	4. …….
	(i) Voltage.	(i) ……

	(ii)	Current	(ii) …….
	(iii)	Frequency	(iii) ……
	iv)	Megawatt	(iv) …….
	v)	Megavar	(v) ……..
5.	Accuracy class.		5. …….
6.	Total deflection angle		6. ……
7.	Overall dimensions in mm.		7. ……
8.	Burden		8. …….
	(i)	Current coil	(i) ……
	(ii)	Voltage coil.	(ii) ……..
9.	Digital type		9.....
	a) Recording Meter for voltage		
1.	Name and address of Manufacturer		1. …….
2.	Manufacturer's type and designation		2……
3.	Accuracy class.		3. ……
4.	Full span response time		4. ……..
5.	Is it strip type recorder/ digital type		5. ……
6.	If it is digital type		6……
	i)	No of channels beings used.	I) ……..
	ii)	Whether time tagged information is available	ii) ……..
	iii)	Whether EMNC./EMI compatibility is tested	iii) …….
	b) Recording Meter for Current		
1.	Name and address of Manufacturer		1. …….
2.	Manufacturer's type and designation		2……
3.	Accuracy class.		3. ……
4.	Full span response time		4. ……..
5.	Is it strip type recorder/ digital type		5. ……
6.	If it is digital type		6……
	i)	No of channels beings used.	I) ……..
	ii)	Whether time tagged information is available	ii) ……..
	iii)	Whether EMNC./EMI compatibility is tested	iii) …….

c) Recording Meter for MW

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	Accuracy class.	3. ……
4.	Full span response time	4. ……..
5.	Is it strip type recorder/ digital type	5. ……
6.	If it is digital type	6……
	i) No of channels beings used.	I) ……..
	ii) Whether time tagged information is available	ii) ……..
	iii)Whether EMC./EMI compatibility is tested i	**ii) …….**

d) Recording Meter for MVAR

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	Accuracy class.	3. ……
4.	Full span response time	4. ……..
5.	Is it strip type recorder/ digital type	5. ……
6.	If it is digital type	6……
	i) No of channels beings used.	I) ……..
	ii) Whether time tagged information is available	ii) ……..
	iii)Whether EMC./EMI compatibility is tested	**iii) …….**

e) Recording Meter for frequency.

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	Accuracy class	3. ……..
4.	Full span response time.	4. ……..
5.	Is it strip type recorder/ digital type	5. ……..
6.	If it is digital type	6……
	i) No of channels beings used.	I) ……..
	ii) Whether time tagged information is available	ii) ……..
	iii) Whether EMC./EMI compatibility is tested	iii) …….

6) OTHERS:

a) Terminal Block

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2…….
3.	Rated current.	3. ……
4.	Rated voltage.	4. ……
5.	Minimum no. of conductors of area 2.5mm² suitable for connection.	5.
	(i) All circuits except CT./P.TCircuits.	(i)……
	(ii) C.T. Circuits.	(ii) …….

b) Switches.

i) Control Switches.

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2…….
3.	No.of contacts.	3. ……
4.	Type of handle.	4. ……..
5.	Rating of handle.	5. …….
6.	Rating of contacts.	6. …….. …….
	a) Make and carry continuously.	a) ……..
	b) Make & carry for 0.5 sec.	b) …….
	c) Break resistive load, in Amps (d.c)	c) ……..
	d) Break inductive load with L/R=40 m.sec inn Amps. (d.c)	d) ……..
7.	Life of switch in terms of million mechanical operations	7.

ii) Synchronizing switch

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2…….
3.	Contact ratings.	3. ……..
4.	No.of positions.	4. ……
5.	Removable handle type?	5. ……
6.	No.of contacts	6. ……

iii) Indicating Lamps.

1.	Name and address of Manufacturer	1. …….
2.	Manufacturer's type and designation	2……
3.	Ratings	
	(i) Current	(i) …….
	(ii) Voltage	(ii) ……
	(iii) Wattage	(iii) ……
4.	Whether series resistors are provided?	4. ……
5.	If series resistors provided, give	5. ……
	(i) Ohmic value	(i) ……..
	(ii) Wattage	(ii) ……..
6.	Life of Lamps in burning hours.	6. ……
7.	Permissible voltage variation	7. ……..
8.	Whether LED type	8.....
	iv) Push Buttons.	
1.	Name of Manufacturer.	1. …….
2.	Manufacturer's type and designation	2……
3.	Contact ratings.	3. ……..
4.	No.of contacts	4. ……
	v) Semaphore Indicators.	
1.	Name and address of Manufacturer	1. ……
2.	Manufacturer's type and designation	2……
3.	Is colour similar to mimic?	3. …….
4.	No.of positions	4. ……
5.	Burden DC	5. ……..
6.	Is the coil continuously rated?	6. ……..
	vi) Trransducers.	
1.	Make	1. …….
2.	type & Model No.	2. ……..
3.	Nominal AC input voltage.	3. …….
4.	Frequency.	4. ……..
5.	Input measuring Range	5. ……

6.	Output current range.	6. ……..
7.	Accuracy range.	7.
8.	Response time.	8…….
9.	A.C. ripple on output	9. …….
10.	Load Resistance (Maxm.)	10. …….
11.	Auxiliary supply voltage..	11. …….
	vii) Annunciators.	
1.	Make	1. …….
2.	Type & Model No.	2. …….
3.	Static/electromechanical	3. …….
4.	No. of lamps per window	4. …….
5.	Lamps	5. …….
	a) Voltage	a) …….
	b) Wattage.	b) ……..
6.	Minimum duration of impulse for initiating. Contact in millisecond	6. ……
7.	Type of reset self/manual.	7……..

GTP FOR LIGHTING

LIGHTING SYSTEM

A Lighting System & Accessories A

1. Manufacturer's Name and address 1……..
   a) Fixture a)…….
   b) Accessories b)…….

2. Applicable Standards for 2……
   a) Fixture a)…….
   b) Accessories b)…….

3. Manufacturer's Name type and catalogue no. for 3. …….
   a) Fixture a)…….
   b) Accessories b)…….

4. maximum permissible supply voltage
   Variation for satisfactory operation of
   a) Fixture a)…….

   b) Accessories b)…….

B. Conduits & Accessories B.
(For each type & size)

1. Manufacturer's Name and address 1. ……

2. Manufacturer's type, designation 2. …….

3. Applicable standard 3. ……

C. **Junction Boxes** C
(For each type & size)

1. Manufacturer's Name and address 1. ……

2. Manufacturer's type, designation 2. …….

3. Type of enclosure 3. ……

D. Lighting panels D.
(For each type & size)

1. Manufacturer's Name and address 1. ……

2. Type 2. ……

3. Degree of Protection 3. ……

E. **Lighting Transformer** E.

1. Manufacturer's Name and address 1. ……

2. Type 2. ……

3. Rating (KVA) 3. ……

4. Standards Applicable 4. ……

5. Degree of protection for enclosure 5. ……

F. **Lighting Ploes**

1. Manufacturer's Name and address 1. ……

2. Type 2. ……..

3. Dimensions 3. ……..

G. **Lighting Wires.** G.

1. Manufacturer's Name & Address. 1. ……..

2. Voltage grade 2. ……..

3. Cross section of conductor. 3. ……..

4. Insulation Thickness. 4. ……

GTP FOR DISTRIBUTION BOARD

DISTRIBUTION BOARD

L.T. Switchgear

1.	Manufacturer's Name	1. ……	
2.	Whether Manufacturer's have supplied 50 Nos. draw out Air circuit breaker panel out of which 5 Nos. are with CT and relaying scheme.	2. YES	NO
3.	Whether manufacturer's have supplied 50 Nos. MC panels similar to the offered panels.	3. YES	NO

4.	Whether 100 nos. (at least) circuit breakers of the make and type being offered are already been operating satisfactorily.	4. YES	NO
5.	Rated short circuit current	5.	
5.1	Symmetrical short circuit withstand Current at rated voltage of switchgear cubicle.	5.1 ……	
5.2	Peak short circuit withstand current	5.2 ……	
6.	Degree of protection.	6. ……..	
6.1	Breaker / MCC/ AC & DC	6.1. ……..	
6.2	Distribution Cubicles.	6.2 ……..	
6.3	Busbar Chamber	6.3 ……..	
7.	Standard height, width & depth of typical panel	7.	
7.1	Circuit Breaker Panel	7.1 ……..	
7.2	MCC panel	7.2 ……	
7.3	AC/DC Distribution Board.	7.3 ……	
8.	Width of cable alley	8. ……	
9.	Whether equipment are type tested as per IS	9. YES	NO

GUARANTEED TECHNICAL PARTICULARS

FOR

TRANSMISSION LINE : 400/220/132 KV

GUARANTED TECHNICAL PARTICULARS TO BE FIILED BY THE BIDDERS
SCHEDULE : B
Manufacturers And Place Of Manufacture,
Testing And Inspection
(To be filled up by Bidder)

Item	Manufacturer	Place of manufacture	Place of testing and inspection
Line conductors (ACSR) :	SUPPLIED	BY THE	EMPLOYER
Earthwire (galvanised steel) :			
Steel billets			
Drawing steel wires			
Stranding complete conductors			
Insulator units			
HV testing laboratory	-	-	
Insulator set fittings			
Earthwire fittings			

Conductor joints			
Conductor spacers/spacer dampers			
Vibration dampers (for earthwires and conductors)			
Steel towers :			
Design			
Steel billets, etc.			
Steel sections			
Fabrication			
Galvanising			
Check assembly			
Tower tests	-	-	
Bolts and nuts			
Tower fittings			
Earthing materials			

SCHEDULE : C
General Technical Particulars And Guarantees
(Parameters considered and guaranteed by the Bidder for the purpose of this Contract. The data filled in shall form the part of the Contract, in case of Award and shall be binding on the Contractor)

C. 1 - Span Lengths
(To be filled up by the Bidder)

	Unit	132kV	220kV	400kV
Normal span	m			
Tower design spans:				
Wind spans:				
Suspension towers	m			
Tension towers	m			
Maximum weight spans:				
Suspension towers	m			
Tension towers	m			

Minimum weight spans:				
Suspension towers	m			
Tension towers (uplift net)	m			

C . 2 - Line Conductor : 132 kV Construction
(To be filled up by the Bidder)

	Unit	
Complete line conductor:		
Actual area (total) per single conductor	mm^2	
Number of conductors per phase		
Horizontal distance between conductor centres of one phase	mm	
Each single conductor:		
ACSR conductor of code name		
IEC STANDARD No		
INDIAN STANDARD No		
Material of conductor		
Number and diameter of wires:		
Aluminium	No./mm	
Total area of conductor	mm^2	
Overall diameter of stranded conductor	mm	
Mass of conductor per kilometre	kg	
Ultimate strength of conductor	Newton	
Maximum tension of conductor at 5°C and 36% full wind pressure	Newton	
Maximum tension of conductor at 32°C with full wind pressure	Newton	

Maximum tension of conductor in still air at minimum temperature of 5°C	Newton	
Assumed equivalent modulus of elasticity of conductor	N/mm^2	
Assumed equivalent coefficient of linear expansion of conductor	per °C	

C . 2 - Line Conductor : 132 kV Construction (Continued)
(To be filled up by the Bidder)

	Unit	
Vibration damping system:		
*Maximum span for:		
One vibration damper at each end of span	m	
Two vibration dampers at each end of span	m	
Three vibration dampers at each end of span	m	
Dimensions from clamp mouth to vibration damper attachment:		
First damper	mm	
Second damper when required	mm	
Third damper when required	mm	

* Delete as appropriate and fill in details for selected damping system

(After placement of order, the Contractor has to carry-out vibration analysis and furnish a detailed vibration damper placement chart, as has been specified at Clause No. 2.3.14, for the approval of the Project Manager.)

C . 3 - Line Conductor : 220 kV Construction
(To be filled up by the Bidder)

	Unit	
Complete line conductor:		
Actual area (total) per single conductor	mm^2	
Number of conductors per phase		
Horizontal distance between conductor centres of one phase	mm	
Each single conductor:		
ACSR conductor of code name		
IEC STANDARD No		
INDIAN STANDARD No		
Material of conductor		
Number and diameter of wires:		
Aluminium	No./mm	
Total area of conductor	mm^2	
Overall diameter of stranded conductor	mm	
Mass of conductor per kilometre	kg	
Ultimate strength of conductor	Newton	
Maximum tension of conductor at 5°C and 36% full wind	Newton	
Maximum tension of conductor at 32°C with full wind	Newton	
Maximum tension of conductor in still air at minimum temperature of 5°C	Newton	
Assumed equivalent modulus of elasticity of conductor	N/mm^2	
Assumed equivalent coefficient of linear expansion of conductor	per °C	

C . 3 - Line Conductor : 220 kV Construction (Continued)
(To be filled up by the Bidder)

	Unit	
Vibration damping system:		
*Maximum span for:		
One vibration damper at each end of span	m	
Two vibration dampers at each end of span	m	
Three vibration dampers at each end of span	m	
Dimensions from clamp mouth to vibration damper attachment:		
First damper	mm	
Second damper when required	mm	
Third damper when required	mm	

* Delete as appropriate and fill in details for selected damping system

(After placement of order, the Contractor has to carry-out vibration analysis and furnish a detailed vibration damper placement chart, as has been specified at Clause No. 2.3.14, for the approval of the Project Manager.)

C . 4 - Line Conductor : 400 kV Construction
(To be filled up by the Bidder)

	Unit	
Complete line conductor:		
Actual area (total) per single conductor	mm^2	
Number of conductors per phase		
Horizontal distance between conductor centres of one phase	mm	
Each single conductor:		
ACSR conductor of code name		
IEC STANDARD No		
INDIAN STANDARD No		
Material of conductor		

Number and diameter of wires: Aluminium.	No./mm	
Total area of conductor	mm^2	
Overall diameter of stranded conductor	mm	
Mass of conductor per kilometre	kg	
Ultimate strength of conductor	Newton	
Maximum tension of conductor at 5°C and 36% full wind	Newton	
Maximum tension of conductor at 32°C with full wind	Newton	
Maximum tension of conductor in still air at minimum temperature of 5°C	Newton	
Assumed equivalent modulus of elasticity of conductor	N/mm^2	
Assumed equivalent coefficient of linear expansion of conductor	per °C	

C . 4 - Line Conductor : 400 kV Construction (Continued)
(To be filled up by the Bidder)

	Unit	
Vibration damping system and Spacing system:		
*Maximum span for:		
One vibration damper at each end of span	m	
Two vibration dampers at each end of span	m	
Three vibration dampers at each end of span	m	
Dimensions from clamp mouth to vibration damper attachment:		
First damper	mm	
Second damper when required	mm	
Third damper when required	mm	

Mean sub span for spacers	m	
If spacer dampers are to be offered:		
Mean sub span for spacer dampers	m	

* Delete as appropriate and fill in details for selected damping system

(After placement of order, the Contractor has to carry-out vibration analysis and furnish a detailed vibration damper placement chart, as has been specified at Clause No. 2.3.14, for the approval of the Project Manager. Also ,for spacer and spacer damper the Contractor shall furnish placement chart, for the approval of the Project Manger, as per the Clause No. 2.4.3.2 and 2.5.20 respectively.)

C . 5 - Earth Wire : 132 kV and 220 kV Constructions
(To be filled up by the Bidder)

	Unit	**GSW**
Complete earth conductor:		
Appropriate Indian Standard No		
Appropriate IEC Standard No		
Material of conductor		
Number and diameter of wires	No./mm	
Overall diameter of conductor	mm	
Mass of conductor per kilometre	kg	
Ultimate strength of conductor	Newton	
Lay length	mm	
Direction of the lay of the outer layer		
Chemical composition of the steel wire		
Carbon	%	
Manganese		
Phosphorous		
Sulphur		
Silicon		
Purity of Zinc for galvanising		

Steel strands after galvanising Diameter Minimum breaking load of one strand Galvanising a) Minimum weight of Zinc coating per sq.m. of the uncoated wire surface after galvanising	% mm kN gms	

C . 5 - Earth Wire : 132 kV and 220 kV Constructions (Continued)
(To be filled up by the Bidder)

	Unit	**GSW**
b) Minimum no. of one minute dips that the galvanised strand can withstand after stranding in Standard Preece Test	Nos.	
Maximum tension at 5°C and 36% full wind	Newton	
Maximum tension at 32°C with full wind	Newton	
Maximum tension of conductor in still air at 5°C	Newton	
Assumed equivalent modulus of elasticity of Conductor	hbar	
Assumed equivalent coefficient of linear expansion of conductor	per °C	
Maximum length of conductor on drum #	km	
D.C. resistance at 20 ^{o} C	ohms/km	
Maximum span for:		
One vibration damper at each end of span	m	
Two vibration dampers at each end of span	m	
Three vibration dampers at each end of span	m	
Dimensions from clamp mouth to vibration damper attachment		
First damper	mm	
Second damper when required	mm	

Third damper when required	mm	

It is permitted to supply two lengths of 2 kms each, in a single drum.

(After placement of order, the Contractor has to carry-out vibration analysis and furnish a detailed vibration damper placement chart, as has been specified at Clause No. 3.3 , for the approval of the Project Manager.)

C . 6 - Earth Wire : 400 kV Construction (To be filled up by the Bidder)

	Unit	**GSW**
Complete earth conductor:		
Appropriate Indian Standard No		
Appropriate IEC Standard No		
Material of conductor		
Number and diameter of wires	No./mm	
Overall diameter of conductor	mm	
Mass of conductor per kilometre	kg	
Ultimate strength of conductor	Newton	
Lay length	mm	
Chemical composition of the steel wire	%	
Carbon		
Manganese		
Phosphorous		
Sulphur		
Silicon		
Purity of Zinc for galvanising	%	
Steel strands after galvanising		
Diameter	mm	
Minimum breaking load of one strand	kN	
Galvanising		

a) Minimum weight of Zinc coating per sq.m. of the uncoated wire surface after galvanising	gms	
b) Minimum no. of one minute dips that the galvanised strand can withstand, after stranding in Standard Preece Test.		

C . 6 - Earth Wire : 400 kV Construction (Continued)
(To be filled up by the Bidder)

	Unit	GSW
Maximum tension at 5°C and 36% full wind pressure	Newton	
Maximum tension at 32°C with full wind pressure	Newton	
Maximum tension of conductor in still air at 5°C	Newton	
Assumed equivalent modulus of elasticity of Conductor	hbar	
Assumed equivalent coefficient of linear expansion of conductor	°C	
Maximum length of conductor on drum #	km	
D.C. resistance of the complete earthwire at 20^{O}C	ohms/km.	
Direction of lay of the outer layer		
Maximum span for:		
One vibration damper at each end of span	m	
Two vibration dampers at each end of span	m	
Three vibration dampers at each end of span	m	
Dimensions from clamp mouth to vibration damper attachment		
First damper	mm	
Second damper when required	mm	
Third damper when required	mm	

It is permitted to supply two lengths of 2kms each, in a single drum.

(After placement of order, the Contractor has to carry-out vibration analysis and furnish a detailed vibration damper placement chart, as has been specified at Clause No. 3.3 , for the approval of the Project Manager.)

C . 7 - Earthwire Fittings and Accessories
(To be filled up by the Bidder)

	Unit	GSW:7/3.15	GSW:7/3.66
Suspension Clamps			
Total drop	mm		
Weight of the assembly	kg		
Breaking load	kN		
Slipping strength	kN		
Tightening torque	kN		
Galvanising			
a) Minimum weight of Zinc coating per Sq.m. of uncoated surface	gms. /sq. m		
b) No. of one minute dips all the galvanised parts can withstand in Standard Preece test			
c) Purity of Zinc used for galvanising	%		
Tension Clamps			
Total weight of the assembly	kg		
Weight of the steel parts	kg		
Weight of the Aluminium encasing	kg		
Slipping strength of the clamp	kN		
Minimum breaking load of the assembly	kN		
Compression pressure	Tonne		
a) Steel sleeve			
b) Aluminium encasing			
Inside diameter (Before compression)	mm		
a) Steel sleeve			
b) Aluminium encasing			

C . 7 - Earthwire Fittings and Accessories (continued)
(To be filled up by the Bidder)

	Unit	GSW:7/3.15	GSW:7/3.66
Outside dimension of the steel sleeve	mm		
a) Before compression			
b) After compression			
i) Corner to corner			
ii) Surface to surface			
Outside diameter of the Aluminium encasing (Before compression)	mm		
Outside dimension of the clamp after compression of the Aluminium encasing	mm		
Length of the steel sleeve	mm		
a) Before compression			
b) After compression			
Final dimension of the clamp after compression with Aluminium encasing	mm		
Brinnel hardness no. of the steel sleeve (range)			
Resistance of the completed tension clamp	ohms		
Galvanising :			
a) Minimum weight of Zinc coating per Sq.m. of uncoated surface	gms./sq.m		
b) No. of one minute dips all the galvanised parts can withstand in Standard Preece test			
c) purity of Zinc used for galvanising	%		
Mid-span compression joints for earthwire			
Total weight of the joints	kg		
Weight of the steel sleeve	kg		
Weight of the aluminium sleeve	kg		

C . 7 - Earthwire Fittings and Accessories (continued)
(To be filled up by the Bidder)

	Unit	GSW:7/3.15	GSW:7/3.66
Inside diameter before compression	mm		
a) Steel sleeve			
b) Aluminium encasing			
Outside diameter before compression	mm		
a) Steel sleeve			
b) Aluminium encasing			
Outside dimensions of the joint after compression	mm		
a) Steel sleeve			
i) Corner to corner			
ii) Surface to surface			
b) With aluminium encasing			
Length of the steel sleeve	mm		
a) Before compression			
b) After compression			
Final length of the joint after compression with aluminium encasing	mm		
Compression pressure	Tonne		
Slipping strength	kN		
Resistance of the completed joint	ohms		
Galvanising :			
a) Minimum weight of Zinc coating per Sq.m. of uncoated surface	gms./sq.m		
b) No. of one minute dips all the galvanised parts can withstand in Standard Preece test			
c) Purity of Zinc for galvanizing	%		
Flexible copper bonds			
Resistance of the Cu-bond	ohms		
Total weight of the Cu-bonds	kg		
Slipping strength	kN		

C . 8 - Conductor(ACSR) Fittings and Accessories
(To be filled up by the Bidder)

	Unit	PANTHER	ZEBRA	MOOSE
Mid-span compression joints for Conductors				
Weight of the joints	kgs			
Slipping strength	kN			
Resistance of the completed joints	ohms			
Material of the joints (specify alloy type and its aluminium contents)				
Before compression dia. of sleeve	mm			
a) Inner diameter				
b) Outer diameter				
Dimensions after compression	mm			
a) Corner to corner				
b) Surface to surface				
Length of the sleeve	mm			
a) Before compression				
b) After compression				
Compression pressure	Tonne			
Whether designed for intermittent or continuous compression				
Minimum corona extinction voltage under dry conditions	kV			
Radio interference voltage under conditions	Micro Volts			

C . 8 - Conductor(ACSR) Fittings and Accessories (continued)
(To be filled up by the Bidder)

	Unit	PANTHER	ZEBRA	MOOSE
Repair sleeve for conductors				
Weight of the sleeve	kgs			
Before compression dia. of sleeve	mm			
a) Inner diameter				
b) Outer diameter				
Dimensions after compression	mm			
a) Corner to corner				
b) Surface to surface				
Length of the sleeve	mm			
a) Before compression				
b) After compression				
Compression pressure	Tonne			
Minimum corona extinction voltage under dry conditions	kV			
Radio interference voltage under conditions	Micro Volts			
T-connector (only for ACSR MOOSE)				
Weight of the T-connector	kgs			
Axial tensile strength of the welded portion of the T-connector	kN			
Breaking strength of the T-connector	kN			
Resistance of the completed T-connection	ohms			

C . 8 - Conductor(ACSR) Fittings and Accessories (continued)
(To be filled up by the Bidder)

	Unit	PANTHER	ZEBRA	MOOSE
Before compression dia. of the T-connector	mm			

a) Inner diameter				
b) Outer diameter				
Dimensions after compression	mm			
a) Corner to corner				
b) Surface to surface				
Length of the T-connector	mm			
a) Before compression				
b) After compression				
Compression pressure	Tonne			
Minimum corona extinction voltage under dry conditions	kV			
Radio interference voltage under conditions	Micro Volts			

C . 9 - Vibration Damper For Conductor and Earthwire
(To be completed by the Bidder)

Vibration Dampers for ACSR PANTHER	Unit	
Total weight of the damper	kgs	
		Left Right
Weight of each damper mass	kgs	
Resonance frequencies		
1) First frequency	Hz	
2) Second frequency	Hz	
Dimension of each damper mass	mm	
Material of :		
1) Damper mass		
2) Messenger cable		
No. of strands in messenger cable		
Lay ratio of the messenger cable strands		
Min. tensile strength of messenger cable	kg/sq.mm.	
Mass pull-off strength	kN	
Clamping torque	kg.-m	
Slipping strength of the damper clamp	kN	
1) Before fatigue test		
2) After fatigue test		
Magnetic power loss per vibration damper	Watts	
Min. corona extinction voltage under dry conditions	kV	
Radio interference voltage under dry conditions at 1MHz , at 105 kV	Micro Volts	
Percentage variation in reactance after fatigue test in comparision with that before the fatigue test	%	
Percentage variation in power dissipation after fatigue test in comparision with that before the fatigue test	%	

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for ACSR PANTHER	Unit	
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanizing	%	
Vibration Dampers for ACSR ZEBRA		
Total weight of the damper	kgs	
		Left Right
Weight of each damper mass	kgs	
Resonance frequencies		
1) First frequency	Hz	
2) Second frequency	Hz	
Dimension of each damper mass	mm	
Material of :		
1) Damper mass		
2) Messenger cable		
No. of strands in messenger cable		
Lay ratio of the messenger cable strands		
Min. tensile strength of messenger cable	kg/sq.mm.	
Mass pull-off strength	kN	
Clamping torque	kg.-m	
Slipping strength of the damper clamp	kN	
1) Before fatigue test		
2) After fatigue test		

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for ACSR ZEBRA	Unit	
Magnetic power loss per vibration damper	Watts	
Min. corona extinction voltage under dry conditions	kV	
Radio interference voltage under dry conditions at 1MHz, at 154 kV	Micro Volts	
Percentage variation in reactance after fatigue test in comparision with that before the fatigue test	%	
Percentage variation in power dissipation after fatigue test in comparision with that before the fatigue test	%	
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanizing	%	
Vibration Dampers for ACSR MOOSE		
Total weight of the damper	kgs	
		Left Right
Weight of each damper mass	kgs	
Resonance frequencies		
1) First frequency	Hz	
2) Second frequency	Hz	
Dimension of each damper mass	mm	
Material of :		
1) Damper mass		
2) Messenger cable		

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for ACSR MOOSE	Unit	
No. of strands in messenger cable		
Lay ratio of the messenger cable strands		
Min. tensile strength of messenger cable	kg/sq.mm.	
Mass pull-off strength	kN	
Clamping torque	kg.-m	
Slipping strength of the damper clamp	kN	
1) Before fatigue test		
2) After fatigue test		
Magnetic power loss per vibration damper	Watts	
Min. corona extinction voltage under dry conditions	kV	
Radio interference voltage under dry conditions at 1MHz , at 305 kV	Micro Volts	
Percentage variation in reactance after fatigue test in comparision with that before the fatigue test	%	
Percentage variation in power dissipation after fatigue test in comparision with that before the fatigue test	%	
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanizing	%	

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for 7/3.15mm Earthwire	Unit		
Total weight of the damper	kgs		
		Left	Right

Weight of each damper mass	kgs	
Resonance frequencies		
1) First frequency	Hz	
2) Second frequency	Hz	
Dimension of each damper mass	mm	
Material of :		
1) Damper mass		
2) Messenger cable		
No. of strands in messenger cable		
Lay ratio of the messenger cable strands		
Min. tensile strength of messenger cable	kg/sq.mm.	
Mass pull-off strength	kN	
Clamping torque	kg.-m	
Slipping strength of the damper clamp	kN	
1) Before fatigue test		
2) After fatigue test		
Percentage variation in reactance after fatigue test in comparision with that before the fatigue test	%	
Percentage variation in power dissipation after fatigue test in comparision with that before the fatigue test	%	

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for 7/3.15mm Earthwire	Unit	
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	

3) Purity of Zinc used for galvanizing	%	
Vibration Dampers for 7/3.66mm Earthwire		
Total weight of the damper	kgs	
		Left Right
Weight of each damper mass	kgs	
Resonance frequencies		
1) First frequency	Hz	
2) Second frequency	Hz	
Dimension of each damper mass	mm	
Material of :		
1) Damper mass		
2) Messenger cable		
No. of strands in messenger cable		
Lay ratio of the messenger cable strands		
Min. tensile strength of messenger cable	kg/sq.mm.	
Mass pull-off strength	kN	
Clamping torque	kg.-m	
Slipping strength of the damper clamp	kN	
1) Before fatigue test		
2) After fatigue test		

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for 7/3.66mm Earthwire	Unit	
Percentage variation in reactance after fatigue test in comparision with that before the fatigue test	%	
Percentage variation in power dissipation after fatigue test in comparision with that before the	%	

fatigue test		
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanizing	%	

C . 10 - Bundle Spacers For 400kV Line Conductors
(To be filled up by the Bidder)

	Unit	
Material of component parts(indicate type of alloy)		
1) Insert		
2) Main body		
3) Retaining rods (if any)		
Manufacturing process for		
1) Insert		
2) Main body		
3) Retaining rods (if any)		
Retaining rods (if used)		
1) Type of alloy used		
2) No. of retaining rods used for each spacer		
3) Diameter of the rod	mm	
4) Length of the rod	mm	
5) Total weight of one set of the rods	kgs	
Elatomer		
1) Supplier		
2) Type		
3) Moulded on the insert or not		
4) Shore hardness		
5) Thickness on the insert	mm	
6) Temperature for which designed	^{o}C	
Minimum strength of the spacer		
1) Compressive load	kN	

2) Tensile load	kN	
Weight of the spacer	kgs	
Designed clamping torque (if applicable)	kg-m	
Slipping strength of spacer clamp 1) Before vibration test	kN	
2) After vibration test	kN	

C . 10 - Bundle Spacers For 400kV Line Conductors (Continued)
(To be filled up by the Bidder)

	Unit	
Magnetic power loss per spacer	Watts	
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanising	%	
Min. corona extinction voltage under dry conditions	kV	
Radio interference voltage under dry conditions	Micro Volts	
Electrical resistance of the elastomer cushioned spacer (specify the range)	ohms	

C.11 - Bundle Spacers For Jumpers Of 400kV Lines
(To be filled up by the Bidder)

	Unit	
Material of component parts (indicate type of alloy) 1) Insert		
2) Main body		
Manufacturing process for 1) Insert		
2) Main body		

Elatomer 1) Supplier		
2) Type		
3) Moulded on the insert or not		
4) Shore hardness		
5) Thickness on the insert	mm	
6) Temperature for which designed	^{o}C	
Minimum strength of the spacer for jumpers 1) Compressive load	kN	
2) Tensile load	kN	
Weight of the spacer for jumpers	kgs	
Designed clamping torque for spacer for jumpers	kg-m	
Slipping strength of spacer clamp for jumpers	kN	
Magnetic power loss per spacer for jumpers	Watts	
Galvanising of ferrous parts (if any) 1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanising	%	
Min. corona extinction voltage under dry conditions	kV	
Radio interference voltage under dry conditions	MicroVolt	
Electrical resistance of the elastomer cushioned spacer for jumpers (specify the range)	ohms	

C.12 - Spacer Dampers For 400kV Line Conductors
(To be filled up by the Bidder)

	Unit	
Material of component parts (indicate type of alloy / rubber component) 1) Insert		
2) Main body		
3) Retaining rods (if any)		
4) Damping ball		
Manufacturing process for		

1) Insert		
2) Main body		
3) Retaining rods (if any)		
4) Damping ball		
Retaining rods (if used)		
1) Type of alloy used		
2) No. of retaining rods used for each unit		
3) Diameter of the rod	mm	
4) Length of the rod	mm	
5) Total weight of one set of the rods	kgs	
Elatomer		
1) Supplier		
2) Type		
3) Moulded on the insert or not		
4) Shore hardness		
5) Thickness on the insert	mm	
6) Temperature for which designed	^{o}C	
Minimum strength of the spacer damper		
1) Compressive load	kN	
2) Tensile load	kN	

C.12 - Spacer Dampers For 400kV Line Conductors (Continued)
(To be filled up by the Bidder)

	Unit	
Weight of the spacer damper	kgs	
Designed clamping torque (if applicable)	kg-m	
Slipping strength of spacer damper clamp		
1) Before vibration test	kN	
2) After vibration test	kN	

Galvanising of ferrous parts (if any)			
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m		
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.		
3) Purity of Zinc used for galvanising	%		
Min. corona extinction voltage under dry conditions	kV		
Radio interference voltage under dry conditions	Micro Volts		
Magnetic power loss per spacer damper	Watts		
Electrical resistance of the elastomer cushioned spacer damper (specify the range)	ohms		

C.13 - Disc Insulator Units (Standard Type)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Weight of the single disc unit	kg				
Size and designation of the ball pin shank	mm				
Diameter of the disc	mm				
Tolerance on the diameter	+/-mm				
Ball to ball spacing between disc	mm				
Tolerance on ball to ball spacing	+/-mm				
Minimum creepage distance of a single disc	mm				
Positive tolerance on the minimum creepage distance	+mm				
Shell material (Glass/Porcelain)					
Power frequency flashover voltage (rms) of single disc unit					
1) Dry	kV				

2) Wet	kV				
Power frequency withstand voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				
Power frequency puncture voltage (rms) of single disc unit	kV				

C.13 - Disc Insulator Units (Standard Type) (Continued)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Impulse flashover voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Impulse withstand voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Steepness of the impulse voltage which the disc unit can withstand in Steep Wave Front Test	kV per micro sec.				
Corona extinction voltage (rms) under dry condition, for single unit					
Maximum RIV at 1 MHz and at 10 kV (rms) for single unit	Micro Volts.				
Purity of Zinc used for galvanising	%				
No. of dips in Standard Preece Test					
1) Cap socket					
2) Ball pin					
Axial and radial run-out (According to IEC)					
1) As per pointer A	mm				
2) As per pointer B	mm				

C.13A - Composite Insulator Units (Standard Type)

(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Weight of the single insulatort unit	kg				
Size and designation of the ball pin shank / clevis and tongue	mm				
Diameter of (along with tolerance)	mm				
1) central core without housing sleeve cover					
2) central core with housing sleeve cover					
3) weather shed					
Length of single insulator unit	mm				
Tolerance on unit insulator length	+/-mm				
Minimum creepage distance of a single insulator unit	mm				
Positive tolerance on the minimum creepage distance	+mm				
Core material					
Shed material					
Power frequency flashover voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				
Power frequency withstand voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				

C.13A - Composite Insulator Units (Standard Type) (Continued)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Impulse flashover voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					

Impulse withstand voltage (peak) of single disc unit (dry) 1) Positive 2) Negative					
Steepness of the impulse voltage which the disc unit can withstand in Steep Wave Front Test	kV per micro sec.				
Corona extinction voltage (rms) under dry condition, for single unit					
Maximum RIV at 1 MHz and at 10 kV (rms) for single unit	Micro Volts.				
Purity of Zinc used for galvanising	%				
No. of dips in Standard Preece Test 1) Cap socket 2) Ball pin					

Note : Any other parameters which Bidder feels are necessary to define the offered composite insulator unit, shall be indicated and guaranteed in the above format.

C.14 - Disc Insulator Units (Anti-fog Type)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Weight of the single disc unit	kg				
Size and designation of the ball pin shank	mm				
Diameter of the disc	mm				
Tolerance on the diameter	+/-mm				
Ball to ball spacing between disc	mm				
Tolerance on ball to ball spacing	+/-mm				
Minimum creepage distance of a single disc	mm				
Positive tolerance on the minimum creepage distance	+mm				
Shell material (Glass/Porcelain)					

Power frequency flashover voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				
Power frequency withstand voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				
Power frequency puncture voltage (rms) of single disc unit	kV				

C.14 - Disc Insulator Units (Anti-fog Type) (Continued)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Impulse flashover voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Impulse withstand voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Steepness of the impulse voltage which the disc unit can withstand in Steep Wave Front Test	kV per micro sec.				
Corona extinction voltage (rms) under dry condition, for single unit					
Maximum RIV at 1 MHz and at 10 kV (rms) for single unit	Micro Volts.				
Purity of Zinc used for galvanising	%				
Purity of Zinc used for sleeve	%				
No. of dips in Standard Preece Test 1) Cap socket					

2) Ball pin					
Axial and radial run-out (According to IEC)					
1) As per pointer A	mm				
2) As per pointer B	mm				

C.14A - Composite Insulator Units (Anti-fog Type)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Weight of the single insulatort unit	kg				
Size and designation of the ball pin shank / clevis and tongue	mm				
Diameter of (along with tolerance)	mm				
1) central core without housing sleeve cover					
2) central core with housing sleeve cover					
3) weather shed					
Length of single insulator unit	mm				
Tolerance on unit insulator length	+/-mm				
Minimum creepage distance of a single insulator unit	mm				
Positive tolerance on the minimum creepage distance	+mm				
Core material					
Shed material					
Power frequency flashover voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				
Power frequency withstand voltage (rms) of single disc unit					
1) Dry	kV				

2) Wet	kV					

C.14A - Composite Insulator Units (Anti-fog Type) (Continued)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Impulse flashover voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Impulse withstand voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Steepness of the impulse voltage which the disc unit can withstand in Steep Wave Front Test	kV per micro sec.				
Corona extinction voltage (rms) under dry condition, for single unit					
Maximum RIV at 1 MHz and at 10 kV (rms) for single unit	Micro Volts.				
Purity of Zinc used for galvanising	%				
No. of dips in Standard Preece Test					
1) Cap socket					
2) Ball pin					

Note : Any other parameters which Bidder feels are necessary to define the offered composite insulator unit, shall be indicated and guaranteed in the above format.

C . 15 - Insulator Strings (Suspension Sets For 132 kV Lines)
(To be filled up by the Bidder)

	Unit	Single "I" Suspension Strings	Double "I" Suspension Strings	Pilot Suspension Strings
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)			

Impulse flashover voltage (peak) under dry conditions				
1) Positive	kV			
2) Negative	kV			
Impulse withstand voltage (peak) under dry conditions				
1) Positive	kV			
2) Negative	kV			
Salt-fog pollution withstand voltage (only for strings with anti-fog disc units)	kV(rms)			
Minimum corona extinction voltage under dry conditions	kV(rms)			
Radio interference voltage under dry conditions at 1MHz, at 105kV	Micro Volts			
Mechanical strength of the complete insulator string along with all hardware fittings	kN			
Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%			
Number of insulator units in each string				

C . 15 - Insulator Strings (Suspension Sets For 132 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Double "I" Suspension Strings**	**Pilot Suspension Strings**
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm			
Weight of the set, complete with all fittings and arcing horns	kg			
Weight of the counter-weights	kg			

Minimum arcing gap distance	mm			
Maximum magnetic power loss of the suspension assembly	Watts			
Slipping strength of the suspension assembly (clamp torque Vs. slip curve shall be enclosed)	kN			
Particulars of Standard/AGS pre-formed armour rod set for suspension assembly		Standard Or, AGS	Standard Or, AGS	Standard Or, AGS
1) No. of rods per set	No.			
2) Direction of the lay				
3) Overall length after fitting on the conductor	mm			
4) Actual length of each rod along its helix	mm			
5) Diameter of each rod	mm			
6) Tolerance in				
a) Diameter of each rod	+/- mm			
b) Length of each rod	+/- mm			
c) Difference of length between the longest and shortest rod in a set	+/- mm			
7) Type of Aluminium alloy used for manufacture of PA rods				
8) UTS of each rod	kg/mm ^{2}			

C . 15 - Insulator Strings (Suspension Sets For 132 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Double "I" Suspension Strings**	**Pilot Suspension Strings**
Particular of Elastomer (for AGS clamps only)				
1) Supplier of elastomer				
2) Type of elastomer				

3) Shore hardness of elastomer				
4) Temperature range for which elastomer is designed	^{o}C			
5) Moulded on insert	yes/no			
Purity of Zinc used for galvanising	%			
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.			
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m			

C . 16 - Insulator Strings (Tension Sets For 132 kV Lines)
(To be filled up by the Bidder)

	Unit	**Single Tension Strings**	**Double Tension Strings**
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)		
Impulse flashover voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Impulse withstand voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Salt-fog pollution withstand voltage (only for strings with anti-fog units)	kV (rms)		
Minimum corona extinction voltage under dry conditions	kV(rms)		
Radio interference voltage under dry conditions at 1MHz, at 105kV	Micro Volts		
Mechanical strength of the complete insulator string along with all hardware fittings	kN		

Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%		
Number of insulator units in each string			
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm		

C . 16 - Insulator Strings (Tension Sets For 132 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single Tension Strings**	**Double Tension Strings**
Weight of the set, complete with all fittings and arcing horns	kg		
Minimum arcing gap distance	mm		
Electrical resistance of the complete tension assembly along with jumper connection	ohms		
Slipping strength of the tension assembly	kN		
Purity of Zinc used for galvanising	%		
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.		
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m		

C . 17 - Insulator Strings (Suspension Sets For 220 kV Lines)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Double "I" Suspension Strings**	**Pilot Suspension Strings**
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)			
Impulse flashover voltage (peak) under dry conditions				
1) Positive	kV			

2) Negative	kV			
Impulse withstand voltage (peak) under dry conditions				
1) Positive	kV			
2) Negative	kV			
Salt-fog pollution withstand voltage (only for strings with anti-fog disc units)	kV(rms)			
Minimum corona extinction voltage under dry conditions	kV(rms)			
Radio interference voltage under dry conditions at 1MHz, at 154kV	Micro Volts			
Mechanical strength of the complete insulator string along with all hardware fittings	kN			
Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%			
Number of insulator units in each string				

C . 17 - Insulator Strings (Suspension Sets For 220 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Double "I" Suspension Strings**	**Pilot Suspension Strings**
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm			
Weight of the set, complete with all fittings and arcing horns	kg			
Weight of the counter-weights	kg			
Minimum arcing gap distance	mm			
Maximum magnetic power loss of the suspension assembly	Watts			
Slipping strength of the suspension assembly (clamp torque Vs. slip curve shall be enclosed)	kN			
Particulars of Standard/AGS pre-formed armour rod set for suspension assembly		Standard Or, AGS	Standard Or, AGS	Standard Or, AGS
1) No. of rods per set	No.			
2) Direction of the lay				
3) Overall length after fitting on the conductor	mm			
4) Actual length of each rod along its helix	mm			
5) Diameter of each rod	mm			
6) Tolerance in				
a) Diameter of each rod	+/- mm			
b) Length of each rod	+/- mm			
c) Difference of length between the longest and shortest rod in a set	+/- mm			
7) Type of Aluminium alloy used for manufacture of PA rods				
8) UTS of each rod	kg/mm ^{2}			

C . 17 - Insulator Strings (Suspension Sets For 220 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Double "I" Suspension Strings**	**Pilot Suspension Strings**
Particular of Elastomer (for AGS clamps only)				
1) Supplier of elastomer				
2) Type of elastomer				
3) Shore hardness of elastomer				
4) Temperature range for which elastomer is designed	^{o}C			
5) Moulded on insert	yes/no			
Purity of Zinc used for galvanising	%			
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.			
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq. m			

C . 18 - Insulator Strings (Tension Sets For 220 kV Lines)
(To be filled up by the Bidder)

	Unit	**Single Tension Strings**	**Double Tension Strings**
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)		
Impulse flashover voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		

Impulse withstand voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Salt-fog pollution withstand voltage (only for strings with anti-fog units)	kV (rms)		
Minimum corona extinction voltage under dry conditions	kV(rms)		
Radio interference voltage under dry conditions at 1MHz, at 105kV	Micro Volts		
Mechanical strength of the complete insulator string along with all hardware fittings	kN		
Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%		
Number of insulator units in each string			
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm		

C . 18 - Insulator Strings (Tension Sets For 220 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single Tension Strings**	**Double Tension Strings**
Weight of the set, complete with all fittings and arcing horns	kg		
Minimum arcing gap distance	mm		
Electrical resistance of the complete tension assembly along with jumper connection	ohms		
Slipping strength of the tension assembly	kN		
Purity of Zinc used for galvanising	%		
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.		
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq. m		

C . 19 - Insulator Strings (Suspension Sets For 400 kV Lines)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Pilot Suspension Strings**
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)		
Switching surge withstand voltage (peak) under wet conditions			
1) Positive	kV		
2) Negative	kV		
Impulse flashover voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Impulse withstand voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Salt-fog pollution withstand voltage (only for strings with anti-fog units)	kV (rms)		
Minimum corona extinction voltage under dry conditions	kV(rms)		
Radio interference voltage under dry conditions at 1MHz, at 305kV	Micro Volts		
Mechanical strength of the complete insulator string along with all hardware fittings	kN		
Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%		
Number of insulator units in each string			

C . 19 - Insulator Strings (Suspension Sets For 400 kV Lines) (Continued)

(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Pilot Suspension Strings**
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm		
Weight of the set, complete with all fittings and arcing horns	kg		
Weight of the counter-weights	kg		
Minimum arcing gap distance	mm		
Maximum magnetic power loss of the suspension assembly	Watts		
Slipping strength of the suspension assembly (clamp torque Vs. slip curve shall be enclosed)	kN		
Particulars of Standard/AGS pre-formed armour rod set for suspension assembly		Standard Or, AGS	Standard Or, AGS
1) No. of rods per set	No.		
2) Direction of the lay			
3) Overall length after fitting on the conductor	mm		
4) Actual length of each rod along its helix	mm		
5) Diameter of each rod	mm		
6) Tolerance in			
a) Diameter of each rod	+/- mm		
b) Length of each rod	+/- mm		
c) Difference of length between the longest and shortest rod in a set	+/- mm		
7) Type of Aluminium alloy used for manufacture of PA rods			
8) UTS of each rod	kg/mm^2		

C . 19 - Insulator Strings (Suspension Sets For 400 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Pilot Suspension Strings**
Particular of Elastomer (for AGS clamps only)			
1) Supplier of elastomer			
2) Type of elastomer			
3) Shore hardness of elastomer			
4) Temperature range for which elastomer is designed	^{o}C		
5) Moulded on insert	yes/no		
Purity of Zinc used for galvanising	%		
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.		
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq. m		

C . 20 - Insulator Strings (Tension Sets For 400 kV Lines)
(To be filled up by the Bidder)

	Unit	**SingleTension Strings (Low Duty)**	**Double Tension Strings**
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)		
Switching surge withstand voltage (peak) under wet conditions			
1) Positive	kV		
2) Negative	kV		
Impulse flashover voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Impulse withstand voltage (peak) under dry conditions			

1) Positive	kV		
2) Negative	kV		
Salt-fog pollution withstand voltage (only for strings with anti-fog units)	kV (rms)		
Minimum corona extinction voltage under dry conditions	kV(rms)		
Radio interference voltage under dry conditions at 1MHz, at 305kV	Micro Volts		
Mechanical strength of the complete insulator string along with all hardware fittings	kN		
Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%		
Number of insulator units in each string			

C . 20 - Insulator Strings (Tension Sets For 400 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**SingleTension Strings (Low Duty)**	**Double Tension Strings**
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm		
Weight of the set, complete with all fittings and arcing horns	kg		
Minimum arcing gap distance	mm		
Electrical resistance of the complete tension assembly along with jumper connection	ohms		
Slipping strength of the tension assembly	kN		
Purity of Zinc used for galvanising	%		
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.		
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m		

C . 21 - Tower Design Particulars : 132 kV Construction
(To be filled up by the Bidder)

	Unit	
Maximum tension per phase, for purposes of tower design and application		
Suspension towers	Newton	
Tension towers	Newton	
Slack span side downleads, `per individual conductor'	Newton	
Maximum uplift per phase on each crossarm for purpose of tension tower design	Newton	
Maximum tension of earth conductor for purpose of tower design and application:		
Suspension towers	Newton	
Tension towers	Newton	
Earthwire slack span side downleads	Newton	
Maximum uplift of each earth conductor on the tower for purpose of tower design	Newton	
Minimum clearance between live metal and tower steelwork:		
i. with suspension insulator set swing 0°	mm	
with suspension insulator set swing 15°	mm	
with suspension insulator set swing 30°	mm	
with suspension insulator set swing 45°	mm	
with suspension insulator set swing 60°	mm	
ii. with jumper loop swing 0°	mm	
with jumper loop swing 10°	mm	
with jumper loop swing 20°	mm	
with jumper loop swing 30°	mm	
with jumper loop swing 40°	mm	
Insulator suspension set, unobstructed transverse swing angle from vertical	degrees	
Earth conductor suspension clamps, unobstructed transverse swing angle from vertical	degrees	

Earth conductor maximum shielding angle from vertical at tower attachment point over outer line conductors	degrees	

C . 22 - Tower Design Particulars : 220 kV Construction
(To be filled up by the Bidder)

	Unit	
Maximum tension per phase, for purposes of tower design and application		
Suspension towers	Newton	
Tension towers	Newton	
Slack span side downleads, `per individual conductor'	Newton	
Maximum uplift per phase on each crossarm for purpose of tension tower design	Newton	
Maximum tension of earth conductor for purpose of tower design and application:		
Suspension towers	Newton	
Tension towers	Newton	
Earthwire slack span side downleads	Newton	
Maximum uplift of each earth conductor on the tower for purpose of tower design	Newton	
Minimum clearance between live metal and tower steelwork:		
i. with suspension insulator set swing 0°	mm	
with suspension insulator set swing 15°	mm	
with suspension insulator set swing 30°	mm	
with suspension insulator set swing 45°	mm	
with suspension insulator set swing 60°	mm	
ii. with jumper loop swing 0°	mm	
with jumper loop swing 10°	mm	
with jumper loop swing 20°	mm	
with jumper loop swing 30°	mm	
with jumper loop swing 40°	mm	

Insulator suspension set, unobstructed transverse swing angle from vertical	degrees	
Earth conductor suspension clamps, unobstructed transverse swing angle from vertical	degrees	
Earth conductor maximum shielding angle from vertical at tower attachment point over outer line conductors	degrees	

C . 23 - Tower Design Particulars : 400 kV Construction
(To be filled up by the Bidder)

	Unit	
Maximum tension per phase, for purposes of tower design and application		
Suspension towers	Newton	
Tension towers	Newton	
Slack span side downleads, `per individual conductor'	Newton	
Maximum uplift per phase on each crossarm for purpose of tension tower design	Newton	
Maximum tension of earth conductor for purpose of tower design and application:		
Suspension towers	Newton	
Tension towers	Newton	
Earthwire slack span side downleads	Newton	
Maximum uplift of each earth conductor on the tower for purpose of tower design	Newton	
Minimum clearance between live metal and tower steelwork:		
i. with suspension insulator set swing 0°	mm	
with suspension insulator set swing 15°	mm	
with suspension insulator set swing 30°	mm	
with suspension insulator set swing 45°	mm	
with suspension insulator set swing 60°	mm	
ii. with jumper loop swing 0°	mm	
with jumper loop swing 10°	mm	
with jumper loop swing 20°	mm	
with jumper loop swing 30°	mm	

with jumper loop swing 40°	mm	
Insulator suspension set, unobstructed transverse swing angle from vertical	degrees	
Earth conductor suspension clamps, unobstructed transverse swing angle from vertical	degrees	
Earth conductor maximum shielding angle from vertical at tower attachment point over outer line conductors	degrees	

C . 24 - Tower Design Particulars (Common for all Towers)
(To be filled up by the Bidder)

	Unit		
Maximum ratio of unsupported length of steel compression member to their least radius of gyration:			
Leg members, ground wire peak members and lower members of the crossarms in compression			
Other members carrying computed stresses			
Redundant members			
Tension only members			
		Mild steel	High yield steel
Maximum ultimate stresses, for checking tower designs not subjected to test (unless otherwise approved) :			
Compression members, Bidder to indicate his design Assumptions	N/mm^2		
Tension members (elastic limit)	N/mm^2		
Shear on bolts	N/mm^2		
Bearing on bolts	N/mm^2		

C . 25 - Particulars Of Double Circuit Towers : 132 kV Construction
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	DA	DB	DC	DD
Type of insulator sets		Suspension	Tension	Tension	Tension
Maximum angle of deviation	degree				
Normal span length	m				
Minimum ground clearance of line conductor at 85°C, normal ground	m				
Sag of line conductor in normal span length at 85°C	m				
Maximum distance of line conductor below crossarm	m				
Height above ground of bottom conductor Crossarm	m				
Minimum height of earth conductors above upper line conductor : at tower	m				
: at mid-span	m				
Vertical spacing between line conductors at tower : Minimum	m				
Actual	m				
Overall tower height	m				
Maximum differential foundation movement permitted under ultimate loads	mm				
Clearance between conductors of one circuit and tower climbing leg of the other circuit : Minimum	m				

Actual	m				
Horizontal distance, from tower centre line of insulator attachments	m				
Horizontal distance, from tower centre line of earth conductors	m				

C . 25 - Particulars Of Double Circuit Towers : 132 kV Construction (Continued)
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	DA	DB	DC	DD
Tower body dimensions at bottom crossarm level (transverse x longitudinal)	m				
Overall tower base dimensions at ground line (transverse x longitudinal) : Maximum for standard height towers	m				
Actual for standard height towers	m				
Total transverse overturning moment at ground line of standard height tower.	kN-m.				
Mass of complete standard height tower above ground line (including bolts/nuts; bolts/nuts to be indicated separately)	kg				
Mass of tower body extension above ground line : 3 metre body extension only	kg				
6 metre body extension only	kg				
9 metre body extension only	kg				
12 metre body extension only	kg		-	-	-
18 metre body extension only	kg		-	-	-

C . 26 - Particulars Of Double Circuit Towers : 220 kV Construction
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	DA	DB	DC	DD

Type of insulator sets		Suspension	Tension	Tension	Tension
Maximum angle of deviation	degree				
Normal span length	m				
Minimum ground clearance of line conductor at 85 °C, normal ground	m				
Sag of line conductor in normal span length at 85 °C	m				
Maximum distance of line conductor below crossarm	m				
Height above ground of bottom conductor crossarm	m				
Minimum height of earth conductors above upper line conductor : at tower	m				
: at mid-span	m				
Vertical spacing between line conductors at tower : Minimum	m				
Actual	m				
Overall tower height	m				
Maximum differential foundation movement permitted under ultimate loads	mm				
Clearance between conductors of one circuit and tower climbing leg of the other circuit : Minimum	m				
Actual	m				
Horizontal distance, from tower centre line of insulator attachments	m				
Horizontal distance, from tower centre line of earth conductors	m				

C . 26 - Particulars Of Double Circuit Towers : 220 kV Construction (Continued)
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	DA	DB	DC	DD
Tower body dimensions at bottom crossarm level (transverse x longitudinal)	m				
Overall tower base dimensions at ground line (transverse x longitudinal) Maximum for standard height towers	m				
Actual for standard height towers	m				
Total transverse overturning moment at ground line of standard height tower	kg-m.				
Mass of complete standard height tower above ground line (including bolts/nuts; bolts/nuts to be indicated separately)	kg				
Mass of tower body extensions above ground line					
3 metre body extension only	kg				
6 metre body extension only	kg				
9 metre body extension only	kg				
12 metre body extension only	kg		-	-	-
18 metre body extension only	kg		-	-	-
25 metre body extension only	kg		-	-	-

C . 27 - Particulars Of Double Circuit Towers : 400 kV Construction
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	DA	DB	DC	DD
Type of insulator sets		Suspension	Tension	Tension	Tension
Maximum angle of deviation	degree				
Normal span length	m				
Minimum ground clearance of line conductor at 85 °C, normal ground	m				
Sag of line conductor in normal span length at 85 °C	m				

Maximum distance of line conductor below crossarm	m				
Height above ground of bottom conductor crossarm	m				
Minimum height of earth conductors above upper line conductor : at tower	m				
: at mid-span	m				
Vertical spacing between line conductors at tower : Minimum	m				
Actual	m				
Overall tower height	m				
Maximum differential foundation movement permitted under ultimate loads	mm				
Clearance between conductors of one circuit and tower climbing leg of the other circuit : Minimum	m				
Actual	m				
Horizontal distance, from tower centre line of insulator attachments	m				
Horizontal distance, from tower centre line of earth conductors	m				

C . 27 - Particulars Of Double Circuit Towers : 400 kV Construction (Continued)
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	**DA**	**DB**	**DC**	**DD**
Tower body dimensions at bottom crossarm level (transverse x longitudinal)	m				
Overall tower base dimensions at ground line (transversex longitudinal) Maximum for standard height towers	m				
Actual for standard height towers	m				

Total transverse overturning moment at ground line of standard height tower	kg-m.				
Mass of complete standard height tower above ground line (including bolts/nuts; bolts/nuts to be indicated separately)	kg				
Mass of tower body extensions above ground line					
3metre body extension only	kg				
6metre body extension only	kg				
9metre body extension only	kg				
12metre body extension only	kg		-	-	-
18metre body extension only	kg		-	-	-
25metre body extension only	kg		-	-	-

C . 28 - Foundation Design Particulars
(To be filled up by the Bidder)

	Unit	
Assumed density of Plain Cement Concrete (PCC) for foundation in dry soil	kg/m^3	
Assumed density of Plain Cement Concrete (PCC) for foundation in presence of sub-soil water	kg/m^3	
Assumed density of Re-inforced Cement Concrete (RCC) for foundation in dry soil	kg/m^3	
Assumed density of Re-inforced Cement Concrete (RCC) for foundation in presence of sub-soil water	kg/m^3	
28 day concrete cube strength (characteristic strength for M-20 concrete)	N/mm^2	
28 day concrete cube strength (characteristic strength for M-15 concrete)	N/mm^2	
Minimum proportion of stub load to be allowed for in the design of stub cleats	%	
Density of all type of soils :		
1) under dry conditions	kg/m^3	
2) in presence of surface water	kg/m^3	
3) in presence of sub-soil water	kg/m^3	

Ultimate bearing capacity of the soil : 1) normal soil under dry condition	kN/m^2	
2) normal soil in presence of surface as well as sub-soil water	kN/m^2	
3) wet black cotton soil	kN/m^2	
4) fissured rock (both for dry and wet)	kN/m^2	
5) hard rock	kN/m^2	
Angle of repose for : 1) dry soil	Degree	
2) wet soil due to presence of surface/ sub-soil water	Degree	
3) wet black cotton soil	Degree	
4) dry fissured rock	Degree	
5) wet fissured rock	Degree	
Ultimate bond between steel and concrete	kN/m^2	

C . 29 - Quality Of Materials
(To be filled up by the Bidder)

Particulars	Unit						
Towers:		**Mild steel**		**High tensile steel**			
		Steel members	**Steel nuts and bolts**	**Steel members**	**Steel nuts and bolts**		
Grade/standard							
Tensile breaking stress	2 N/mm						
Elongation on breaking	%						
Gauge length of specimen	mm						
Diameter of specimen	mm						
Yield point as percentage of breaking stress							
Insulators and fittings:		**Insulator unit metalwork**			**Phase and earth conductor metal fittings**		
		Steel	**Malleable cast iron**	**Insulator caps**	**Steel**	**Malleable cast**	

						iron
Grade/standard						
Tensile breaking stress	N/mm^2					
Elongation on breaking	%					
Gauge length of specimen	mm					
Diameter of specimen	mm					
Yield point as percentage of breaking stress	%					