

## Guaranteed Technical Particulars

(To be filled by the Tenderer)

### 1. 400/220/132KV GIS

SI No	Particulars	To be Filled in by Tenderer		
<b>1</b>	<b>General</b>			
<b>2</b>	Name of manufacturer (OEM)			
<b>3</b>	Country of Origin			
<b>4</b>	Delivery from (location)			
<b>5</b>	Type & Designation			
<b>6</b>	Type tested at Name of laboratory: Address of laboratory:			
<b>7</b>	Whether suitable for OUTDOOR installation or			
<b>8</b>	Standards applicable			
<b>9</b>	i) No. of Phases ii) Single or Three phase design	400KV	220KV	132KV
<b>10</b>	<b>Configuration</b>			
i	Number of Feeder bays			
ii	Number of transformer bays			
iv	Future extension possibility			
<b>11</b>	<b>Service conditions</b>			
i	Ambient Air Temp. in Deg. C			
ii	Max Temp. in Deg. C			
iii	Min Temp. in Deg. C			
iv	Daily Average Temp. in Deg. C			
v	Solar Radiation W/sq mtr			
vi	Altitude above MSL, in mtr			
vii	Pollution class			
viii	Creepage distance, in mm/kV			
ix	Relative humidity			
x	Condensation			
xi	Vibration level			
xii	Noise level			
xiii	Induced Electromagnetic Disturbance, in kV			
xiv	Seismic conditions			
a	Vertical			
b	Horizontal			
<b>12</b>	<b>Enclosure</b>			
i	Code of pressure vessel			
ii	Type of manufacturing			
iii	Design temperature in Deg.C			
iv	Material			
v	Material grade & applicable standard			
vi	Outside diameter in mm			
vii	Minimum Wall Thickness, in mm			
viii	Painting Shade & Thickness			

SI No	Particulars	To be Filled in by Tenderer		
a	- External			
b	- Internal			
ix	Degree of Protection			
x	Inductance in H/mt			
xi	Capacitance in pF/mt			
xii	Resistance in Ohm/mt			
xiii	Expansion Bellow			
a	Material			
b	Min allowable adjustable displacement Longitudinal Transverse			
xiv	Sealing system			
a	Type			
xv	Estimated life in years			
xvi	Barrier			
a	Material			
b	Dielectric strength			
<b>13</b>	<b>Support Structure</b>			
i	Material			
ii	Minimum thickness of galvanizing			
iii	Foundation channels /Anchor bolts			
<b>14</b>	<b>Grounding</b>			
i	Grounding Material			
ii	Grounding of complete GIS			
iii	Grounding of individual compartment			
iv	Grounding at flange joints			
<b>15</b>	<b>System Parameters</b>			
i	Highest System voltage in kV			
ii	Rated voltage of System in kV			
iii	Rated voltage of Equipment in kV			
iv	Rated Insulation level Phase to Earth and between Phases			
a	One Min Power Frequency withstand voltage			
b	Switching impulse withstand voltage, kVp			
	- Phase to Earth			
	- Between Phases			
c	Lightning Impulse withstand voltage, kVp			
v	Rated Frequency			
vi	Rated current in Amp			
vii	Rated current at 50 °C (equipment) in Amp			
viii	Rated current at 50 °C (bus bar) in Amp			
ix	Rated short circuit withstand current kArms			
a	Duration in sec			
b	Peak, kAp			
x	Enclosure withstand time for an internal fault in			
xi	Estimated total energy loss at			
	100 % of rated capacity			
	75 % of rated capacity			
	50 % of rated capacity			
	25 % of rated capacity			

SI No	Particulars	To be Filled in by Tenderer		
xii	Measures taken to minimize Over Voltage			
xiii	Phase labeling			
xiv	<b>Auxiliary supply (AC Voltage, Frequency; DC voltage)</b>			
	-Operation			
	-Control			
	-Illumination & heater			
<b>16</b>	<b>Delivery conditions</b>			
i	Bays fully assembled at works			
ii	Dimensions of longest section for transportation			
iii	Weight of heaviest package			
iv	Pressure of SF6 gas during transportation			
v	SF6 gas monitoring system provided during transportation			
<b>17</b>	<b>Bus Bar</b>			
I	Configuration (Single/double)			
ii	Nos of Phases			
iii	Material			
iv	Size			
V	Rating			
vi	Current density adopted			
vii	Current density as per type test report			
viii	Short time current withstand rating in kA			
Ix	Duration			
X	Resistance per phase			
xi	Surge impedance			
xii	SF6 immersed insulator			
A	Material			
B	Dielectric strength			
xiv	Maximum Partial Discharges measured at HSV			
<b>18</b>	<b>SF6 Gas</b>			
I	Applicable standard			
ii	Quantity of SF6 Gas of complete GIS at filling			
iii	Quantity of SF6 Gas of <b>largest</b> compartment GIS at filling pressure, in kg			
Iv	Nos of Gas compartments			
v	Quantity of SF6 Gas of <b>individual</b> compartment GIS at filling pressure, in kg			
vi	Maximum permissible dew point, in Deg.C			
vii	Composition of Gas			
A	SF6 > 99.90 % by weight			
B	Air < 500 ppm by weight (0.25 vol.-%)			
C	CF4 < 500 ppm by weight (0.1 vol.-%)			
D	H2O < 15 ppm by weight (0.012 Vol.-%)			
E	Mineral oil < 10 ppm by weight			

SI No	Particulars	To be Filled in by Tenderer		
F	Acidity, in terms of HF < 0.3 ppm by weight			
G	Hydrolysable fluorides, In terms of HF < 1 ppm by weight			
	<b>PRESSURE</b>			
viii	Design pressure			
A	Circuit breaker			
B	Other compartments			
Ix	Rated filling pressure			
A	Circuit breaker			
B	Other compartments			
X	Type tested pressure.			
A	Circuit breaker			
B	Other compartments			
Xi	Routine test pressure			
A	Circuit breaker			
B	Other compartments			
xii	Operating pressure of PRD			
A	Circuit breaker			
B	Other compartments			
xiii	Alarm Pressure			
A	Circuit breaker			
B	Other compartments			
C	CB lock out Pressure			
D	Over pressure signaling			
xiv	Maximum SF6 Gas leakage rate, in % per year			
Xv	Density Monitor to be provided for each Individual gas compartment.			
<b>19</b>	<b>Circuit Breaker</b>			
I	Applicable standard			
ii	Type			
iii	Designation			
Iv	Operating Mechanism type			
V	Nos. of phases			
Vi	Rated current in Amp			
vii	Mechanical Endurance class			
viii	Electrical Endurance class			
Ix	Restrike probability class			
X	Rated SC breaking current			
Xi	Rated SC breaking current - single phase test			
Xii	Rated Line charging breaking current			
xiii	Rated Cable charging breaking current			
Xiv	Capacitor bank switching capability, BC1 BC2			
Xv	Inductive current			
xvi	Reactive current			
xvii	Out of phase making & breaking current			
xviii	Rated short line fault current			

SI No	Particulars	To be Filled in by Tenderer		
Xix	TRV characteristic			
Xx	First Pole to Clear factor			
xxi	Nos. of interrupters per phase			
xxii	Type of arc control device provided, if any			
xxiii	Type of arcing contacts			
xxiv	Material of main contact			
xxv	Material of Arcing contacts			
xxvi	Filter material			
xxvii	Timings of operations			
A	- Opening at nominal control voltage			
	- Opening at minimum control voltage			
B	Closing time at nominal control voltage			
xxviii	Rated operating duty cycle			
xxix	Tripping Coils			
	- No of coils			
	- Rated Voltage			
	- Rated Current			
	- Rated Watts			
	- Resistance			
xxx	Closing Coil			
	- Rated Voltage			
	- Rated Current			
	- Rated Watts			
	- Resistance			
xxxi	Spring Charging Motor			
	- Rated Voltage			
	- Rated Current			
	- Rated Watts			
xxxii	Spring charging time at rated Aux supply			
xxxiii	Spring charging time at min Aux supply			
xxxiv	Maintenance required after nos. of operation at			
I	No load			
Ii	Rated current			
Iii	25% of rated SC current			
Iv	50% rated SC current			
V	Rated SC current			
E	Provision of anti pumping			
F	No of operations after switching off of motor Aux. supply			
xxxvi	Provision of Manual trip			
xxxvii	Electrical interlocking			
xxxviii	Padlocking			
xxxix	Type of Operation counter provided			
<b>20</b>	<b>DISCONNECTORS</b>			
I	Applicable standards			
Ii	Type			
Iii	Rated current in Amp for			
	- Bus disconnecter			
	- Line disconnecter			
	- PT disconnecter			
Iv	Maximum Current that can be safely interrupted by the Isolator (Amp).			
	- Inductive			
	- Capacitive			

SI No	Particulars	To be Filled in by Tenderer		
v	Rate Short time withstand Current in kA, for 3 Sec			
vi	Rated peak short time Current, kAp			
vii	Rated bus charging current, in Amp			
viii	Type of contacts			
ix	Material of contacts			
x	Current Density at minimum cross section (A/mm <sup>2</sup> )			
xi	Rated lightning impulse withstand voltage across the open gap, kVp			
xii	Rated Power Freq withstand voltage across the open gap, kVrms			
xiii	Mechanical Endurance class			
xiv	Type of Operating Mechanism			
xv	Operating Motor details			
	- Type			
	- Rated Voltage			
	- Rated Current			
	- Rated Watts			
xvi	Operating Time - Closing - Opening			
xvii	Mechanical indication on drive shaft			
<b>21</b>	<b>Maintenance Grounding Switch</b>			
i	Applicable standards			
ii	Type			
iii	Rate Short time withstand Current in kA, for 3 Sec			
iv	Rated peak short time Current, kAp			
v	Rated lightning impulse withstand voltage across the open gap, kVp			
vi	Rated Power Freq withstand voltage across the open gap, kVrms			
vii	Type of Operating Mechanism			
viii	Operating Motor details			
	- Type			
	- Rated Voltage			
	- Rated Current			
	- Rated Watts			
xi	Operating time -Closing -Opening			
x	Mechanical indication on drive shaft			
<b>22</b>	<b>Fast Acting Grounding Switch</b>			
i	Applicable standards			
ii	Type			
iii	Rate Short time withstand Current in kA, for 3 Sec			
iv	Rated peak short time Current, kAp			
v	Rated induced current switching capability Rated capacitive current switching capability			
vi	Rated lightning impulse withstand voltage across the open gap, kVp			
vii	Rated Power Freq withstand voltage across the open gap, kVrms			
viii	Electrical Endurance class			

SI No	Particulars	To be Filled in by Tenderer		
ix	Type of Operating Mechanism			
x	Operating Motor details			
	- Type			
	- Rated Voltage			
	- Rated Current			
	- Rated Watts			
xi	Operating Time			
	- Closing			
	- Opening			
xii	Mechanical indication on drive shaft			
<b>23</b>	<b>Current transformers</b>			
i	Type			
ii	Material			
iii	Position of Current Transformer			
iv	Reference Standard			
v	Rated Continuous thermal current			
vi	Rated Short Time current			
vii	Duration			
a	<b>Feeder/Transformer/ Bus coupler Bay CT</b>			
i	Metering Core			
	- Ratio			
	- Output Burden			
	- Accuracy Class			
	- ISF			
ii	Protection Core			
	- Ratio			
	- Output Burden			
	- Accuracy Class			
	- ALF			
<b>24</b>	<b>Voltage Transformer</b>			
	Type			
	Position of Voltage Transformer			
	Reference Standard			
	Rated Over Voltage Factor - Continuous			
	Short Time Over Voltage Factor			
	Duration			
	Partial Discharge Level			
	Thermal Rating of Primary Winding			
<b>25</b>	<b>Local Control Cubical</b>			
i	Name of Manufacturer (OEM of GIS)			
ii	Location in GIS			
iii	Material			
iv	Sheet Thickness			
v	Degree of Protection			
vi	Padlocking arrangement			
vii	Major components of LCC			
	- Bay control mimic diagram			
	- Control Switches			
	- Indicating Lamps			
	- Position indicators			
	- Annunciation scheme			
	- Auxiliary relays			
	- Contact multiplication relays			

SI No	Particulars	To be Filled in by Tenderer		
	- System parameters display			
	- Heater with thermostat			
	- Interface terminal blocks for relaying & Protection			
<b>26</b>	<b>Maintenance</b>			
I	Maximum down time for replacement or removal of any part			
ii	Maximum down time for degassing and re-filling the biggest compartment			
iii	Time between two refilling of SF6 gas.			
iv	Recommended period for overhauling			
V	Operation and Maintenance manual attached			
vi	Nearest local service centre			
vii	Minimum time of availability of local service			
viii	Availability of spares at local service centre			
ix	List of recommended spares attached?			
X	List of recommended special tools, etc attached			
xi	List of commission spares attached?			
xii	List of maintenance spares attached?			

**420/245/145 KV SF6 Gas filled Bushing**

1	Rated Voltage			
2	Highest System Voltage			
3	One minute Power Frequency Voltage @			
4	Impulse Voltage (1.2/ 50 micro sec)			
5	Rated Current			
6	Maximum Service Current @ ambient of 40°C			
7	Rated Short Circuit Current			
8	Partial Discharge Extinction Voltage			
9	Partial discharge level			
10	Filling Pressure at 20 deg C			
11	Minimum Service Pressure at 20 deg C			
12	Max. Service Pressure at 20 deg C			
13	Test pressure at 20 deg C			
14	Maximum Allow leak rate per annum			
15	Arcing Distance			
16	Creepage Distance (Minimum)			
17	Specific Creepage Distance			
18	Mechanical Load			
19	Maximum Mechanical Load			
20	Maximum Earthquake acceleration (Horizontal and Vertical)			

## 2. LIGHTNING ARRESTER

SI No	Particulars	To be filled in by the tenderer			
		400KV	220KV	132KV	33kV
1	Name of Manufacturer				
2	Arrester Class & Type				
3	Applicable standard				
4	Rated arrester voltage(KV)				
5	Maximum Continuous Operating Voltage(KV)				
6	Nominal Discharge Current (KA with 8/20 micro-sec wave)				
7	Long Duration Discharge Class				
8	Minimum Energy Discharge Capability(KJ/KV)				
9	Maximum Switching current impulse residual voltage at i) 1000Amps ii) 250Amps				
10	Maximum residual voltage with 1 micro second current wave at 10kA(KV <sub>p</sub> )				
11	Maximum residual voltage with 8/20 micro-sec wave (KV <sub>p</sub> ) i) 5KA ii) 10KA iii) 20KA				
12	Safe fault current (KA)				
13	Lightning Impulse withstand voltage of Arrester Housing with 1.2/50 micro-sec wave (KV <sub>p</sub> )				
14	One minute power frequency withstand voltage of housing (ry/wet)KVrms				
15	High current short duration impulse withstand level with 4/10 micrsec wave(KA) Peak				
16	Pressure Relief Class				
17	Over voltage withstand capability a) 10 seconds b) 1 sec c) 0.1 sec				
18	a) Reference voltage(KV) b) Reference current(mA)				
19	Number of units per phase and rating of each unit				
20	Minimum total creepage distance(mm)				
21	Leakage current(mA)				
22	Total weight of Arrester(Kg)				
23	Maximum Cantilever strength of Surge Arrester(Including Wind Load)				
24	Overall Height of Surge Arrester(mm)				

Sl No	Particulars	To be filled in by the tenderer			
		400KV	220KV	132KV	33kV
25	Maximum distance from equipment to be protected by Surge Arrester (mm)				
26	Any other particulars				

### 3. Horizontal Centre Break Isolators

Sl No	Particulars	To be filled in by the tenderer		
		400KV	220KV	132KV
1	Name of manufacturer			
2	Reference Standard			
3	Maximum Design Voltage at which the Isolator can Operate (KV)			
4	Frequency (Hz)			
5	Seismic acceleration			
6	Maximum Current that can be safely interrupted by the Isolator (Amp rms and pf ) (a) Inductive (b) Capacitive			
7	Continuous Current rating			
8	Rated Short time Current rating for 3 sec a) Main Switch b) Earth Switch			
9	Rated Peak Short time Current rating for 3 sec a) Main Switch b) Earth Switch			
10	Current density at minimum cross section Main Switch Earth Switch Of _____ A/mm <sup>2</sup> a) Main Switch i) Moving blade ii) Terminal pad iii) Contacts: iv) Terminal connector: b) Earth Switch i) Moving blade ii) Terminal pad iii) Contacts: iv) Terminal connector			
11	Maximum temperature of current carrying parts when carrying rated current continuously (°C)			
12	Maximum ambient temperature for which (a) is applicable (°C)			
13	Insulation			
	(a) One minute power frequency wet withstand voltage			

SI No	Particulars	To be filled in by the tenderer		
		400KV	220KV	132KV
	i) Across the isolating distance (KV) ii) To earth and between poles (KV)			
	(b) 1.2/ 50 micro sec impulse withstand voltage (+ and – polarity) i) Across the isolating distance (KV) ii) To earth and between poles (KV)			
14	<b>CONTACTS</b> a) Self- aligned b) b) Self cleaning			
14.1	<b>MAIN CONTACT AT HINGE ENDS :</b> a) Type (rotary tulip) b) Swivel c) Nos of fingers d) Size of finger e) Material f) Cross sectional area g) Thickness of silver plating (min) in micron h) Housing / cover on tulip contacts i) Material and size of housing iii) No. of bearings, location and size iv) No. of bushes, joints, location and size			
14.2	<b>MAKE BREAK CONTACTS of blade</b> a) Type (spring less or reverse loop) b) Nos of fingers c) Size of finger d) Material e) Cross sectional area f) Thickness of silver plating (min) in micron			
14.3	No. of operation the isolator can make without deterioration of contacts			
14.4	Earth switches Contacts			

SI No	Particulars	To be filled in by the tenderer		
		400KV	220KV	132KV
	(a) Type of fixed contacts (b) Size of Contacts (i) Material and Grade (ii) Cross sectional area (mm <sup>2</sup> ) (c) Thickness of silver coating (Micron) (d) Moving Blade (i) Material and Grade (ii) Cross sectional area (mm <sup>2</sup> ) (e) Contact support (main and earth switch) (i) Material and size of channel/block (ii) Material and size of plate (f) Material and size of housing (iii) No. of bearings, location and size (iii) No. of bushes, joints, location and size			
18	Clearances (a) Between poles (mm) (b) Between live parts and earth (mm) (c) Between live parts when the switch is open (d) On the same pole (mm) (e) Between adjacent poles (mm)			
19	Type of interlock a) Constructional b) Mechanical c) Electrical			
20	Number and Type of Auxiliary contacts for a) main blade b) earth switch c) Operating time for closing (secs.) d) Operating time for opening (secs.)			
21	CONTROL CABINET a) Material			

SI No	Particulars	To be filled in by the tenderer		
		400KV	220KV	132KV
	b) Thickness c) Size d) Electrical ON/OFF indication e) Type of motor f) Rating of motor g) Degree of protection			
22	<b>Insulator</b>			
	a) Type of Insulator			
	b) Standard to which insulators will confirm			
	c) Insulating material			
	d) Height of Insulator (in mm)			
	e) Total creepage distance (in mm)			
	f) Protected creepage distance			
	g) Power frequency flashover voltage (in kV rms) (a) Dry : (b) Wet :			
	Power frequency withstand test voltage (in kV rms) (a) Dry : (b) Wet :			
	Nominal system voltage			
	Highest system voltage			
	Mechanical characteristics (a) Cantilever strength : (b) Tensile strength : (c) Torsion strength : (d) Compression strength			

#### 4. SOLID CORE INSULATOR (Post Insulator)

SI No	Particulars	Unit	To be filled in by the tenderer			
			400KV	220KV	132KV	33kV
1	Highest system voltage	kV				
2	Height of unit	mm				
3	Bending strength (approximate failing load): a) Upright	Kgf				
4	Tensile strength (Approximate)	Kgf				
5	Compression strength (Approximate)	Kgf				

SI No	Particulars	Unit	To be filled in by the tenderer			
			400KV	220KV	132KV	33kV
6	Torsion strength (Approximate)	KgfM				
7	a) Power frequency flashover voltage (dry) b) (wet)	kV				
8	a) Impulse flashover voltage (Positive) b) (Negative)	kV				
9	a) One min PF withstand voltage (dry) b) (wet) (w/o arcing horns )	kV				
10	Impulse positive/negative withstand voltage	kV				
11	Power frequency puncture voltage	KV				
12	RIV a) Test V to Ground KV rms b) at 1000 KHz with grading rings	kV mV				
13	(a) Visible discharge (b) Switching surge withstand voltage	kV KV <sub>p</sub>				
14	Creepage distance a) Total b) Protected	mm				
15	Top metal fitting PCD	mm				
16	Bottom metal fitting PCD	mm				
17	All ferrous part should be hot dip galvanized to IS:2629/1966	Y/N				
18	Suitable for Hot line washing	Y/N				
19	Corona Extinction device					
20	Dry Arcing Distance	mm				

#### 5. 400KV/22KV/132KV CVT

SI No	Description	To be filled in by the Tenderer		
		420KV	220KV	132KV
1	Applicable standard			
2	Highest system voltage KV (rms)			
3	Rated frequency(Hz)			
4	Rated system voltage KV (rms)			
5	System fault level KA (rms)			
6	System neutral earthing			
7	Installation			
8	Limits of Temperature rise (immersed)			

SI No	Description	To be filled in by the Tenderer		
		420KV	220KV	132KV
	in oil)			
9	Voltage factor			
10	Rated insulation level : 1.2/50 microsecond Lightning impulse withstand voltage KV (peak).			
11	One minute Dry & Wet power frequency withstand voltage KV (rms)			
	Visual Corona extinction voltage			
12	Radio interference voltage (max) at 156 kV (rms)			
13	Total capacitance (picofarad)			
14	a) High frequency capacitance for the entire carrier frequency range. b) Equivalent series resistance over the entire carrier frequency range (Ohms)			
15	Stray capacitance (Pico farads) & stray conductance (micro Siemens) of the low voltage terminal of a complete CVT including Electro Magnetic Unit over the entire carrier frequency range			
15	One minute power frequency test a) Withstand voltage between HF (low voltage terminal of intermediate transformer & earth terminal, KV (rms)			
	b) Withstand voltage for secondary windings & earth terminal in KV (rms).			
	c) Withstand voltage between HF(LV) carrier coupling terminal 14& earth terminal, KV(rms)			
16	Creepage distance Total (mm)			
17	Partial discharge level, Pico coulombs			
18	Seismic acceleration in g			
19	Suitable for carrier coupling			
20	Degree of protection of terminal box:			
21	<b>ELECTROMAGNETIC UNIT</b>			
	Rated primary voltage kV			
	Rated secondary voltages			
	Rated burden of secondary winding			
	Accuracy class of secondary winding: Metering: Protection:			

#### 6. 33KV INDOOR VCB PANEL

SI No	Particulars	To be filled in by the tenderer
1	<b>General :</b>	
	Name of the Company	
2	<b>Panel</b>	
	Type & Designation	
	Application Standard	
	Rated Voltage ( KV )	
	Highest Voltage (KV )	
	Normal Current ( Amps.)	

SI No	Particulars	To be filled in by the tenderer
	Frequency ( Hz	
	STC for 3 Sec. ( KA/ 3 Sec)	
	Breaking Capacity (KA)	
	Making Capacity ( KAp)	
	Power frequency withstand voltage (KV rms)	
	Impulse withstand voltage ( KVp)	
	Degree of protection	
	Material of enclosure	
	Sheet thickness of load bearing members	
	Sheet thickness of doors & covers	
	Position of Mechanical & Electrical Emergency Trip Arrangement	
	Power cable termination height	
	Position of Power Cable Entry	
	Position of Control Cable Entry	
	Separate Bus Section Panel at the side of Bus Coupler	
	Separate Panel for both Bus PT as per Drawing	
	Degree of protection of HV compartment	
3	<b>Bus Bar</b>	
	Material	
	Shape	
	a) Main Bus	
	b) Earth Bus	
	Cross sectional area ( Sq. mm)	
4	Type of plating	
	Normal Current currying capacity ( Amps)	
	STC for 3 Sec. ( KA/3 Sec)	
	Temp. Rise over ambient at normal current	
	Current density ( Amps/ sq. mm)	
	Phase to Phase clearance (mm)	
	Phase to ground clearance (mm)	
Type of insulation		
	<b>Bus support insulator</b>	
	Material	
	Dry Power frequency Withstand Voltage for one minute	
	Wet Power frequency Withstand Voltage for one minute	
	Impulse Withstand voltage	
	Creepage distance	
5	<b>Vacuum Circuit Breaker</b>	
	Make	
	Type	
	Reference Standard Arc	
	Quenching medium	
	Number of break per phase Rated voltage	
	Highest voltage	
	Frequency	
	Normal Current	
	Breaking capacity	
	Making capacity	

SI No	Particulars	To be filled in by the tenderer
	STC for 3 Sec.	
	Insulation level	
	Temp. Rise over ambient at normal current	
	Operating duty cycle	
	Single Phase Capacitor Breaking capacity	
	Three Phase Capacitor Breaking capacity	
	Line Charging Breaking capacity	
	Cable Charging Breaking capacity	
	Minimum phase to phase clearance	
5	Minimum phase to ground clearance	
	Type of operating mechanism	
	Closing time	
	Opening time	
	Mechanical Endurance capacity	
	Electrical Endurance capacity	
	Operating mechanism	
	Type of isolation	
	Details of mechanical interlock provided	
	Interchangeability between I/C, Feeder & B/C (Yes/No)	
	No. contacts in Aux. Switch (NO & NC )	
No. contacts in Limit Switch (NO & NC )		
6	<b>Vacuum Bottle</b>	
	Make	
	Rated voltage	
	Type and model no.	
	Normal current	
	Breaking capacity	
	Making capacity	
	STC for 3 Sec.	
	Maximum contact separation length	
	Minimum Mechanical life in no. of operation	
	Minimum Electrical Life in no. of operation at rated normal current	
	Minimum Electrical Life in no. of operation at rated full short circuit current	
	Power frequency withstand voltage (dry)	
	Impulse withstand voltage	
	Contact material	
	Type of plating	
Contact pressure		
7	<b>Current Transformer</b>	
	Make	
	Reference Standard	
	Type	
	Rated voltage	
	Rated frequency	
	Insulation level	
	Continuous over load in %	
	Class of insulation	
	Ratio	Transformer : Bus Coupler: Outgoing :

SI No	Particulars	To be filled in by the tenderer		
	Class of accuracy	Transformer :		
		Bus Coupler:		
		Outgoing :		
	Burden			
	STC for 1 Sec.			
	ALF of Protection core			
	ISF of Metering Core at lower ratio			
	Core identification			
8	<b>Potential Transformer</b>			
	Make			
	Reference Standard			
	Whether withdrawable Type (Yes/No)			
	Insulation level			
	Type of insulation			
	Winding connection			
	Rated voltage			
	Class of insulation Ratio			
	Class of accuracy			
	Burden per Phase			
	Core identification			
	Over Voltage Factor			
	Installation Position			
	Primary fuse rating			
9	<b>Terminal connector</b>			
	Make			
	Type			
	Size			
10	<b>Trip &amp; Close coils</b>			
	Voltage & Wattage of Closing coil			
	Voltage & Wattage of Tripping coil			
11	<b>Control wire</b>			
	Make			
	Voltage Grade			
	Size			
	i) CT Circuit			
	ii) PT Circuit			
	iii) Other Circuit			
Colour				
12	<b>Earth Bus</b>			
	Material			
	Shape			
	Size			
	Current rating			
	Current density			
	Type of plating			
13	Adaptor cable box arrangement for 33 KV Power Cable to Station Service Transformer.			
14	Painting Details			
	Surface cleaning process			
	Paint thickness			
	Paint shed			
15	<b>Shipping dimension of equipment ( mm )</b>	<b>Height</b>	<b>Width</b>	<b>Depth</b>

SI No	Particulars	To be filled in by the tenderer
16	Lifting Hooks provided (Yes/No)	
17	Accessories	
	Spring Charging Handle (no. )	
	VCB Operating Handle (no. )	

## 7. PLCC EQUIPMNTS

### A. LINE TRAP

SI No	Particulars	TO BE FILLED IN BY THE TENDERER		
		400 KV	220 KV	132 KV
1	Name and address of manufacturer and country			
2	Type /Model			
3	System voltage rating			
4	Continuous current rating at 50 <sup>0</sup> C			
5	Maximum symmetrical short circuit current rating for 3 sec. duration			
6	Asymmetrical peak value of first half of rated short time current			
7	Rated inductance			
8	Blocking range			
9	Minimum Guaranteed resistive component of impedance in Blocking Frequency range			
	a. Centre frequency			
	b. Over Blocking range			
10	Type of tuning			
11	Variation in 50 Hz impedance over degree centigrade variation in ambient temperature			
12	Variation in resonant frequency band per degree centigrade variation in ambient temperature			
13	Impedance at tuned frequency			
14	Change in impedance per degree Centigrade change in ambient temp.			
15	Attenuation in Tuned Frequency Band			
16	Attenuation at the distance of 10 kHz from the tuned frequency band			
17	Maximum Tapping loss			
18	Type of Mounting			
19	Class of insulation of line trap			
20	Temperature rise in line trap under rated continuous current (Specify the value)			
21	Visual corona Inception voltage			
22	Visual corona Extinction voltage			
23	Radio interference voltage			
24	Type of incoming & outgoing terminal			
25	Maximum working stress			
26	Ultimate tensile strength			
<b>Technical data for protective device</b>				
1	Type of Protective device provided for protection of capacitors and coil against voltage surges & type of class			
2	Basic insulation level			

SI No	Particulars	TO BE FILLED IN BY THE TENDERER		
		400 KV	220 KV	132 KV
3	Standard nominal discharge current of protective device for 8/20 micro second wave impulse			
4	Rated voltage of the protective device (Arrester)			
5	Minimum value of power frequency spark over voltage (dry & Wet) of protective device			
6	Impulse spark over voltage of protective device			
7	Virtual steepness and maximum front of wave impulse spark over voltage of protective device			
8	Maximum residual discharge voltage of protective device for 8/20 micro second impulse discharge current of			
	a) 5000 A			
	b) 1000 A			
<b>Technical data for tuning device</b>				
1	Power frequency withstand voltage for 5 sec			
2	Tuning band (Blocking band)			
3	Material of main coil			
4	Material of terminal connector			
5	Material of suspension link			
6	Material of mounting hard wares			
7	Net weight			
8	Whether corona rings are provided?			
9	Whether Bird barriers are provided?			
10	Overall diameter			
11	Total height			
12	No. of turns in Line trap main coil			
13	Type of conductor whether solid or stranded			
14	Cross sectional area of conductor			
15	Overall conductor size			
16	Type of construction i.e. No. of coils and whether open type or covered with insulating material			
17	Type and material of spacers between turn to turn			
18	No. of tie rods in tie rod Assembly			

### B. COUPLING DEVICE

SI No	Description	To be filled in by the tenderer
1	Name of manufacturer, address and country	
2	Type, Model and Catalogue No	
3	Carrier Frequency Range	
4	Maximum temperature limit for satisfactory operation of coupling device mounted outdoor	
5	Composite loss	
6	Return loss	
7	Nominal line side impedance	
8	Nominal carrier equipment side impedance	

9	Nominal Peak Envelop power with Distortion and Inter-modulation Products 80 dB Down)	
10	Power frequency Impedance between primary terminal and Earth Terminals of Coupling Device	
11	Maximum number of PLC terminals that can be connected in parallel	
	(a) 20 W (P.E.P) PLC Terminals	
	(b)40 W (P.E.P.) PLC Terminals	
	(c ) 100 W (P.E.P.) PLC Terminals	
12	1 Minute Power Frequency Insulation level between Primary and Secondary Terminals of Coupling Device	
13	Impulse (1.2/50 micro-sec) withstand level between Primary and Secondary Terminals of Coupling Device	
14	Drainage Coil :	
	(a) Power frequency impedance	
	(b)Continuous power frequency current	
	(c) Short time rating for 0.2 sec	
15	Lighting Arrestor :	
	(a) Type of construction	
	(b) Rated Voltage	
	(c) Rated discharge current	
	(d) Maximum permissible short time current	
	(e) Impulse spark over voltage (max)	
16	Earthing Switch	
	(a) Rated Current	
	(b) Short time current	
17	Details of interlock provided with cover enclosed	
18	Overall dimensions	
19	No of HF terminals provided for carrier equipment connection	
20	Whether suitable for mounting Outdoor in Switchyard & Type of Mounting	

**C. DIGITAL POWER LINE CARRIER COMMUNICATION TERMINAL  
(TO BE FILLED BY THE TENDERER)**

<b>SI No</b>	<b>Technical parameters</b>	<b>TO BE FILLED IN BY THE TENDERER</b>		
1	Name and address of manufacturer and country			
2	Model No			
3	Operating mode			
4	Modulation			
5	Nominal Bandwidth			
6	Standard compliance			
7	Nominal transmit output power (PEP)			
8	Carrier frequency range and stability			
9	Nominal output impedance			
10	Return loss in the transmit band			
11	Tapping loss			
12	AGC (Automatic Gain Control)			
13	Receiver sensitivity			
14	Receiver selectivity			
15	Power supply			
16	Power consumption			
17	Alarm relay outputs			
18	Event recording			
19	Ambient Conditions			
	Climatic condition			
	Mechanical condition			
	Vibration and shock			
20	Dimensions and weight			
21	Speech Interface	E&M	FXS	FXO
	a) Impedance			
	b) Transmit level range			
	c) Receive level range			
22	No Transit Filters			
23	No of data ports and bit rate supported			
	a) V.24 ports/RS232			
	b) V.11 ports			
	c) LAN ports			
24	Speech + data + teleprotection channel at 8 kHz B.W.			
25	Type of speech channel			
26	No of speech channel in 8 kHz and 12 kHz Bandwidth			
27	Minimum signal to noise ratio			
28	Gross bit rate			
29	Voice interfaces supported			
30	Speech level adjustment (T <sub>x</sub> and R <sub>x</sub> )			
31	Speech coding algorithm and bit rate supported			
32	Number of Broadband modems, transmission bandwidth and data rates			
33	Number of narrowband modems, bandwidth and data rate			
34	Type and No of channels of data multiplexer			
35	No of Digital transit ports			

#### D. DIGITAL TELE PROTECTION COUPLER

SI No	Technical parameters	TO BE FILLED IN BY THE TENDERER			
1	Application				
2	Number of units				
3	Number of commands				
4	Secure against				
5	Bandwidth requirement				
6	Processing of received signal				
7	Guard signal				
8	Number and type of inputs Method of tripping Voltage ranges				
9	Number and type of outputs Tripping voltage Tripping current				
10	Whether HMI configurable, if yes specify				
11	Test facilities				
12	Event recording				
13	Teleprotection performance		Blocking	Permissive	Direct
	Nominal transmission time	T			
	Dependability(SNR=6 dB) (Probability of not receiving a command in a maximum actual transmission time)	P			
		T <sub>r</sub>			
Security (Probability of unwanted command under worst-case SNR condition)					

#### E. VALVE REGULATED LEAD ACID BATTERY

SI No	Technical parameters	To be filled in by the Tenderer
1	Type/ Designation	48V, 200AH battery bank
2	Manufacturer's type designation	
3	Ampere-Hour capacity 10hrs rate of discharge to 1.75V	
4	Total No. of Plates per cell	
5	Nominal Cell Voltage (V)	
6	No. of Cells in each Bank	
7	No. of Spare Cell, if any, in each Bank	
8	Internal Resistance for each Cell	
9	Resistance of the Battery including Inter-connection between the Cells ( $\Omega$ )	
10	Cell Discharge rate in Ampere (from rated Voltage to final discharge rate in Ampere (i) 5hrs Discharge rate in Amp (ii) 2hrs Discharge rate in Amp (iii) 1hr Discharge rate in Amp (iv) 30min Discharge rate in Amp (v) 10min Discharge rate in Amp	

Sl No	Technical parameters	To be filled in by the Tenderer
	(vi) 1min Discharge rate in Amp (vii) 30sec Discharge rate in Amp (viii) 1sec Discharge rate in Amp (Please furnish a graph showing Amps against time for the type of battery offered)	
11	Short Circuit Current (Amps)	
12	(i) Material of Cell Containers (ii) Material used for Battery Box (iii) Trays	
13	Thickness, Type & Material of Separators	
14	Constructional details and dimension: Surface area plates of (i) Positive Plate (ii) Negative Plate in Sq.mm.	
15	(i) Ampere Hour efficiency (%) (ii) Watt Hour efficiency (%)	
16	(i) Recommended Float Charge Current & Voltage (ii) Recommended Boost Charge Current & Voltage	
17	Time required for Boost Charging from Discharged condition	
18	(i) Max. Charging Current/Cell (ii) Nominal Charging Rate	
19	(i) Whether explosion proof or vent plugs provided (ii) Whether vent is spill proof	
20	Type of Inter Cell connection & whether they are covered with plastic sleeves	
21	(i) Dimensions of each 2V Block/Cell a. Length (mm) b. Width (mm) c. Height (mm) (ii) Thickness of Container (mm)	

**8. GUARANTEED AND OTHER TECHNICAL PARTICULARS FOR POWER/AUTO TRANSFORMERS (500MVA, 160 MVA, 50 MVA)**

Sl. No.	Description	Unit	Specified by Buyer	Offered by manufacturer
1.	General Information i) Supplier ii) Name of Manufacturer iii) Place of Manufacture (Country & City) iv) Type of transformer (Core/Shell)			
2.	Applications i) Indoor/Outdoor ii) 2wdg/3wdg/Auto iii) GT/Step-down/ICT/Station Start-up/ Auxiliary/ Rail Trackside Supply			
3.	Corrosion Level at Site i) Light ii) Medium iii) Heavy iv) Very Heavy			

4.	Site altitude above mean sea level	M		--
5.	Seismic zone and ground acceleration at site (both in horizontal & vertical direction)			--
6.	Maximum and minimum ambient temperature at site			
7.	Applicable Standards i) IEC: 60076 ii) IS : 2026 iii) Any other, please specify			
8.	Rated Capacity / Full load rating (HV/IV/LV)	MVA		
9.	3-Phase/Bank of Three Single Phase (A,B,C)			
10.	Rated No Load Voltages (HV/IV/LV)	kV		
11.	Currents at normal tap (HV/IV/LV)	Amp		
12.	Rated Frequency	Hz		
13.	Connections and phase displacement symbols (Vector Group)			
14.	Weight Schedules (Minimum with no negative tolerance)			
	i) Active part (Core + coil)	Kg		
	ii) Insulating Oil (excluding mass of extra oil)	Kg		
	iii) Tank and Fittings	Kg		
	iii) Total weight	Kg		
	iv) Transportation Weight	Kg		

	v) Overall dimensions L x B x H	Mm		
	vi) Size of heaviest package L x B x H	Mm		
	vii) Weight of heaviest package	Kg		
	viii) Weight of 5% extra oil	kg		
	ix) Weight of core	Kg		
	x) Weight of copper (HV/IV/LV/ Regulating)	kg		
	xi) Insulating Oil volume (excluding 5% extra oil)	Ltrs		
	xii) Quantity of oil in OLTC	Ltrs		
15.	Transport limitation			
16.	LV Winding Stabilizing tertiary (Yes/No) Loaded (Yes/No)			
17.	Tappings i) Type (OLTC/OCTC) and make of tap changer ii) Position of Tapping on the winding iii) Variation on iv) Range of variation No. of Steps vi). Whether control suitable for: <ul style="list-style-type: none"> <li>• Remote/local operation</li> <li>• Auto/manual operation</li> </ul> vi) Parallel Operation Requirements	%		
18.	Impedance and Losses			
	i) Guaranteed No load loss at rated voltage and frequency	kW		

	Tolerance (to be considered for loss evaluation)	%		
	ii) Guaranteed $I^2R$ Loss at rated current & frequency (at 750C) at principal tap	kW		
	Tolerance (to be considered for loss evaluation)	%		
	iii) Eddy current and stray loss at rated current & frequency (at 750C) at principal tap	kW		
	iv) Load Loss ( $I^2R$ +Eddy and Stray) at rated current & frequency (at 750C) at principal tap	kW		
	v) Guaranteed Auxiliary loss at rated voltage and frequency	kW		
	Tolerance (to be considered for loss evaluation)	%		
	vi) Calculated Fan Loss	kW		
	vii) Calculated Pump Loss	kW		
	viii) Air core reactance of HV winding	%		
	ix) Guaranteed Impedance (at Highest MVA base)	%		
	(a) HV-IV (at Principal tap) (b) HV-LV (at Principal tap) (c) IV-LV (at Principal tap)			
	Tolerance			
	x) Impedance at extreme tapplings at Highest MVA base [for HV-IV for 3winding transformer (or) HV-LV for two winding transformer] a) Max. Voltage tap b) Min. Voltage tap	%		
	Tolerance	%		

	xi) Zero sequence impedance at principal tap (for 3-phase transformers)			
19.	Capacitance to earth for HV/IV/LV	pF		
20.	Regulation at full load at 75 0C winding temperature at: a) upf b) 0.8 pf			
21.	Guaranteed maximum Magnetizing Current at rated Voltage	%		
22.	Efficiency: At 100% load upf 0.8 lead 0.8 lag At 75% load upf 0.8 lead 0.8 lag At 50% load upf 0.8 lead 0.8 lag	%		
23.	Load at Maximum efficiency	%		
24.	Any limitations in carrying out the required test? If Yes, State limitations			
25.	Fault level of system (in kA) and its duration (in sec)	kA (sec)		
26.	Calculated short Circuit current (in kA) withstand capability for 2 seconds(3 seconds for generator transformers) without exceeding temperature limit (i.e. Thermal ability to withstand SC current)	kA		
27.	Test current (in kA) and duration (in ms) for short Circuit current test (i.e. Dynamic ability to withstand SC)	kA & msec		
28.	Over fluxing withstand time (due to combined voltage & frequency fluctuations):  110% 125% 140% 150% 170%	msec		
29.	Free space required above the tank top for removal of core			

30.	Maximum Partial discharge level at $1.58 U_r/\sqrt{3}$	pC		
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#### A. MAGNETIC SYSTEM

Sl. No.	Description	Unit	Specified by Buyer	Offered by manufacturer
1.	Core Type: i) 3 Phase 3 Limb (3 wound limbs) ii) 3 Phase 5 Limb (3 wound limbs) iii) 1 Phase 2 Limb (2 wound limbs) iv) 1Phase 3 Limb (1 wound limb) v) 1 Phase 4 Limb (2 wound limbs) vi) 1Phase 5 Limb (3 wound Limbs)			
.	Type of Core Joint: i. Mitred ii Step Lap			
3.	CRGO: i) Make & Country of Origin ii). Thickness, mm iii) Max. Specific loss at 1.7 T, 50Hz, in Watts/kg iv) Grade of core as per BIS v) Insulation between core lamination v) BIS certified (Yes/No)			
4.	Minimum Gross & Net Area of: 1). Core ii) Limb iii) Yoke iv) Unwound limb (May be verified during manufacturing stage – at the discretion of buyer)	cm <sup>2</sup>		
5.	Stacking Factor	%		
6.	Voltage per turn	V		
7.	Apparent Core Density for Weight Calculation			
8.	Minimum Net Weight of Silicon Steel Lamination CRGO (may be verified during manufacturing stage by calculation)	Kg		

9.	Maximum Flux density at 90%, 100% and 110% voltage and frequency(may be verified during manufacturing stage by calculation)	T		
10.	W/kg at working flux density			
11.	Building Factor Considered			
12.	Calculated No Load Loss at rated voltage and Frequency(Net Weight x W/kg x Building factor)	kW		
13.	Magnetizing inrush current	Amp		
14.	No load current at normal ratio and frequency for :85% of rated voltage 100% of rated voltage 105% of rated voltage	Amp		
15.	Core Isolation test	kV		
16.	Core bolt in limb / yoke	Yes/No		
17.	Core bolt insulation withstand voltage for one minute	kV		
18.	Maximum temperature rise of any part of core or its support structure incontact with Oil	0C		

## B. CONDUCTING SYSTEM

Sl. No.	Description	Unit	Offered by manufacturer			
			HV	IV	LV	Regulating
1.	Type of Winding Helical/Disc/Layer/inter wound					

2.	Type of Conductor PICC/CTC/CTCE/CTCEN/BPICC					
3.	Minimum Yield Strength of Conductor for 0.2% elongation	N/mm <sup>2</sup>				
4.	Maximum Current density at CMR and conductor area at any tap:  i) HV ii) IV iii) LV	A/mm <sup>2</sup> & sq. mm				
5.	Maximum current density under short circuit:  i) HV ii) IV iii) LV	A/mm <sup>2</sup>				
6.	Bare Weight of copper without paper insulation and lead (Minimum)	Kg				
7.	Per Phase Maximum resistance of winding at rated tap at 75 °C	ohm				
8.	Number of Turns/Phase					
9.	Insulating material used for HV/IV/LV winding					
10.	Insulating material used between :  i) HV and IV winding ii) IV and LV winding iii) LV winding and core iv) Regulating winding and adjacent winding/core					
11.	Details of special arrangement provided to improve surge voltage distribution in the winding.					
12.	Dielectric Shielding used:  i) Interleaved winding ii) Wound in Shield iii) Others					
13.	Magnetic Shielding used:  i) Yoke Shunt on core clamp ii) Magnetic shunt on tank iii) Electromagnetic (Copper/Aluminum) shield on tank iv) Others					
14.	Noise level when energized at normal voltage and frequency without load	dB				

### C. COOLING SYSTEM

Sl. No.	Description	Unit	Specified by Buyer	Offered by manufacturer
1.	Type of Cooling [ONAN (or) ONAN/ONAF (or) ONAN / ONAF / OFAF (or) ONAN / ONAF/ODAF etc.]			
2.	Percentage Rating Corresponding to Cooling Stages (HV/IV/LV)			
3.	No. of Cooler banks (2x50% / 2x100% / 1x100% etc.)			
4.	Temperature gradient between windings and oil			
5.	Time in minutes for which the transformer can run at full load without exceeding maximum permissible temperature at reference ambient temperature when supply to fans and / or pumps is cut off	min		
6.	Guaranteed Maximum Temperature rise at 1000 mts. altitude and at actual altitude at site at ambient temperature at cooling specified at sl. No. 1:  i) Top Oil by thermometer ii) Average Winding by resistance iii) Winding hot spot	0C		
7.	Type of Cooler:  i) Radiator Bank ii) Oil to Air Heat Exchanger (Unit Cooler) iii) Oil to Water Cooler (Single Tube) iv) Oil to Water Cooler (Double Tube) v) Tank Mounted vi) Header Mounted vii) Separately Mounted viii) Degree of Protection of terminal box			
8.	Cooling Fans:  i) Type ii) Size iii) Rating (kW) iv) Supply voltage v) Quantity (Running + Standby) per cooler bank vi) Whether fans are suitable for continuous operation at 85% of their rated voltage calculated time constant: <ul style="list-style-type: none"> <li>• natural cooling</li> <li>• forced air cooling</li> </ul> vii) Degree of Protection of terminal box			
9.	Oil Pumps:  i) Type ii) Size iii) Rating (lpm and kW) iv) Supply voltage v) Quantity (Running + Standby) per cooler bank vi) Efficiency of motor at full load vii) Temperature rise of motor at full load viii) BHP of driven equipment			

10.	Coolers (Oil to Air): i) Quantity (Running + Standby) ii). Type and Rating			
11.	Coolers (Oil to Water): i) Quantity (Running + Standby) ii) Type and Rating iii)Oil flow rate (lpm) iv) Water flow rate (lpm) v) Nominal Cooling rate (kW) vi) Material of tube			
12.	Radiators: i) Width of elements (mm) ii) Thickness (mm) iii) Length (mm) iv) Numbers			
13.	Cooler loss at rated output, normal ratio, rated voltage, rated frequency at ambient temperature of 50°C	kW		

#### D. DIELECTRIC SYSTEM

Sl. No.	Description	Unit	Offered by manufacturer				
1.	Geometric Arrangement of winding with respect to core.g: Core-LV-IV-HV-Reg Coarse-Reg Fine						
2.	Regulating Winding: i) Body Tap ii) Separate						
3.	HV Line Exit point in winding: i) Top ii) Center						
4.	Varistors used across Windings If yes, Details	Yes/No					
5.	Insulation Levels of windings		HV	IV		HV-N	IV-N
	i) Lightning Impulse withstand voltage (1.2/50 $\mu$ s)	kVp					

	ii) Chopped wave Lightning Impulse withstand voltage	kV <sub>p</sub>					
	iii) Switching Impulse withstand voltage (250/2500μs)	kV <sub>p</sub>					
	iv) Power frequency withstand voltage	kV <sub>rms</sub>					
	(one minute / 5 minutes)						
6.	Tan delta of windings at ambient temperature	%					

### E. ACCESSORIES

Sl. No.	Description	Unit	Offered by manufacturer	Specified by Buyer
1.	Tap Changers			
	i) Control a-Manual Remote      b-Automatic- d-Local			
	ii) Voltage Class and Current Rating of Tap Changers			
	iii) Make and Model			
	iv) Make and Type of Automatic Voltage Regulator (AVR)			
	v) Tie-in resistor requirement (to limit the recovery voltage to a safe value) and its value			
	vi) OLTC control and monitoring to be carried out through Substation Automation System.	Y/N		
	vii) Power Supply for control motor (No. of Phases/Voltage/Frequency)			
	viii) Rated Voltage for control circuit (No. of Phases/Voltage/Frequency)	V		
2.	Tank			
	i) Tank Cover: Conventional/Bell/Bottom Plate			
	ii) Material of plate for tank			
	iii) Plate thickness : side, bottom, cover	mm		
	iv) Rail Gauge	mm		
	v) Minimum Clearance height from rail for lifting Active Part	mm		
	vi) Wheels : Numbers/Plane/Flanged/Uni-Directional/Bi-Directional/Locking Details			
	vii) Vacuum withstand Capability a) Tank b) Radiators/Conservator/Accessories	mm of Hg		

	High Pressure withstand Capability Tank Radiators/Conservator/Accessories	mm of Hg				
	ix) Radiator fins/ conservator plate thickness	mm				
	x) Tank Hot spot temperature	O C				
3.	Bushings:		HV	IV	LV	HV-N LV-N
	i) Termination Type a). Outdoor b) Cable Box (oil/Air/SF6)- Plug in Type					
	ii) Type of Bushing: OIP/RIP/RIS/oil communicating					
	iii) Bushing housing - Porcelain / polymer					
	iv) Rated Voltage Class	kV				
	v) Rated Current	A				
	vi) Lightning Impulse withstand voltage (1.2/50 $\mu$ s)	kVp				
	vii) Switching Impulse withstand voltage (250/2500 $\mu$ s)	kVp				
	viii) One minute Power frequency withstand voltage(dry & wet)	kVrms				
	ix) Minimum Creepage Distance	mm				
	x) Quantity of oil in bushing and specification of oil used					
	xi) Make and Model					
	xii) Tan delta of bushings	%				
	xiii) Max Partial discharge level at Um	pC				
	xiv) Terminal Pad details					
	xv) Weight of assembled bushings	kg				
	xvi) Whether terminal connector for all bushings included in the scope of supply					
4.	Minimum clearances between bushings (for HV, IV and LV) i) Phase to phase ii) Phase to ground					
5.	Indicator / Relay					

	i) Winding temperature thermometer/ indicator Range Accuracy		
	ii) Oil temperature thermometer/ indicator Range Accuracy		
	iii) Temperature sensors by fiber optic (if provided)		
	iv) Oil actuated/gas operated relay		
	v) Oil level Indicators: Main Conservator OLTC Conservator		
	vi) Oil Sight Window: Main Tank Main Conservator OLTC Conservator		
6.	Conservator: i) Total volume ii) Volume between highest and lowest visible oil levels		
7.	Conservator Bag (air cell) i) Material of air cell ii) Continuous temperature withstand capacity of air cell		
8.	Air cell rupture relay provided	Yes / No	
9.	Pressure Relief Device: i) Number of PRDs provided ii) Location on the tank iii) Operating pressure of relief device		
10.	Sudden Pressure Relay / Rapid Pressure rise relay provided; if yes, i) Location on the tank ii) Operating pressure	Y/N	
11.	Dehydrating Breathers (Type & No. of breathers) a) For main Conservator tank b) For OLTC conservator		
12.	Flow sensitive Conservator Isolation Valve Provided	Y/N	
13.	Tap Changer protective device		
14.	Type and material of gaskets used at gasketed joints		
15.	Bushing CTs: (HV side and IV/LV side) i) Voltage class ii) No. of cores iii) Ratio iv) Accuracy class v) Burden vi) Accuracy limit factor vii) Maximum resistance of secondary winding viii) Knee point voltage	kV  VA Ω V A	

	ix) Current rating of secondaries		
16.	Neutral CTs: i) Voltage class ii) No. of cores iii) Ratio iv) Accuracy class v) Burden vi) Accuracy limit factor vii) Maximum resistance of secondary winding viii) Knee point voltage ix) Current rating of secondaries	kV  VA  $\Omega$ V A	
17.	Transformer Oil i) IS 335 / IEC60296 / as per specification ii) Inhibited/ un-inhibited iii) Mineral / Natural Ester / Synthetic Ester iv) Spare oil as percentage of first filling v) Manufacturer vi) Quantity of oil (before filling and before commissioning) vii)Moisture vii) content (mg/L or ppm) viii) Tan delta (Dielectric Dissipation Factor) at 90oC ix) Resistivity ( $\Omega$ -cm)		
	x) Breakdown Voltage (before and after treatment) (kV) xi) Interfacial tension at 20 oC (N/m) xii) Pour point (oC)xii)Flash point(oC) xiii) Acidity (mg KOH/gm) xiv) Inhibitors (for inhibited oil) (%) xv) Oxidation Stability		
18.	Press Board: i) Make ii) Type		
19.	Conductor Insulating Paper i) Kraft paper ii) Thermally upgraded Kraft paper iii) Nomex		
20.	Provision for fire protection system (as per spec), if yes, provide details	Y/N	
21.	Insulation of core bolts, washers, end plates etc.		
22.	Weights and Dimensions: i) Weights: a) Core b) Windings c) Tank d) Fittings e) Oil f) Total weights of complete transformers with oil and fittings  ii) Dimensions; a) Overall Height above track b) Overall length c. Overall breadth		

	iii) Minimum bay width required for installation of the transformer iv) Weight of the heaviest package of the transformer arranged for transportation.		
23.	Lifting Jacks  i) Number of jacks included ii) Type and Make iii) Capacity iv) Pitch v) Lift v) Height in close position		
24.	Rail Track gauges  1. Rails or 3 rails or 4 rails 2. Distance between adjacent rails on shorter axis 3. Distance between adjacent rails on longer axis		

#### F. NIFPS SYSTEM FOR TRASFORMER

Sl. No	Particulars	To be filled in by theTenderer
	Name of Manufacture of Nitrogen Injection Fire Protection System.	
	Details of system equipments for NIFPS	
	<b>Fire Extinguishing Cubicle (FEC) of NIFPS</b>	
1	Dimensions (LXBXH) mm	
	Weight Kg	
	Capacity of Nitrogen cylinder	
	Number of cylinders	
	Minimum distance of FE cubicle from the transformer	
	Method of mounting	
	Whether the following items are provided in FE cubicle. If so furnish make, type & other details.	
	Contact manometer	
	Pressure Regulator	
	Oil Release Unit	
	Gas release unit	
	Oil drain assembly	
	Pressure /limit switches	
	No of contacts & spare contacts (NO & NC)	
	Oil drain valve (above FEC)	
	Make	
	Type	
	Size	
	Type of metal	
	Nitrogen Injection Valve (above FEC)	
	Make	
	Type	
	Size	
Oil drain pipe		
Size		
Length		
Number of openings in the transformer tank		
Material		

2	Control Box of NIFPS		
	Dimensions (LXBXH) mm		
	Weight		
	Type & Thickness of sheet steel		
	Details of components provided in the control box		
	Control voltage		
	Method of mounting		
	Whether audio and visual alarms provided?		
3	<b>Transformer Conservator Isolation Valve of NIFPS</b>		
	Make		
	Type		
	Location		
	Whether suitable for pipe of size 80mm dia		
	No of contacts & spare contacts (NO &N)		
	Padlocking provision		
4	<b>Detectors of NIFPS</b>		
	Make		
	Type		
	Quantity required		
	Method of fixing		
	Effective heat sensing area		
	Temperature recommended for effective heat sensing		
5	<b>Power Supply of NIFPS</b>		
	Control box		
	FEC (lighting)		
	Extinction period On system activation		
	On commencement of Nitrogen injection		
6	<b>FEC suitable for capacity of NIFPS</b>		
	Dimensions (LXBXH) mm		
	Weight		
	Nitrogen cylinder capacity		
7	<b>Control Box of NIFPS</b>		
	Dimensions (LXBXH) mm		
	Weight		
8	<b>Detectors of NIFPS</b>		
	Heat sensing temperature		
	Time of Operation	Transformer Tank Explosion Prevention	Fire Extinction
	For system activation		
	For reduction of pressure in Tank by Nitrogen release		
	Any other technical details not covered above		

## 9. FIRE PROTECTION AND FIRE FIGHTING SYSTEM

Sl.No.	Particulars	To be filled in by the Tenderer
1	Name and Address of the Fire Protection System Supplier	

2	No. of Fire Protection System executed by the supplier and duration of successful operation for each type of Fire Protection System	
	a. Automatic HVW/MVW spray type Fire Protection System	
	b. Automatic hydrant type Fire Protection System	
3	Portable Fire Fighting Equipment	
	a. Maker's Name & Address	
	b. Standards to which conform	
	c. Type & Designation	
	d. Capacity	
	e. Mounting details	
	f. Total quantity of different type	
4	Water Hydrant System	
5	Standby Diesel Engine Driven Pump	
6	Fire detection system	

Sl.No.	Particulars	To be filled in by the Tenderer
7	Water supply System	
8	Instrumentation & Control System	
9	Annunciation System	

**10. CONTROL & RELAY PANEL, BAY CONTROL UNIT, MANAGED ETHERNET SWITCH, TIME SYNCRONISATION DEVICE AND SUBSTATION AUTOMATION SYSTEM**

**A. Control & Relay Panel**

Sl No	Technical Particulars	Unit	To be filled in by Tenderer
1.	<b>General</b>		
1.1	Panel Sheet thickness		
1.2	Overall dimensions		
	i) Width		
	ii) Depth		
	iii) Height		
	Total weight of the panel		
1.3	Whether panel type is simplex with swing front door		
1.4	Whether lockable glass cover provided		
1.5	Whether Rear side of panel is blocked		
1.6	Internal finish		
1.7	External Finish		
1.8	Control wiring		
	Material and Size of wiring For CT & PT circuit For other circuit		
1.9	Number of stranded in conductor		
1.10	Tinned/untinned		
1.11	Material of insulation and sheath		
1.12	Voltage grade of control wiring		
1.13	Numbered ferrules at both ends		
1.14	<b>Terminals</b>		
	a) Make		
	b) Current rating		

Sl No	Technical Particulars	Unit	To be filled in by Tenderer
	c) Clamp type or bolt type		
	d) Maximum conductor size and number of conductor which it can receive		
	e) Disconnecting type of CT circuit		
	f) Terminal making facility provided		
	g) Crimp type connectors provided at the terminals		
	h) Spare terminals		
2.	<b>PROTECTIVE RELAYS</b>		
2.1	<b>Numeric over current / Earth fault relays</b>		
	a) Type		
	b) Current coil range		
	c) Tap range		
	d) Power consumption		
	i) Highest tap		
	ii) Lowest tap		
	e) Time of operation at maximum time dial setting		
	f) Type of characteristic		
	g) Whether draw out type or not		
	h) Trip contact rating Amps		
	i) Whether seal in contact provided or not		
	j) Is the slope setting variable?		
	k) Disturbance recorder capacity in time duration		
	l) Number of event recording		
	m) Does it have LBB protection		
	n) Does it have frequency protection, describe		
	o) Does it have voltage protection, describe		
	p) Compliance with IEC 61850 protocol (Yes/ No)		
	q) Numbers of Analogue inputs		
	r) Numbers of Binary inputs		
	s) Numbers of Binary outputs		
2.2	<b>Numeric Differential Relays</b>		

SI No	Technical Particulars	Unit	To be filled in by Tenderer
	a) Manufacturer's Name & address		
	b) Type		
	c) Current coil Rating		
	d) Tap Range		
	e) Maximum VA burden at:- (i) Operating coil (ii) Restraining coil.		
	f) Is the slope setting variable?		
	g) Harmonic restraint provided or not.		
	h) Range of HT/LT ratios over which the relay can be used.		
	i) Operating time		
	j) Trip contact rating.		
	k) Whether sealed in contact provided or not.		
	l) Does it have over fluxing feature		
	m) Disturbance recorder capacity in time duration		
	n) Number of event recording		
	o) Does it have REF functions		
	p) Does it have O/C & E/F protection		
	q) Does it have LBB protection		
	r) Does it have frequency protection		
	s) Does it have voltage protection		
	t) Does it have Over Load protection		
	t) Compliance with IEC 61850 protocol (Yes/ No)		
	u) Numbers of Analogue inputs		
	v) Numbers of Binary inputs		
	w) Numbers of Binary outputs		
2.3	<b>Numeric Distance Scheme, Main-I</b>		
	a) Manufacturer's Name & address		
	b) Type		
	c) Current coil Rating		

Sl No	Technical Particulars	Unit	To be filled in by Tenderer
	d) Tap Range		
	e) Maximum VA burden at:- (i) Operating coil (ii) Restraining coil.		
	f) How many zones of protections, describe them		
	g) Minimum time of operation		
	h) Does it have mho/Quad characteristics		
	i) Does it have SOTF & PSB		
	j) Does it have carrier aided protection		
	k) Does it have AR facility		
	l) Does it have directional O/C & E/F protection		
	q) Does it have LBB protection		
	r) Does it have frequency protection, describe		
	s) Does it have voltage protection, describe		
	t) Disturbance recorder capacity in time duration		
	u) Number of event recording		
	v) Compliance with IEC 61850 protocol(Yes/ No)		
	w) Numbers of Analogue inputs		
2.31	x) Numbers of Binary inputs		
	y) Numbers of Binary outputs		
	z) Does it have Tripping logic functions (Yes/No)		
	aa) Does it have Fault Locator functions (Yes/No)		
	ab) Does it have Broken Conductor check functions (Yes/No)		
	ac) Does it have Fuse Fail Supervision functions (Yes/No)		
	ad) Whether it has df/dt function (Yes/No)		
	ae) Whether U/F is settable for multistage (Yes/No)		
	<b>Fill up the as per item 2.3, with operating characteristic details</b>		
2.4	<b>Auxiliary Relays</b>		
	a. Manufacturer's Name & address		

SI No	Technical Particulars	Unit	To be filled in by Tenderer
	b. Type		
	c. Rated current/voltage and permissible variation		
	d. Rated burden		
	e. No. and type of contacts (whether 'NO' or 'NC')		
	f. Rating of contacts		
	g. Total operating time of relays		
	h. One minute power frequency withstand voltage		
	i. Detailed literature furnished with reference (Yes/No)		
	j. Details of testing facilities provided		

**B. BAY CONTROL UNIT**

SI No	Technical Particulars	Unit	To be filled up by Tenderer
1.	a) Manufacturer's Name & address		
	b) Size of the BCU		
	c) Disturbance recorder capacity in time duration		
	d) Whether the BCU has the capability to control two or more bays		
	e) Size of HMI window		
	f) Numbers of Analogue input		
	g) Numbers of BI		
	h) Numbers of BO		
	i) Numbers of input/output modules		
	i) Whether BCU has Synchronization features, (Yes / No)		
	j) Whether BCU has Auto Reclose features, (Yes / No)		
	k) Whether BCU has OC & EF protection function (Yes/ No)		
	l) Whether BCU has Trip Ckt Supervision facilities (Yes/ No)		

SI No	Technical Particulars	Unit	To be filled up by Tenderer
	m) Number of event recording		
	n) Compliance with IEC 61850 protocol (Yes/ No)		
	p) Number of equipment it can handle		
	q) Speed of operation		
	r) Describe inherent protection functions, if any		
	s) Metering (Phase Current/Voltage, MW, MVAR, Freq, Phase angle etc)		
	t) Monitoring		
	u) Disturbance Recorder		
	v) Card extension provisions, BI & BO (yes/No)		
	w) Whether site configurable		
	x) Nos of front configurable LED		
	y) Whether Self Supervision features provided (yes/No)		
	z) Whether communication partisan front (yes/no)		
	aa) Power card redundancy (Yes/No)		
	ab) Min & Maximum range of auxiliary voltage		
	ac) Numbers of FO ports		
	ad) % Accuracy at 1% of $I_n$ for metering		
	ae) Whether Bay mimic can distinguish the live & dead section of the bay (yes/ no)		

### C. Managed Ethernet Switch

SI No	Technical Particulars	Unit	To be filled in by Tenderer
1.0	a) Manufacturer's Name & address:		
	b) Size of the Switch		
	c) Redundant Power Card (yes/ no)		
	d) Numbers of FO ports for Bay Level switches		
	e) Numbers of FO & Copper ports for Station Level switches		
	f) Whether self-diagnostic features is available (Yes/No)		

SI No	Technical Particulars	Unit	To be filled in by Tenderer
	g) Whether Port Monitoring Software for Ethernet Switches will be provided (Yes/No)		
	h) Whether active port availability indication is available (Yes/No)		
	i) Name the Protocol used		
	k) Standards followed (list to be provided)		
	l) Auxiliary Power Supply (mention range & type of auxiliary voltage)		

#### D. Time Synchronization Device

SI No	Technical Particulars	Unit	To be filled up by Tenderer
1.0	a) Manufacturer's Name & address:		
	b) Model No		
	b) Size of the device		
	c) Redundant Power Card (yes/ no)		
	d) Numbers of communication ports		
	e) Day Display Format		
	f) Time display Format		
	g) Date Format		
	h) Frequency display Format		
	i) Remote display Digit Height (shall be more than 100 mm)		
	k) SCADA/RCCC Interface		
	l) Heat Load (BTU/hr)		
	m) Time Synchronization Protocol		
	n) Accuracy (shall be more than 20 ns)		
	p) Configuration Software		
	q) List the Accessories along with make.		
	r) Compliance to IEC 61850 Protocol (Yes/No)		

#### E. Substation Automation System

SI No	Technical Particulars	Unit	To be filled up by Tenderer
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SI No	Technical Particulars	Unit	To be filled up by Tenderer
1.0	<b>General</b>		
1.1	<b>SAS Panel</b>		
	a) Size of the Panel		
	b) Number of Panel		
1.2	<b>HMI (Main, Redundant &amp; DR Station)</b>		
	a) Manufacturer's Name & address		
	b) Model No		
	c) General Configurations		
	d) Redundant Power Supply Card (Yes/No)		
	e) Are all the input/output ports are hardware lockable (yes/no)		
	f) Size of the LED Monitor		
	g) Protocol used for HMI		
	n) Name the Protocols Compliant to		
	Are the HMIs are fire wall protected (yes/no)		
1.2	<b>Configuration of Mass Storage Device</b>		
1.3	<b>Gateways</b>		
	a) Manufacturer's Name & address		
	b) Model No.		
	c) Redundant power card (yes/no)		
	d) Compatible to IEC 68870-101/104 (Yes/No)		
	e) Time Synchronisation (yes/no)		
	f) Nos. of output ports		
	g) Whether the Gateways are expandable for future 4 numbers of bays? (yes/no)		
	h) Whether it is site configurable? (Yes/no)		
1.4	<b>Printers</b> (Please provide the information regarding Manufacturer, basic configuration for Colour laser, Dot matrix & Line printers separately)		
1.5	<b>Furniture</b> (Please provide the information regarding Make, size etc for each item)		
1.6	<b>FO cable</b> (Please provide make, size, nos. of pair etc)		

SI No	Technical Particulars	Unit	To be filled up by Tenderer
	Patch/CAT cable (Please provide make, size, core, type etc)		
1.7	Nos. of Licensed SAS software including NMS to be provided?		
1.8	<b>INVERTER</b>		
	a) Manufacturer's Name & address		
	b) Model		
	c) KVA Capacity		

### **11 DISC INSULATOR**

Sl. No.	DESCRIPTION	To be filled in by the Tenderer			
		70 KN	90 KN	120KN	160 KN
1.	Manufacturer's name & address				
2	Type of Insulator				
3	Size of ball & socket				
4	Dimensions				
(a)	Disc diameter				
(b)	Unit spacing				
(c)	Creepage distance of the single insulator-mm				
5	Electro-mechanical strength of single insulator-kN				
6	Materials of shell				
7	<b>Electrical value</b>				
7.1	Power frequency Withstand Voltage Disc				
	(a) Dry-kV (rms)				
	(b) Wet-kV (rms)				
7.2	Power frequency Withstand Voltage Disc				
	(a) Dry-kV (rms)				
	(b) Wet-kV (rms)				
7.3	Impulse Withstand Voltage Disc				
	1.2/50 micro second				
	(a) Positive – kV(Peak)				
	(b) Negative – kV(Peak)				
7.4	Impulse Flashover Voltage Disc				
	1.2/50 micro second				
	(a) Positive – kV(Peak)				

(b) Negative – kV(Peak)				
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### 12. 132 KV LONG ROD INSULATORS

Sl.	Description	Unit	To be filled in by the Tenderer		
			70 KN/ 90KN	120 KN	160 KN
1.0	<b>General</b>				
a)	Size and Designation of ball & Socket assembly				
2.0	<b>Dimensions</b>				
a)	Core diameter				
b)	Tolerance on core diameter				
c)	Minimum nominal creepage distance				
	1. Normal				
	2. Anti Fog				
3.0	Colour of glaze of finished porcelain insulator				
4.0	Mechanical Strength of Long Rod				
5.	<b>Minimum electrical values</b>				
a)	Power frequency <b>Withstand</b> voltage				
b)	Power frequency <b>Flashover</b> voltage (DRY/WET)				
c)	Impulse <b>Withstand</b> test voltage 1.2 x 50 $\mu$ s (Dry) POSITIVE / NEGATIVE				
d)	Impulse <b>Flashover</b> test voltage 1.2 x 50 $\mu$ s (Dry) POSITIVE / NEGATIVE				
6.	Eccentricity of Long Rod				
a)	Max. axial/radial run out				
b)	Max. angular displacement				
7.	Galvanizing				
a)	Minimum mass of zinc coating				
b)	Minimum no. of one minute dips in the standard preece test				
c)	Minimum purity of zinc used for galvanizing				

### 13. 220 KV LONG ROD INSULATORS

Sl. No	Description	Unit	To be filled in by the Tenderer			
			70 KN	90 KN	120 KN	160 KN
1.0	<b>General</b>					
a)	Size and Designation of ball & Socket assembly	mm				
2.0	<b>Dimensions</b>					
a)	Core diameter	mm				
b)	Tolerance on core diameter	± mm				
c)	Minimum nominal creepage distance 1. Normal 2. Anti Fog	mm				
3.0	Colour of glaze of finished porcelain insulator					
4.0	Mechanical Strength of Long Rod	kN				
5.0	<b>Minimum electrical values</b>					
a)	Power frequency <b>Withstand</b>	kV				
b)	Power frequency <b>Flashover</b>	kV				
c)	Impulse <b>Withstand</b> test voltage 1.2 x 50µs (Dry) POSITIVE / NEGATIVE	kV (pe ak)				
d)	Impulse <b>Flashover</b> test voltage 1.2 x 50µs (Dry) POSITIVE / NEGATIVE	kV (pe ak)				
e)	Corona extinction voltage level	kV				
f)	Max. RIV for string including corona rings at 156kV rms	micro volts				
6.	<b>Eccentricity of Long Rod</b>					
a)	Max. axial/radial run out					
b)	Max. angular displacement	deg				
7.	<b>Galvanizing</b>					
a)	Minimum mass of zinc coating	Gm/ sq.m.				
b)	Minimum no. of one minute dips in the standard preece test	Nos.				
c)	Minimum purity of zinc used for galvanizing	%				

**14. 400 KV LONG ROD INSULATOR STRING**

Sl.	Description	Unit	To be filled in by the tenderer			
			70 KN	90 KN	120 KN	160 KN
1.0	<b>General</b>					
a)	Size and Designation of ball & Socket assembly	mm				
2.0	<b>Dimensions</b>					

a)	Core diameter	mm				
b)	Tolerance on core diameter	± mm				
c)	Minimum nominal creepage distance	mm				
	1. Normal					
	2. Anti Fog					
3.0	Colour of glaze of finished porcelain insulator					
4.0	Mechanical Strength of Long Rod	kN				
5.0	<b>Minimum electrical values</b>					
a)	Power frequency Withstand voltage	kV rms				
b)	Power frequency Flashover voltage	kV rms				
c)	Impulse Withstand test voltage 1.2 x 50 µs (Dry) POSITIVE / NEGATIVE	kV (peak )				
d)	Impulse <b>Flashover</b> test voltage 1.2 x 50 µs (Dry) POSITIVE / NEGATIVE	kV (peak)				
e)	Wet Switching impulse withstand voltage (POSITIVE / NEGATIVE)	kV (peak)				
f)	Corona extinction voltage level	kV rms				
g)	Max. RIV for string including corona rings at 320kV rms	micro volts				
6.	<b>Eccentricity of Long Rod</b>					
a)	Max. axial/radial run out					
b)	Max. angular displacement	deg				
7.	<b>Galvanizing</b>					
a)	Minimum mass of zinc coating	Gm/				
b)	Minimum no. of one minute dips in zinc	Nos.				
c)	Minimum purity of zinc used for	%				

### 15 XLPE CABLE A.XLPE CABLE

		400kV	200kV	132kV	33kV
1	Manufacturer's Name and Address				
2	Type of cable				
3	Conforming Standard				
4	No. of Cores				
5	<b>Voltage</b>				
i	Rated Voltage ( U <sub>0</sub> /U)				
ii	Highest System Voltage				
6	System Current				

7	Maximum Conductor temperature for continuous operation				
8	Maximum short time conductor temperature with duration				
9	Maximum allowable conductor temp.during overload				
10	<b>Details of Conductor</b>				
I	Conductor material and grade				
ii	Shape of conductor				
iii	Diameter (mm)				
iv	Cross sectional area (sq.mm)				
V	No. of Strands and Diameter of each Strand				
11	Water swellable powder/yarn provided				
12	Core Insulation				
I	Type of insulation				
ii	Diameter over insulation (mm)				
iii	Nominal thickness (mm)				
iv	Designed maximum stress				
V	Detail of vulcanization process				
13	Extruded Conductor Screen				
I	Material				
ii	Nominal thickness (mm)				
iii	Diameter over Conductor Screen (mm)				
<b>Sl. No.</b>	<b>Particulars</b>	<b>To be filled in by the tenderer</b>			
		<b>400kV</b>	<b>220kV</b>	<b>132kV</b>	<b>33kV</b>
iv	Resistivity (ohm-m)				
vi	Designed maximum stress at Conductor Screen				

14	<b>Extruded Insulation Screen</b>				
i	Material				
ii	Thickness (Nominal/Minimum)				
iii	Diameter over Insulation Screen				
iv	Strippable/ Bonded				
15	<b>Conducting Longitudinal Water Sealing</b>				
i	Material				
<sup>B</sup> ii	Thickness				
16	<b>Metal Sheath/ Screen</b>				
i	Material				
ii	No. of Strands				
iii	Diameter of Cable after stranding				
17	<b>Armouring</b>				
i	Type				
ii	Material				
iii	Diameter over Armouring (mm)				
18	Nominal overall Diameter of Cable				
19	Nominal overall Weight of Cable per Metre				
20	Minimum Bending Radius allowable during installation				
21	Bushing Type (if applicable)				
22	Rated Power Frequency Withstand Voltage ( 1 min)				
23	Impulse withstand BIL (1.2/ 50/ micro Sec) Line to earth				
24	Switching impulse voltage (250/ 2500 micro-sec)				
25	Rated short time withstand current (1 sec)				
26	Rated peak withstand current (1 sec)				
27	Fault Level				
28	<b>Drum details</b>				
i	Material and Weight of Drum				
<b>Sl. No.</b>	<b>Particulars</b>	<b>To be filled in by the tenderer</b>			
		<b>400kV</b>	<b>220kV</b>	<b>132kV</b>	<b>33kV</b>
ii	Weight of Drum with Cable				
iii	Approximate length of cable in a drum				
iv	Flange diameter (mm)				
v	Barrel diameter (mm)				
<b>I29</b>	Safe pulling force (kg/sqmm)				

**INDOOR/OUTDOOR TERMINATION & STRAIGHT THROUGH JOINT**

Sl.No.	Particulars	Details to be filled in by the tenderer
1	Name of Manufacturer	
2	Applicable Standards	
3	Rated Voltage of Cable accessories	
4	AC / DC Voltage Withstand (Dry)	
5	AC Voltage Withstand (Wet) (for Outdoor termination)	
6	Partial Discharge	
7	Impulse Voltage	
8	Load Cycle test	
	a. Each cycle heating duration	
	b. Temperature	
	c. Cooling Duration	
	d. Continuous Phase to earth Voltage withstand	
9	Humidity Test	
10	Salt Fog Test	
11	Thermal Short Circuit test	
12	Dynamic Short circuit test	
13	Method of Stress Control	
14	Tubing's & Molded parts	
15	Non Tracking material	
16	Di-electric strength of insulating material	

**16. Aluminium IPS Tube BUS**

Sl no	Description	Details to be filled in by the tenderer		
		4 inch	3 inch	2.5 inch
1.0	<b>BUS PIPES : GENERAL</b>			
1.1	Name & address of Manufacturer			
1.2	Conforming Standard			
1.3	Type of tube			
1.4	Material & grade			
1.5	Manufacturing length in (mm)			
1.6	0.2% proof stress (yield strength)kg/mm2:			

1.7	% min. Elongation on 50 mm gauge length			
2.0	Chemical composition of material			
2.1	Cu (%)			
2.2	Mg (%)			
2.3	Si (%)			
2.4	Fe (%)			
2.5	Al (%)			
3	Area for 4inch, 3inch, 2.5 inch I.P.S. tubes separately (mm <sup>2</sup> )			
4	Weight for the above items separately (Kg/m)			
5	Minimum Ultimate tensile strength (Kg/mm <sup>2</sup> )			
6	Modulus of Elasticity (Kg/mm <sup>2</sup> )			
7	Thermal conductivity (calories/sec./Cm <sup>2</sup> / °C at 100°C)			
8	Linear temperature co-efficient of expansion (20°C – 200°C) (/°C)			
9	Temperature Co-efficient of resistance (/°C)			
10	Rated normal current (Amps.)			
11	Temp. rise above ambient temperature of 50oC at rated normal current (°C)			
12	Short time Current rating in KA(3 for second for 132/220/400 KV)			
13	Electrical resistivity (Maxm) at 20°C (ohm-cm)			
14	D.C. resistance(Max.) at 20°C (Micro-Ohm)			
15	Minimum Electrical Conductivity (% I.A.C.S.)			
16	OPTICAL GROUND WIRE (OPGW) – 24/48 Fibre			

#### F. CABLE CONSTRUCTION

SI No	Parameter	Unit	TO BE FILLED IN BY THE TENDERER
1.	No. of Fibres Dual Window Single-Mode:	each	
2.	Buffer Type:		
3.	Buffer Tube material		
4.	No. of Buffer Tubes:	each	
5.	No. of Fibers per buffer Tube:	each	
6.	Expected Cable Life:		
7	Buffer tube diameter	mm	
7	Filling material		
8	Filling material compliant with technical specifications?	Yes/no	
9	Strength member(s)		
10	Binding yarn/ tape		
11	Describe Central Core Design		

12	20% Aluminum Clad steel wire Diameter:	mm	
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	Number:	each	
13	Aluminum alloy wires Diameter: Number:	mm each	
14	Aluminum tube inner diameter	mm	
15	Aluminum tube outside diameter	mm	
16	Cable Diameter: (nominal $\pm$ deviation)	mm	
17	Cable Diameter: (nominal $\pm$ deviation)	mm	
<b>Mechanical Properties of Cable</b>			
18	Max. breaking load/ Ultimate Tensile Strength (UTS)	kN	
19	Fibre strain margin	%	
20	Zero fibre strain up to load	kN	
21	Weight	kg/km	
22	Crush strength	kg/mm	
23	Equivalent Modulus of elasticity	KN/m <sup>2</sup>	
24	Minimum Bending Radius without micro bending	mm	
25	Maximum Bending Radius Short Term Long Term (Continuous)	mm	
26	Tensile proof test (Screening) level	KN/m <sup>2</sup>	
27	Maximum permissible tensile stress	KN/m <sup>2</sup>	
28	Permissible CTS. tensile stress	KN/m <sup>2</sup>	
29	Maximum sag at maximum temperature and design span with no wind	mm	
30	Everyday tension , no wind	% of UTS	
31	Maximum tension at Every day condition with full wind pressure of..... Kg/m <sup>2</sup> on full projected are, 400 meter span		

**G. OPTICAL FIBRE [DUAL-WINDOW SINGLE MODE (DW-SM)]**

Sl no	Parameter	Unit	As per Technical Specification	TO BE FILLED IN BY TENDERER
1	Fiber anufacturer(s)/Type:			
2	Attenuation Coefficient @ 1310 nm: @ 1550 nm:	dB/km	$\leq 0.35$ dB/km $\leq 0.21$ dB/km	
3	Point discontinuity @ 1310nm: @ 1550nm:	dB	$\leq 0.05$ dB $\leq 0.05$ dB	
4	Nominal Mode Field Diameter @ 1310 nm: @ 1550 nm:	$\mu\text{m}$	8.6 to 9.5 $\mu\text{m}$ ( $\pm 0.6\mu\text{m}$ )	
5.	Chromatic Dispersion Coefficient @ 1310 (1288-1339) nm: @ 1310 (1271-1360) nm: @ 1550 nm:	ps/nm.k m	3.5 ps/(nm $\times$ km) 5.3 ps/(nm $\times$ km) 18 ps/(nm $\times$ km)	
6	Mode field concentricity error		$\leq 0.6 \mu\text{m}$	
7	Zero dispersion wavelength:	nm	1300 to 1324 nm	
8	Zero Dispersion Slope	ps/nm <sup>2</sup> . km	0.092ps/nm <sup>2</sup> $\times$ km maximum	
9	Cable Cutoff wavelength	nm	$\leq 1260$ nm	
10	Temperature dependance		Induced	

			attenuation $\leq 0.05$ dB(-60 <sup>0</sup> C -+85 <sup>0</sup> C)	
11	Refractive Index			
12	Refractive Index profile			
13	Cladding Design			
14	Numerical aperture			
<b>Physical &amp; Mechanical Properties</b>				
15	Bend Performance: (37.5 mm radius, 100 turns) @1310 nm (30 mm radius, 100 turn) @1550 nm (16mm radius, 1 turn) @ 1550nm	dB	$\leq 0.05$ dB $\leq 0.05$ dB $\leq 0.50$ dB	
16	Core Diameter(nominal $\pm$ deviation) in $\mu\text{m}$	$\mu\text{m}$		
17	Core non-circularity in %			
18	Cladding Diameter (nominal $\pm$ deviation):		$125.0 \mu\text{m} \pm 1 \mu\text{m}$	
19	Polarisation mode dispersion coefficient		$\leq 0.2 \text{ ps/km}^{1/2}$	
20	Proof test level		$\geq 0.69 \text{ Gpa}$	
21	Colour coding scheme compliant with EIA/TIA 598 or IEC 60304 or Bellcore GR-20 State YES/NO)			

#### H. HARDWARE AND ACCESSORIES

- Suspension Clamp Assembly:

SI No	Description Unit	Unit	TO BE FILLED IN BY THE TENDERER
1	Minimum vertical Strength	kN	
2	Maximum Slip Strength	kN	
3	Minimum Slip Strength	kN	
4	Length (nominal)	mm	
5	Weight (nominal)	kg	
6	Total Drop (maximum) including shackles	Nm	
7	Tightening torque (nominal)	Nm	
8	Details of Armour Rod Set a) No. of rods per clamp b) Direction of Lay c) Overall length d) Diameter of each Rod e) Tolerances (i) Diameter of each rod (ii) Length of each rod f) Material of manufacture g) UTS of each Rod h) Weight	mm mm $\pm\%$ $\pm\%$ kN kg	
9	Details of Protection Splice Set (Reinforcing Rods) i) No. of rods per clamp j) Direction of Lay k) Overall length l) Diameter of each Rod m) Tolerances	mm	

	(i) Diameter of each rod	mm	
	(ii) Length of each	±%	
	n) Material of manufacture	±%	
	o) UTS of each Rod	kN	
	p) Weight	kg	

- **Dead End Clamp Assembly**

SI No	Description	Unit	TO BE FILLED IN BY THE TENDERER
1	Minimum Slip Load	kN	
2	Length (nominal) a) Reinforcing Rods b) Dead end	mm mm	
3	Weight (nominal) a) Reinforcing Rods b) Dead end	kg kg	
4	Breaking strength (minimum)	kN	
5	Wire Size a) Reinforcing Rods b) Dead end	mm mm	

- **Vibration Damper**

SI	Description	Unit	TO BE FILLED IN BY THE TENDERER
1	Total Weight	Kg	
2	Weight of each Damper	Kg	
3	Material of Damper Weight		
4	Clamp Material		

5	Clamp bolt tightening torque	Nm	
6	Clamp bolt material		
7	Messenger Cable Material		
8	No. of Strands in Messenger Cable		
9	Breaking Strength of Messenger Cable	kN	
10	Resonance Frequencies a) First Frequency b) Second Frequency c) Third Frequency d) Forth Frequency	Hz Hz Hz Hz	
11	Minimum Slip Strength of Damper Clamp a) Before Fatigue Test b) After fatigue Test	kN kN	

- **Down Lead Clamp /Fastening Clamp**

SI No	Description	Unit	TO BE FILLED IN BY THE TENDERER
1	Material		
2	Suitable for OPGW (range):	mm	
3	Tightening torques	Nm	
4	Vertical load	kN	
5	Filler details (a) Material (b) diameter	mm	
6	Tower attachment arrangement		

- **Optical Fibre Distribution Panel (FODP)**

SI no	Parameter	Unit	TO BE FILLED IN BY THE TENDERER
1	Dimensions H * W * D:	cm	
2	Weight:	kg	
3	Colour and Finish:		
4	Cable Glanding and Fixing:		
5	Construction materials & Gauge:		
6	Locking arrangements:		
7	Installation Clearances Front Access: Rear Access: Top * Bottom * Sides:	cm	
8	IP Protection		
9	Total number of optical couplings:	each	
10	Provision of pass through splicing	Yes/No	
11	Whether filled with encapsulant	Yes/No	
12	Method(s) for mounting:		

- **Approach Cable**

SI No	Parameter:	Unit:	TO BE FILLED IN BY THE TENDERER
1	No. of Fiber Dual Window Single-Mode:	Each	
2	Fibre Manufacturer Dual Window Single-Mode:		
3	Buffer Type:		

4	Buffer Tube Diameter:	mm	
5	Buffer Tube material		
6	No. of Buffer Tubes:	Each	
7	No. of Fibres per Tube:	Each	
8	Identification/numbering of individual tubes:		
9	No. of empty tubes (If any):	Each	
10	Filling material:		
11	Filling material compliant with technical specifications?	Yes/No	
12	Strength member(s):		
13	Binding yarn/ tape:		
14	Describe Central Core Design:		
15	Outside Jacket Coating (if any)		
16	Jacket Thickness	mm	
17	Jacket non-circularity	%	
18	Cable Diameter: (nominal $\pm$ deviation)	mm	
19	Cable cross-sectional area	mm <sup>2</sup>	
20	Rip-cord provided?	Yes/No	
21	Fully Compliant with IEC 60974-3	Yes/No	

**Mechanical Properties of Approach Cable**

22	Max. breaking load/ Ultimate Tensile Strength (UTS):	kN	
23	Fibre strain margin:	%	
24	Zero fibre strain up to load	kN	
25	Weight:	kg/km	
26	Crush strength:	kg/m <sup>2</sup>	
27	Equivalent Modulus of elasticity:	kN/mm <sup>2</sup>	
28	Minimum Bending Radius without micro bending:	mm	
29	Maximum Bending Radius: Short Term: Long Term (Continuous):	mm	
30	Tensile proof test (Screening) level:	kN/mm <sup>2</sup>	
31	Maximum permissible tensile stress:	kN/mm <sup>2</sup>	
32	Permissible CTS. tensile stress:	kN/mm <sup>2</sup>	
33	Everyday Tensile Stress	N	
34	Torsion	twist/m	

**16. AAAC POWER CONDUCTOR**

Sl.No	DESCRIPTION	TO BE FILLED IN BY THE TENDERER
1.0	Name of manufacturer and address for: (a) Aluminium Alloy rods: (b) Aluminium Alloy Conductor:	
2.0	Applicable Standard for: (a) Aluminium Alloy rods: (b) Aluminium Alloy Conductor:	
	No of Strand x Size, (No. x mm)	
3.0	Conductor over all diameter, (mm)	
4.0	Total sectional area, (mm <sup>2</sup> )	
5.0	Approx. weight, (kg/kM)	
6.0	Minimum UTS, (kN)	
7.0	Modulus of Elasticity (Final), (kg/cm <sup>2</sup> )	
8.0	Coefficient of linear expansion, (per <sup>0</sup> C)	
9.0	Calculated maximum resistance of Conductor at 20°C,	

Sl.No	DESCRIPTION	TO BE FILLED IN BY THE TENDERER
	(ohm/Km)	
10.0	Lay Ratio: (i) 6 wire layer (max/min) (ii) 12 wire layer (max/min) (iii) 18 wire layer (max/min)	
11.0	Particulars of Aluminium Alloy Wires (strands)	
	(a) Wire Diameter, (mm) (i) Standard: (ii) Maximum: (iii) Minimum:	
	(b) Resistivity of wire, (ohms.mm <sup>2</sup> /m)	
	(c) Density	
	(d) Co-efficient of Linear expansion (per <sup>0</sup> C)	
	(e) Cross Sectional area of Aluminium wire	
	(f) Approximate Total weight of each strand, (kg/km)	
	(g) Calculated resistance at 20°C (D.C.), (ohms/km)	
	(h) Minimum Breaking Load of each strand, (kN)	
	(i) Minimum elongation on a gauge length of 200 Mm	

### 17. ACSR POWER CONDUCTOR

Sl. No.	Description	Unit	To be filled in by the bidder
1.0	Maker's Name, Address		
2.0	Particulars of Raw Materials		
2.1	Aluminium		
a)	Minimum Purity of aluminum	%	
b)	Maximum Copper Content	%	
2.2	Steel Wires/Rods		
a)	Carbon	%	
b)	Manganese	%	
c)	Phosphorus	%	
d)	Sulphur	%	
e)	Silicon	%	
2.3	Zinc		
a)	Minimum Purity of Zinc	%	
3.0	Aluminum Strands after stranding		
3.1	Diameter		
a)	Nominal	mm	
b)	Maximum	mm	
c)	Minimum	mm	
3.2	Minimum Breaking Load of Strand	kN	
3.3	Maximum Resistance of 1m length of	Ohm	
4.0	Steel Strands after stranding		
4.1	Diameter		
a)	Nominal	mm	
b)	Maximum	mm	
c)	Minimum	mm	
5.0	Galvanizing		
a)	Minimum weight of zinc coating per Uncoated wire surface	gm/m <sup>2</sup>	
b)	Minimum number of one minute dips galvanized strand	Nos.	

Sl. No.	Description	Unit	To be filled in by the bidder
	can withstand in the preece test		
c)	Minimum number of twists in a guage length times dia of wire which the strand can in the torsion test (after stranding)	Nos.	
6.0	ACSR Stranded Conductor		
6.1	UTS of Conductor	kN	
6.2	Lay ratio of Conductor	Max.	
a)	Outer Steel Layer		
b)	12 wire aluminum layer		
c)	18 wire aluminum layer		
d)	24 wire aluminum layer		
6.3	D.C. resistance of conductor at 20°C	Ohm/Km	
6.4	Standard length of conductor	M	
6.5	Maximum length of conductor that can be	Meter	
6.6	Tolerance on standard length of conductor	%	
7.0	Direction of lay for outside layer		
7.1	Linear mass of the Conductor		
a)	Standard	Kg/Km	
b)	Minimum	Kg/Km	
c)	Maximum	KgKm	
8.0	No. of Cold pressure butt welding available at works	Nos.	

### 18 Circuit Breakers

Sl. No	Description	To be filled in by the Tenderer	
		132kV	33kV
1.0	Manufacturer's Name & Address of manufacturing plant		
2.0	Type of Construction		
3.0	Type of circuit breaker		
4.0	Standard applicable		
5.0	Principle of operation		
6.0	Rated voltage, kV		
7.0	Reference ambient temperature		
8.0	Continuous current in Ampere a) Reference ambient temperature 40°C b) Reference ambient temperature 50°C		
9.0	Maximum temperature rise over an ambient of 50°C		
10.0	Short time current rating a) For 1second b) For 3second		

Sl. No	Description	To be filled in by the Tenderer	
		132kV	33kV
11.0	Dynamic peak circuit withstand capacity (kA peak)		
12.0	Operating duty		
13.0	Opening time in millisecond		
14.0	a) Arcing time in ms. At 100%/ 50%/ 25%/ 10% of rated breaking current. b) Arc length		
15.0	Interrupting capacity based on duty cycle specified  a) Symmetrical(kA) b) Asymmetrical(kA) c) D.C.component d) Asymmetrical factor		
16.0	Re-striking voltage characteristics at  a) Symmetrical(kA) b) Asymmetrical(kA) c) D.C.component d) Asymmetrical factor		
17.0	Re-striking voltage characteristics at  a) Amplitude factor b) Rate of rise of re-striking voltage(kV/ $\mu$ s) c) First pole to clear factor d) Type of device used, if any to control RRRV		
18.0	Number of breaks in series per pole.		
19.0	Length of contact travel (mm)		
20.0	Total length of break (mm)		
21.0	Rate of contact travel  a) Tripping(metre/sec) b) Closing(metre/sec)		
22.0	Rated line charging breaking current (Amps)		
23.0	Rated small inductive breaking current (Amps)		
24.0	Maximum shunt capacitor bank (single bank) breaking current (Amps)		
25.0	Maximum current breaking capacity under normal condition when connected to back to back capacitor bank, Amps		
26.0	a) Type and material of main contact b) Thickness of silver plating(micron)		
27.0	Type & material of arcing contact		
28.0	Contact pressure (N/finger)		

Sl. No	Description	To be filled in by the Tenderer	
		132kV	33kV
29.0	Insulation level (I) Power frequency voltage withstand for 1 min (kVrms) (II) Lightning impulse (1.2/50µs) voltage withstand (kV peak)		
30.0	Insulation level (III) Power frequency voltage withstand for 1 min (kVrms) (IV) Lightning impulse (1.2/50µs) voltage withstand (kV peak)		
31.0	Radio interference voltage test at 28 kV (µV)		
32.0	Whether circuit breaker is trip free or fixed trip		
33.0	Type & designation of the drive		
34.0	Rated control voltage for closing coil (V dc)		
35.0	Pick up voltage of the closing coil		
36.0	Power required at i) Rated voltage(W) ii) 85% of rated voltage(W) iii) 110% of rated voltage(W)		
37.0	Type of tripping mechanism		
38.0	Power required at i) Rated voltage(W) ii) 70% of rated voltage(W) iii) 110% of rated voltage(W)		
39.0	i) Total interrupting time measured from instant of trip coil energising to arc extinction(ms.) ii) Closing time measured from instant of application of power to closing coil up to arcing contact touches(ms) iii) Opening time (switches)		
40.0	Maximum over voltage factor of the circuit breaker when switching off  i) Unloaded transformer ii) Loaded transformer		
41.0	Maximum current breaking capacity when switching off asynchronous system (out of phase condition)		

Sl. No	Description	To be filled in by the Tenderer	
		132kV	33kV
42.0	<p>Number of operations, the circuit breaker is capable of performing without inspection, replacement of contacts, main parts of SF6 gas / vacuum bottles</p> <p>i) At rated current  ii) At 50% rated current  iii) At rated breaking capacity  iv) At 50% rated breaking capacity</p>		
43.0	Creepage distance (mm)		
44.0	<p>Weight of complete breaker including poles, operating mechanism and structure</p> <p>i) Weight of structure(kg)  ii) Weight of operating mechanism(kg)  iii) Weight of SF6 gas per breaker (kg)  (For exact details submit GA drawing)</p>		
45.0	<p>Impact loading for foundation design (to include dead load and impact value)</p> <p>i) On opening(Newton)  ii) On closing(Newton)</p>		
46.0	<p>Insulator</p> <p>i) Material  ii) Type  iii) Insulation class  iv) 1min dry power frequency withstand voltage(kVrms.)  v) 10 Sec. Wet power frequency withstand voltage (kV rms.)  vi) Full wave impulse withstand voltage (kVrms.)  vii) Permissible cantilever loading(kg)</p>		
47.0	<p>SF6 gas (for SF6 breaker only)</p> <p>i) Name of gas  ii) Supplier of gas</p>		

Sl. No	Description	To be filled in by the Tenderer	
		132kV	33kV
	iii) General properties of SF6 gas, Purity (mass in%) <ul style="list-style-type: none"> <li>a) CF4</li> <li>b) Air</li> <li>c) Water</li> <li>d) Hydrolytic fluorides(PPM.)</li> <li>e) Acidity(PPM.)</li> </ul> iv) Equivalent standard v) Storage of gas vi) Thermal characteristics, Specific heat (Joules / kg °C, kcal / kg°C) vii) Sublimation temperature (at 760 Torr)°C viii) Breaking temperature (at 2.29 atm)°C ix) Physical properties <ul style="list-style-type: none"> <li>a) Molecular mass(relative)</li> <li>b) Vapour pressure at 20°C</li> <li>c) Critical temperature, °C</li> </ul>		
48.0	Whether circuit breaker suitable for 1 or 3 phase reclosing		
49.0	Minimum dead time (ms)		
50.0	Minimum reclosing time at full rated interrupting capacity (ms)		
51.0	Minimum reclaim time (seconds)		
52.0	Limits of adjustment of dead time		
53.0	Device provided to give alarm and block tripping closing of circuit breaker in case of loss of. (for SF6 Breaker only) <ul style="list-style-type: none"> <li>a) SF6 gas</li> <li>b) Air pressure of operating mechanism</li> </ul>		
54.0	Rated pressure (bar at 20°C gauge) & limits of pressure (for SF6 Breaker only)		
55.0	Rate of SF6 gas leakage (% per annum) (for SF6 Breaker only)		
56.0	Whether the breaker will self-close on low pressure of SF6 gas (for SF6 Breaker only)		
57.0	Pole to pole distance <ul style="list-style-type: none"> <li>i) Centre to centre</li> <li>ii) Clearance(mm)</li> </ul>		

Sl. No	Description	To be filled in by the Tenderer	
		132kV	33kV
58.0	Maximum pole discrepancy i) Between poles for tripping(ms) ii) Between poles for closing(ms) iii) Between poles for C-O(ms) iv) Spare auxiliary switches provided(nos.)		
59.0	Auxiliary switch contact rating i) Continuous ii) Inductive breaking(Amp) iii) Number of sparecontacts		
60.0	Clearance between i) Live part to earth(mm) ii) Live part to base of structure(mm) iii) Terminal to base of structure(mm)		
61.0	Material of operating rods/ levers		
62.0	Permissible humidity for SF6 gas (ppm) (for SF6 Breaker only)		
63.0	Refilling period for SF6 gas (years) (for SF6 Breaker only)		
64.0	Type and rating of heater		
65.0	Details and ratings of motors		

### 19 Potential Transformers (Outdoor)

Sl. No	Description	UNIT	To be filled in by the Tenderer	
			132kV	33kV
1.0	Name of the Manufacturer			
2.0	Country of Origin			
3.0	Manufacture's type and Designation			
4.0	Standards Applicable			
5.0	Type of installation			
6.0	Windings:			

Sl. No	Description	UNIT	To be filled in by the Tenderer	
	A). Primary Winding (i) Material (ii) Design density for short circuit current. (iii) Conductivity of metal used. (iv) Area of cross section.			
	B). Secondary Winding (i) Material (ii) Area of cross section.			
7.0	Rated primary voltage	KV		
8.0	Rated frequency	Hz		
9.0	Rated primary current	Amps		
10.0	Rated secondary current	Amps		
11.0	Ratio taps (on secondary side only)			
12.0	Type of insulation			
13.0	RIV at 1.1 x Rated voltage	mV		
14.0	Tank material and Tank coating			
15.0	Porcelain housing and it make (Single piece only)			
16.0	Sealing (Metal Bellow) provided			
17.0	Acceptable limit of temperature			

### 20 NEUTRAL GROUNDING REACTOR:

Sl No	Description	To be filled in by the Tenderer	
1	Rated voltage from insulation strength considerations		
2	Rated frequency		
3	No of phases		
4	Type		
5	Insulation		
6	Max. continuous current		
7	Rated short time current (10 sec)		
8	Rated impedance at rated short time current		
<b>9</b>	<b>Bushings</b>	<b>Line Side</b>	<b>Ground Side</b>
	Rated Voltage		
	Creepage Distance(Total in mm)		
	Mounting		
	Lightning Impulse (1.2/50 micro sec) withstand voltage (kVp)		
	Frequency withstand voltage (kV rms)		

Sl No	Description	To be filled in by the Tenderer	
10	Connection		
11	Insulation level for winding	Line Side	Ground Side
	i) Lightning Impulse (1.2/50 micro sec) withstand voltage (kVp)		
	ii) Power Frequency withstand voltage (kV rms)		
	admissible temperature rise over ambient temperature of 50°C at rated voltage		
	a) of winding measured by resistance		
	b) of top oil measured by thermometer		
	Winding system		
	v) Cooling medium		
	vi) Whether neutral is to be brought out		
	vii) Method of grounding		

### 21. 420KV SHUNT REACTOR

Sl No	Description	
1	Name of Manufacturer & Address	
2	Type & Designation	
3	Conforming Standard	
4	Class (Outdoor)	
5	Rated voltage (KV) & Capacity	
6	Rated frequency (Hz)	
7	Rated power	
	(a) 100% rated voltage	At
	(b) 110% rated voltage	At
8	Rated current per phase (Amps)	
	(a) 100% rated voltage	At :
	(b) 110% rated voltage	At
9	Inductance per phase (Henry)	
	a) At 100% rated voltage	:
	b) At 110% rated voltage	:
10	Type of core	
11	Maximum current density in copper conductor (Amps/Cm <sup>2</sup> )	
12	a) Temperature rise (by resistance) of winding (°C)	

	b) Temperature rise in oil (by the thermometer) ( $^{\circ}$ C)	
	c) Hot spot temperature over $50^{\circ}$ C	
	ambient temperature ( $^{\circ}$ C)	
<b>13</b>	Limit of Hot Spot temperature for which the shunt reactor is designed	
<b>14</b>	Total loss at rated voltage and frequency at $75^{\circ}$ C temperature (KW)	
<b>15</b>	Auxiliary losses at rated output (KW)	
<b>16</b>	Type of winding	
<b>17</b>	Insulation of winding	
<b>18</b>	Whether shielding between tank and winding is provided	
<b>19</b>	If so, nature of shielding and if not reasons	
<b>20</b>	Thickness of tank's plates (mm)	
<b>i</b>	Sides	
<b>ii</b>	Bottom	
<b>iii</b>	Cover	
<b>iv</b>	Conservator tanks	
<b>21</b>	Test voltages of winding	
<b>A</b>	Power frequency High Voltage Test voltage for 1 minute withstand test (KVrms)	
<b>B</b>	Impulse test	
<b>i</b>	Test voltage for 1.2/50 micro sec. full wave lightning impulse withstand test (KVp)	
<b>ii</b>	Test voltage for 250 / 2500 micro sec. full wave switching impulse withstand test (KVp)	
<b>22</b>	Inter turn insulation	
<b>i</b>	Extent of end turns reinforcement	
<b>ii</b>	Induced over voltage test at 100 Cycles for 1 minute for inter turn Insulation test (KVrms)	
<b>iii</b>	The turn voltage during induced over voltage test (times the rated turn voltage)	
<b>iv</b>	Partial Discharge Level (pc)	
<b>23</b>	A. Guaranteed total loss at rated frequency and at $75^{\circ}$ C winding temperature	

<b>i</b>	At 100% rated voltage		
<b>ii</b>	At 110% rated voltage		
	B. Tolerance to above		
<b>24</b>	Vibration of stress level at rated voltage & Frequency (micron)		
<b>25</b>	Acoustic Noise level (db)		
<b>26</b>	Types of winding temperature indicator		
<b>27</b>	<b>Bushing particulars</b>	<b>Line side</b>	<b>Neutral side</b>
<b>i</b>	Type of bushing		
<b>ii</b>	Creepage distance (Total in mm)		
<b>iii</b>	Weight of bushing ( Kg )		
<b>iv</b>	Quantity of oil in one bushing insulator in litres		
<b>v</b>	One minute power frequency voltage withstand test		
<b>a.</b>	Dry		
<b>b.</b>	Wet		
<b>vi</b>	Impulse withstand test voltage value with 1.2 / 50 micro second full wave of bushing (KVp)		
<b>vii</b>	250 / 2500 micro-second switching Impulse withstand test voltage for 400 KV only (KVp)		
<b>viii</b>	Clearance (mm)		
<b>A</b>	Minimum clearance between phases		
<b>i</b>	In oil		
<b>ii</b>	In air		
<b>B</b>	Minimum clearance between terminal to earth		
<b>28</b>	Weight of coil assembly (kg)		
<b>29</b>	Weight of tank and cover (kg)		
<b>30</b>	Weight of oil in shunt reactor inclusive of that in bushings conservator and cooling system (kg)		
<b>31</b>	Weight of complete shunt reactor with all fittings and oil (kg)		
<b>32</b>	Dimensions of shunt reactor		
<b>i</b>	Maximum height to top of bushing from ground (mm)		
<b>ii</b>	Overall length (mm)		
<b>iii</b>	Overall width (mm)		
<b>33</b>	Minimum clear height for lifting coil assembly from tank (mm)		

• **220 V VALVE REGULATED LEAD ACID BATTERY**

<b>Sl.No.</b>	<b>DETAILS</b>	<b>To be filled in by the Bidder</b>
1	Type/ Designation	
2	Manufacturer's type designation	
3	Ampere-Hour capacity 10hrs rate of discharge to 1.75V	
4	Total No. of Plates per cell	
5	Nominal Cell Voltage (V)	
6	No. of Cells in each Bank	
7	No. of Spare Cell, if any, in each Bank	
8	Internal Resistance for each Cell	
9	Resistance of the Battery including Inter-connection between the Cells ( $\Omega$ )	
10	Cell Discharge rate in Ampere (from rated Voltage to final discharge rate in Ampere  (i) 5hrs Discharge rate in Amp (ii) 2hrs Discharge rate in Amp (iii) 1hr Discharge rate in Amp (iv) 30min Discharge rate in Amp (v) 10min Discharge rate in Amp (vi) 1min Discharge rate in Amp (vii) 30sec Discharge rate in Amp (viii) 1sec Discharge rate in Amp (Please furnish a graph showing Amps against time for the type of battery offered)	
11	Short Circuit Current (Amps)	
12	(i) Material of Cell Containers (ii) Material used for Battery Box (iii) Trays	
13	Thickness, Type & Material of Separators	
14	Constructional details and dimension: Surface area plates of  (i) Positive Plate (ii) Negative Plate inSq.mm.	
15	(i) Ampere Hour efficiency(%) (ii) Watt Hour efficiency(%)	
16	(i) Recommended Float Charge Current & Voltage (ii) Recommended Boost Charge Current & Voltage	
17	Time required for Boost Charging from Discharged condition	
18	(i) Max. Charging Current/Cell (ii) Nominal Charging Rate	
19	(i) Whether explosion proof or vent plugs provided (ii) Whether vent is spill proof	

20	Type of Inter Cell connection & whether they are covered with plastic sleeves	
21	(i) Dimensions of each 2VBlock/Cell a. Length(mm) b. Width(mm) c. Height(mm) (ii) Thickness of Container(mm) (iii) Net weight of the cell complete with acid 12V block(kg)	
22	Expected Life Span of Battery	
23	Accessories provided	
24	Special conditions, if any	

• **220V BATTERY CHARGER**

<u>Sl. No.</u>	<u>DETAILS</u>	<u>To be filled in by the Bidder</u>	
1	Manufacturer's Name & Address		
2	Conforming Standard		
3	(ii) (i) Type & Designation of charger		
	(iii) Capacity(min.) of Battery Charger		
	(iv) Charger rate/output current		
	(v) Float charger (A) –min.30A		
	(vi) Float Cum Boost charger(A) – min 60		
	(vii) Confirm whether battery chargers are type tested as per spec.(Yes/No):		
4	% voltage regulation of Float charger		
5	% Ripple Content :		
6	Method of control		
7	Transformer	for Float	for Float Cum Boost
	a) Make :		
	b) Type :		
	c) Rating		
8	Rectifier		
	a) Make :		
	b) Type :		
	c) Rating		
8	A.C. Switch fuse unit		
	a) Make :		
	b) Continuous Rating Amps. :		
	c) Interrupting Rating KA.		
10	A.C.Contactors		
	a) Make :		
	b) Rating(Amps)		

<b>Sl. No.</b>	<b>DETAILS</b>	<b>To be filled in by the Bidder</b>	
11	MCB/MCCB		
	a) Make :		
	b) Type :		
	c) Rating		
12	Fuses		
	a) Make :		
	b) Continuous Rating Amps. :		
	c) Interrupting Rating KA. :		
13	D.C.Contactors		
	a) Make :		
	b) One (1)minute rating :		
	c) One (1)hour rating :		
14	D.C. tripple pole switch connected between battery and charger		
	a) Make :		
	b) Continuous Rating Amps :		
	c) Short Time Rating KA		

• **36 KV Double Break (DBR) Isolator**

<b>Sl no</b>	<b>Particulars</b>	<b>To be filled in by the Bidder</b>	
1	Type/installation		
2	Name of manufacturer and address		
3	Standards according to which isolators are manufactured		
4	Highest design voltage		
5	Frequency(Hz)		
6	Rated voltage(KV)		
7	Maximum current that can be safely interrupted by the isolator inductive and capacitive current		
8	Continuous current rating		
9	Rated short time current for 3 sec and 1 sec		
10	Rated peak short time current		
11	Current density at the minimum cross-section of		
	a) Moving blade		
	b) Terminal pad		
	c) Contacts		
12	d) Terminal connector		
	Maximum temperature rise of current carrying parts when carrying rated current continuously		
	Derating factor		
	Insulation level		
14	a) Impulse withstand voltage		
	i) phase to earth		
	ii) isolating distance		
	b) Power frequency withstand voltage(KV peak)		
	i)Phase to earth		
	ii) isolating distance		
15	Minimum clearance in air		
	i)Between poles(mm)		
	ii)Between live part and earth		

Sl no	Particulars	To be filled in by the Bidder
	iii) Between adjacent poles	
	iv) on the same pole	
16	Design & Construction	
	i) no of insulators per pole	
	ii) No of breaks per pole	
	iii) Types of closing/opening mechanism	
	iv) contacts	
	a) Material and grade	
	b) Cross-sectional area	
	v) Moving Blade	
	a) Material and grade	
	b) Cross-sectional area	
	vi) Type of interlock	
	vii) Operating mechanism	
	a) Material and thickness control cabinet	
	b) Degree of protection	
	viii) Tandem pipe	
	a) Size class and no of pipes	
17	SUPPORT INSULATOR	
	Cantilever Strength (Kgf)	
	Min. Creepage Distance (mm)	
	Insulation Level: One minute Power frequency voltage withstand test (KVrms)	
	Insulation Level: 1.2/50 micro-sec. Lightning Impulse Voltage withstand test (KVp)	
18	Voltage of Motor Drives	
19	Rated auxiliary supply voltage to coil for close & Open Operation	
20	Number and type of auxiliary contacts for	
	main blade	
	earth switch	
	Operating time for closing (secs.)	
	Operating time for opening (secs.)	

• 33/0.415KV STATION SERVICE TRANSFORMERS

SL	DESCRIPTION	(To be filled in and signed by the Bidder)
<b>1</b>	<b>GENERAL</b>	
1.01	Name of Manufacturer	
1.02	Manufacturer's Type	
1.03	Conforming Standard	
1.04	Date of Last Type Test	
1.05	Dimension of the Main Tank ( L x B x H)	

1.06	Weight of the Transformer with oil	
1.07	Volume of the Oil (KL)	
1.08	Continuous maximum KVA Rating	
1.09	Primary Voltage (Volt)	
1.10	Secodary Voltage (Volt)	
1.11	No load voltage ratio	
1.12	Primary Current (Amp)	
1.13	Secodary Current (Amp)	
1.14	Vector Group	
2	Insulation Level	
2.01	Power frequency withstand voltage (KVrms)	
2.01.1	On H.V. side	
2.01.2	On L.V. side	
2.02	Full wave Lightning Impulse withstand voltage	
2.02.1	HV Winding(KVp)	

2.02.2	LV Winding (KVp)	
2.03	Induced over voltage (KVrms)	
2.03.1	HV Winding	
2.03.2	iLV Winding)	
3	Rated temperature rise over maximum ambient temperature (50°C) at rated output (°C)	
3.01	oil	
3.02	winding	
3.03	Hot spot temperature	
4	Exciting current referred to H.V. & 50 c/s at (Amp.)	
4.01	90% rated voltage	
4.02	100% rated voltage	
4.03	110% rated voltage	
4.04	Power factor of excitation current at 100% rated voltage and 50 c/s	
5	No load loss (Core loss) (KW) at 50 c/s and at	
5.01	90% rated voltage	
5.02	100% rated voltage	
5.03	110% rated voltage	
5.04	Copper (load) loss at 75°C (KW) (excluding aux. Loss)	
5.05	Aux. Loss	
5.06	Total loss at normal tap and at rated frequency and at 75°C (KW) winding temperature including aux. loss.	
6	Percentage Impedance at rated current and voltage (%)	

6.01	At normal tap	
6.02	At highest tap	
6.03	At lowest tap	
7	Resistance per phase at 75°C (Ohm)	
7.01	H.V.	
7.02	L.V.	
8	Regulation at full load (75°C) and following p.f.	
8.01	unity p.f.	
8.02	0.90 lagging	
8.03	0.80 lagging	
9	Efficiency at unity & 0.8 p.f. (lag) at various loads (Unity p.f./ 0.8 p.f.)	
9.01	100% load	
9.02	75% load	
9.03	0% load	
9.04	25% load	
9.05	Zero sequence impedance (75°C) at normal tap & maximum/minimum tap positions (Ohm)	
10	Core particulars	
10.01	Materials & grade	
10.02	Thickness of stamping (mm)	
10.03	Flux density in the core at rated voltage and 50 c/s (Tesla)	
10.04	Flux density at 110% rated voltage and 50 c/s (Tesla)	
11	Windings :	
11.01	Current density in H.V. winding (Amp./Sq.cm.)	

11.02	Current density in low voltage winding (Amp./Sq.cm.)	
11.03	Phase to phase clearance of HV Bushing In Air	
11.04	Phase to phase clearance of LV Bushing In Air	
11.05	Phase to phase (L.V.)	
11.06	Clearance of HV Bushing terminal to ground	
12	Tap changer	
12.01	Type of tap changer	
12.02	Taps provided at Winding (Like HV or LV )	
12.03	Position of tap ( Like on the neutral end or in the middle of the winding)	
12.04	No. of taps provided on the winding and % variation of each tap	
12.05	Permissible over loads, % of full load	
12.06	Core type or shell type	
13	HV Bushing	
13.01	Name of manufacturer	
13.02	Impulse withstand voltage on H.V. winding (KVp)	
13.03	1-min. P.F dry withstand voltage on H.V.Bushing (KVrms)	
13.04	1-min. P.F. wet withstand voltage on H.V.Bushing (KVrms)	
13.05	Details of L.T. Bushings and switch fuse assembly with regard to "Manufacturer", capacity & relevant technical particulars	