

PART 2: EMPLOYER'S REQUIREMENTS

CHAPTER 13B: 220 kV RECEIVING SUBSTATIONS (GTP)

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1 TRACTION TRANSFORMER

1.1 220kV/27.5kV Traction Transformer

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 60076, 60137, 60296
1) ELECTRICAL CHARACTERISTICS		
Type		Outdoor
Coupling		I.i.
Rated frequency	Hz	50
Rated secondary power	MVA	40/50
Cooling mode		ONAN / ONAF
Primary rated insulation voltage	kV	245
Primary operating voltage	kV	220
Rated Power frequency withstands voltage for one minute (1 Min.)	kV r.m.s	395
Rated Impulse withstand (1.2/50 micro second)	kV peak	950
Secondary rated voltage Without load	kV	27.5
Rated power frequency withstand voltage for one-minute secondary winding	kV	95
Rated impulse withstand (1.2/50 microsecond) voltage for secondary winding	kV	250
Short-circuit voltage - On load tap changer on tap 1 - On load tap changer on median tap - On load tap changer on tap 16	% % %	
Magnetic loading	Tesla	< 1.55
Voltage drops at secondary winding - 4/4 of secondary load	V	
Permissible overload duration at - 50% - 100%	min min	15 5
Iron losses	kW	16 (max)
Copper losses - 4/4 of secondary load	kW	@40MVA - 84kW (max) @50MVA - 131kW(max)
Short circuit current at secondary(for 3 sec) - On load tap changer on tap 1 - On load tap changer on median tap - On load tap changer on tap 16	kA kA kA	14
Transformation ratio - On load tap changer on tap 1 - On load tap changer on median tap - On load tap changer on tap 16	kV kV kV	187 / 27.5 220 / 27.5 242 / 27.5

Power at primary winding 4/4 of secondary load	MVA	30/40
Short circuit voltage	%	13.8 (max)
Duration of admissible short-circuit	Seconds	3
Efficiency (not accounting for the power drawn by the secondary) - 4/4 of secondary load		99.6 (min)
2) CONSTRUCTIONAL CHARACTERISTICS		
Winding type		
On load tap changer type - Rating - Number of taps - Voltage corresponding to each tap		As per transformer current rating with over loading capacity 15 (+6/-9) 2200
3) DIMENSIONAL CHARACTERISTICS		
- Dimensions of complete transformer: Length/Width/Height (*)	mm	
- weight of complete transformer (*) - with oil - with inert gas	kg kg	
Rolling tracks (between inner faces of the rails) spacing - large axis - small axis - rail profile	m m	2.14 1.676
Handling, i.e. under hooks height required for travelling crane to enable handling (*)	m	2.
Overall dimension drawing number		
4) NOISE LEVEL		
Transformer alone (As per testing mode stipulated in IEC standards)	dB	
Overall noise level at a distance of 1.5 m - at rated voltage and no load - at 110% of rated voltage and no load - at maximum over-induction	dB dB dB	70
5) MISCELLANEOUS INFORMATION		
- Thermal time constant - of oil - of transformer	h h	
- Maximum value of energizing current at no load	A peak	
- Value of direct and reverse impedance - as seen from primary terminals - as seen from secondary terminals	Ω Ω	
Degree of protection for auxiliary circuit		IP 55
6) COOLING SYSTEM (If Applicable)		
1. Number & Type of Fans 2. Rated Voltage (AC) 3. Fan rotating Speed 4. Power per fan 5. Fan starting Current 6. Total Power drawn by cooling equipment 7. Air output per fan Total Air necessary	V rpm kW Amp. kW m ³ /hr . m ³ /hr.	415 / 230

1.2. On Load Tap Changer (OLTC) for 220 kV/27.5 kV Traction Transformer

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 60214
1) ELECTRICAL CHARACTERISTICS		
Rated frequency	Hz	50
Cooling mode		ONAN
Rated insulation voltage	kV	245
Operating Voltage	kV	220
Rated Power frequency withstand voltage-one minute	kV r.m.s.	395
Rated Impulse withstand (1.2/50 micro second)	kV peak	950
Rated current	A	As per transformer current rating with over loading capacity
Short-circuit withstand current		
- Thermal (2seconds)	kA r.m.s.	
- Dynamic	kA peak	
Tap voltage	V	3667
Number of taps		15 (+6,-9)
Mechanical and electrical contact reliability	Operation	50,000
Motor drive		
- Technical data		
- Rated voltage	V DC or AC	110V DC/ 230 (1ph) / 415 (3ph) AC
- Rated current		
- Protection system		
- Over current protection device		RS 1000/ RS 2001
- Other protections		
Degree of protection for auxiliary cubicle		IP55

2 AUXILIARY MAIN TRANSFORMER

2.1 220kV/33kV Auxiliary Main Transformer

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 60076
1) ELECTRICAL CHARACTERISTICS		
Type		Outdoor
Coupling		YnYn0
Rated frequency	Hz	50
Rated secondary power	MVA	15/20
Cooling mode		ONAN / ONAF
Primary rated insulation voltage	kV	245
Primary operating voltage	kV	220
Rated short duration power frequency withstand voltage for primary winding	kV r.m.s.	395
Rated lightning impulse withstand voltage for primary winding	kV peak	950
Rated short duration power frequency withstand voltage for primary neutral	kV r.m.s.	275
Rated lightning impulse withstand voltage for primary neutral	kV peak	650
Secondary rated insulation voltage	kV	36
Secondary rated operation voltage under load	kV	33
Rated short duration power frequency withstand voltage for secondary winding	kV	70
Rated lightning impulse withstand voltage for secondary winding	kV	170
Short-circuit voltage - On load tap changer on tap 1 - On load tap changer on median tap - On load tap changer on tap 16	% % %	12.5
Magnetic Loading	Tesla	< 1.55
Voltage drops at secondary winding 4/4 of secondary load (ONAN mode)	V	
Permissible overload duration with: - 10% overload starting from 4/4, 3/4, 2/4, 1/4 rated output - 25 % overload starting from 4/4, 3/4, 2/4, 1/4 rated output - 50 % overload starting from 4/4, 3/4, 2/4, 1/4 rated output - 100% overload starting from 4/4, 3/4, 2/4, 1/4 rated output	h h h h	

Iron losses	kW	18.5kW (max)
Copper losses		@15 MVA – 44kW (max)
- 4/4 of secondary load (ONAN mode)	kW	@20MVA – 76 kW (max)
Short circuit current at secondary		
- On load tap changer on tap 1	kA	
- On load tap changer on median tap	kA	
- On load tap changer on tap 16	kA	
Transformation ratio		
- On load tap changer on tap 1		187 / 33
- On load tap changer on median tap		220 / 33
- On load tap changer on tap 16		242 / 33
Power at primary winding		
- 4/4 of secondary load, power factor 0.95	MVA	15
Impedance voltage	%	12.5
Duration of admissible short-circuit	seconds	3
Efficiency (not accounting for the power drawn by the secondary) (ONAN)		99.6 (min)
Temperature rise at thermal stabilization for ONAN at secondary at 4/4 load	°C °C	
Temperatures allowable occasionally and temporarily without limitation of the unit service life	°C °C	
Allowable overload on secondary in permanent duty, power factor 0.9, ambient temperature 45°C	MVA	
2) CONSTRUCTION CHARACTERISTICS		
Winding type		
On load tap changer type		
- Rating		
3) DIMENSIONAL CHARACTERISTICS		
Dimensions:		
- Length/Width/Height		
- weight		
- with oil	mm kg kg	
- with insert gas		
Handling, i.e. under hooks height required for travelling crane to enable handling		
- Complete transformer	mm	
- main parcel placed on the trailer	mm	
Overall dimension drawing number		

4) NOISE LEVEL		
Transformer alone (per testing mode stipulated in IEC standards)	dB	
Overall noise level at a distance of 1.5 m	dB	70
- at rated voltage and no load	dB	
- at 110% of rated voltage and no load	dB	
- at maximum over-induction	dB	
5) MISCELLANEOUS INFORMATION		
- Thermal time constant		
- of oil	h	
- of transformer	h	
- Maximum value of energizing current at no load	A peak	
- Value of direct and reverse impedance		
- as seen from primary terminals	Ω	
- as seen from secondary terminals	Ω	
- Value of zero sequence impedance		
- as seen from primary terminals	Ω	
- as seen from secondary terminals	Ω	
Degree of protection for auxiliary circuit		IP 55
6) COOLING SYSTEM (If Applicable)		
- Number and type of fans		415/230
- Rated voltage AC		
- Fan rotating speed	V	
- Power per fan	rpm	
- Fan starting current	kWA	
- Total power drawn by cooling equipment	kW	
- Air output per fan	m ³ /h	
- Total air necessary	m ³ /h	

2.2 On Load Tap Changer (OLTC) for 220kV/33kV Auxiliary Main Transformer

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 60214
ELECTRICAL CHARACTERISTICS		
Rated frequency	Hz	50
Cooling mode		ONAN
Rated insulation voltage	kV	245
Operating voltage	kV	220
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Rated current	A	As per transformer current rating with over loading capacity
Short-circuit withstand current - Thermal (2 seconds) - Dynamic	kA r.m.s. kA peak	
Tap voltage	V	3667
Number of taps		15 (+6, -9)
Mechanical and electrical contact reliability	Operations	50,000
Motor drive		
- Technical data - Rated voltage - Rated current	V DC or AC	110V DC or 230 / 415 V AC
- Protection system - Over current protection device - Other protections		RS 1000/ RS 2001
Degree of protection for Auxiliary cubicle		IP 55

3 STATION AUXILIARY TRANSFORMER

AUXILIARY TRANSFORMER 200 KVA (FOR RSS AUXILIARY LT POWER SUPPLY)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 60076
Insulation type		Cast resin
Rated power	kVA	200
Cooling mode		AN
Primary rated insulation voltage	kV	36
Primary operating voltage	kV	33
Secondary rated operating voltage	V	415/240
Rated short duration power frequency withstand voltage for primary winding	kV	70
Rated lightning impulse withstand voltage for primary winding	kV	200
Short-circuit voltage	%	4
Voltage setting	%	+5.0, +2.5, 0, 2.5, 5.0
Coupling		Dyn11
Maximum noise level	dB	65 dB at 1.5 M
Maximum iron losses	kW	1.05
Maximum load losses	kW	2.50
Dimensions Length Width Height	mm mm mm	
Weight (maximum)	kg	
Class of insulation		F
SCC at secondary	kA	7

4 220KV CIRCUIT BREAKER

4.1. 220kV Circuit Breaker (GIS)

4.1.1 220kV Circuit Breaker, 3 phases (GIS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC60694, IEC 62271-1, IEC 62271-100, 62271-203
Type		Indoor
Substation type		GIS
Phase number		3
Rated frequency	Hz	50
Rated insulation voltage	kV	245
Operating voltage	kV	220
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Rated short duration power frequency withstand voltage across isolating distance	kV r.m.s.	460
Rated lighting impulse withstand voltage across isolating distance	kV peak	1050
Rated current	A	1250
Rated short-time withstand current (3sec.)	kA r.m.s.	40
Rated peak withstand current	kA peak	100
Breaking capacity	kA r.m.s	40
Making capacity	kA peak	100
Breaking mode:		SF6
Rated Operating Cycle		o-0.3s-co-15s-co
Rated Auxiliary Voltage	Vdc	110
Out of load transformer current breaking capacity	A	
Operating times		
- Opening actuation	ms	
- from current emission on the release coil up to		
- Separation of contacts (opening time)	ms	<60
- Extinguishing of primary arc (breaking time at rated breaking capacity)	ms	<60

4.1.2. 220kV Circuit Breaker, 2 phases (GIS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 62271-1, IEC 62271-100, 62271-203
Type		Indoor
Substation type		GIS
Phase number		2
Rated frequency	Hz	50
Rated insulation voltage	kV	245
Operating voltage	kV	220
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Rated lighting impulse withstand voltage across	kV peak	1050
Rated current	A	1250
Rated short-time withstand current (3sec.)	kA r.m.s.	40
Rated peak withstand current	kA peak	100
Breaking capacity	kA r.m.s	40
Making capacity	kA peak	100
Breaking mode:		SF6
Rated Operating Cycle		o-0.3s-co-15s-co
Rated Auxiliary Voltage	Vdc	110
Out of load transformer current breaking capacity	A	
Operating times		
- Opening actuation	ms	
- from current emission on the release coil up to		<60
- Separation of contacts (opening time)	ms	
- Extinguishing of primary arc (breaking time at rated breaking capacity)	ms	<60

5 220KV ISOLATOR

5.1. 220kV ISOLATOR (GIS)

5.1.1. 220kV Isolator, 3 phases (GIS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 62271-1, 62271-102, 62271-203
Type		Indoor
Substation type		GIS
Number of phases		3
Two rotating columns		Yes
Rated frequency	Hz	50
Rated insulation voltage	kV	245
Operating voltage	kV	220
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Insulation medium		SF6
Rated current	A	1500
Rated short-time withstand current (3 sec.)	kA r.m.s.	40
Rated peak withstand current	kA peak	100
Rated auxiliary voltage	Vdc	110
Rated control motor auxiliary voltage	Vdc	110
2) EARTHING ISOLATOR		
Electrical values		As above
Making capacity		Yes

5.1.2. 220kV Isolator, 2 phases (GIS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 62271-1, 62271-102, 62271-203
Type		Indoor
Substation type		GIS
Number of phases		2
Two rotating columns		Yes
Rated frequency	Hz	50
Rated insulation voltage	kV	245
Operating voltage	kV	220
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Insulation medium		SF6
Rated current	A	1500
Rated short-time withstand current (3 sec.)	kA r.m.s.	40
Rated peak withstand current	kA peak	100
Rated auxiliary voltage	Vdc	110
Rated control motor auxiliary voltage	Vdc	110
2) EARTHING ISOLATOR		
Electrical values		As above
Making capacity		Yes

5.3 220kV FAST ACTING EARTH SWITCH

Indications	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 60265 IEC 62271-1, 102
Type		Indoor
Substation type		GIS
Number of phases		3
Rated frequency	Hz	50
Rated short-circuit withstand current (r.m.s.) for 3 sec	kA	40
Rated making current at 50 Hz	kA	100
Bushings		
- power frequency withstand voltageAC Voltage for 15 minutes)	kV	10
- DC impulse withstand voltage	kV	30
Operated mechanism		
- number per isolator		1
- type		Motor operated Spring charged
Control voltage	VDC	110

6 220KV CURRENT TRANSFORMER

6.1. 220kV CURRENT TRANSFORMER (GIS)

6.1.1 220kV Current Transformer on incomer CTIM-X (GIS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC-61869, 60517
Type		Indoor
Type of substation		GIS
Number of phases		3
- Rated insulation voltage	kV	245
- Operating voltage	kV	220
- Rated frequency	Hz	50
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Insulation medium		SF6
- SF6 rated pressure	Mpa	
- SF6 minimum pressure	%	
- SF6 maximum pressure	%	
- Secondary Cores		
- <i>(The core to be used for differential protection should be of PS Class)</i>	Core 1(Protection)	600-300/1A PS
	Core 2 (Protection)	600-300/1A PS
	Core3 (Protection)	600-300/1A 50 VA, 5P20
	Core 4 (Measurement)	600-300-150/1A CL 0.2S, 20 VA
	Core5 (Measurement)	600-300-150/1 A CL 0.2S, 20 VA
Actual transformation ratio	A	
Short-circuit current allowable for 3 seconds	kA	40
Permanent operation without danger	In	
Overheating	In	
Over-current class		
Total weight	Kg	
Overall dimension of one element	Mm	
Degree of protection for auxiliary circuit		IP3x

* THE VA OF CT MAY BE VARIED as per design

6.1.2. 220kV CURRENT Transformer on coupling bay CTC(GIS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 61869, 60517
Type		Indoor
Type of substation		GIS
Number of phases		3
- Rated insulation voltage	kV	245
- Operating voltage	kV	220
- Rated frequency	Hz	50
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Insulation medium		SF6
- SF6 rated pressure	Mpa	
- SF6 minimum pressure	%	
- SF6 maximum pressure	%	
- Secondary Cores	Core1(Protection)	600-300/1A PS
- <i>(The core to be used for differential protection should be of PS Class)</i>	Core2(Protection)	600-300/1A 50VA, 5P20
Actual transformation ratio	A	
Short-circuit current allowable for 3 seconds	kA	40
Permanent operation without danger	In	
Overheating	In	
Over-current class		
Total weight	Kg	
Overall dimension of one element	Mm	
Degree of protection for auxiliary circuit		IP3x

*THE VA OF CT MAY BE VARIED as per design

6.1.3. 220kV Current Transformer on outgoing bay, 3 phases CT ATP-X(GIS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 61869,60517
Type		Indoor
Type of substation		GIS
Number of phases		3
- Rated insulation voltage	kV	245
- Operating voltage	kV	220
- Rated frequency	Hz	50
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Insulation medium		SF6
- SF6 rated pressure	Mpa	
- SF6 minimum pressure	%	
- SF6 maximum pressure	%	
- Secondary Cores	Core1(Protection)	300-150/1A PS
(The core to be used for differential protection should be of PS Class)	Core2(Protection)	300-150/1A PS
	Core3(Protection)	300-150/1A 50VA,5P20
Actual transformation ratio	A	300-150/1
Short-circuit current allowable for 3 seconds	kA	40
Permanent operation without danger	In	
Overheating	In	
Overcurrent class		
Total weight	kg	
Overall dimension of one element	mm	
Degree of protection for auxiliary circuit		IP3x

* THE VA OF CT MAY BE VARIED as per design

6.1.4. 220kV Current Transformer on outgoing bay, 2 phases CTTTP-X(GIS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 61869, 60517
Type		Indoor
Type of substation		GIS
Number of phases		2
- Rated insulation voltage	kV	245
- Operating voltage	kV	220
- Rated frequency	Hz	50
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Insulation medium		SF6
- SF6 rated pressure	Mpa	3.
- SF6 minimum pressure	%	
- SF6 maximum pressure	%	
- Secondary Cores	Core 1	600-300/1A
<i>(The core to be used for differential protection should be of PS Class)</i>	(Protection)	PS
	Core 2	600-300/1A
	(Protection)	PS
	Core 3	600-300/1A
	(Protection)	50VA,5P20
Actual transformation ratio	A	600-300/1
Short-circuit current allowable for 3 seconds	kA	40
Permanent operation without danger	In	
Overheating	In	
Overcurrent class		
Total weight	kg	
Overall dimension of one element	mm	
Degree of protection for auxiliary circuit		IP3x

* THE VA OF CT MAY BE VARIED as per design

6.2. 220kV CURRENT TRANSFORMER (AIS)**6.2.1. 220kV current Transformer on incomer (AIS IF APPLICABLE)**

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC-61869, 60517
Type		Outdoor
Type of substation		AIS
Number of phases		3
- Rated insulation voltage	kV	245
- Operating voltage	kV	220
- Rated frequency	Hz	50
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Insulation medium		Oil
- Secondary Cores - <i>(The core to be used for differential protection should be of PS Class)</i>	Core 1(Protection)	600-300/1A PS
	Core 2 (Protection)	600-300/1A PS
	Core3 (Protection)	600-300/1A 50 VA, 5P20
	Core 4 (Measurement)	600-300-150/1A CL 0.2S, 15 VA
	Core5 (Measurement)	600-300-150/1 A CL 0.2S, 15 VA
Actual transformation ratio	A	
Short-circuit current allowable for 3 seconds	kA	40
Permanent operation without danger	In	
Overheating	In	
Over-current class		
Total weight	Kg	
Overall dimension of one element	Mm	
Degree of protection for auxiliary circuit		IP3x

* THE VA OF CT MAY BE VARIED as per design

7 220KV VOLTAGE TRANSFORMERS

7.1 220 kV VOLTAGE TRANSFORMER (GIS)

7.1.1.220kV Voltage Transformer VTI-X and VTC-X (GIS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 60186, 60517
Type		Indoor
Type of substation		GIS
- Primary insulation voltage	kV	245
- Operating voltage	kV	220
- Rated frequency	Hz	50
Rated short-time duration power frequency withstand voltage	kV	395
Rated lightning impulse withstand voltage	kV	950
Actual transformation ratio - Primary winding - Secondary winding	kV V	220/√3/0.11/√3/0.11/√3kV
Accuracy class		0.2
Rated output at power factor 0,8 lagging	VA	25
Total weight	kg	
Overall dimension of one element	mm	
Degree of protection for auxiliary circuit		IP3x

* THE VA OF VT MAY BE VARIED as per design

7.2. 220 kV CAPACITIVE VOLTAGE TRANSFORMER(AIS)**7.2.1. 220kV Voltage Transformer VTI-X and VTC-X (AIS)**

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 60186, 60517
Type		Outdoor
Type of substation		AIS
- Primary insulation voltage	kV	245
- Operating voltage	kV	220
- Rated frequency	Hz	50
Capacitance	PF	8800
Rated short-time duration power frequency withstand voltage	kV	395
Rated lightning impulse withstand voltage	kV	950
Actual transformation ratio - Primary winding	kV	220/110
- Secondary winding	V	
Accuracy class		0.2
Rated output at power factor 0,8 lagging	VA	25
Total weight	kg	
Overall dimension of one element	mm	
Degree of protection for auxiliary circuit		IP55

* THE VA OF VT MAY BE VARIED as per design

8 220KV SURGE ARRESTERS

8.1 SURGE ARRESTER LA-X, LAAT-X, LATT-X (AIS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standard		IEC 60099-4
Type of substation		Open
Type		Outdoor
Surge arrester type		ZnO
Rated system voltage	kV	220
Rated voltage for surge arrester	kV	198
Permanent voltage	kV	154
Nominal discharge current	kA	20
Discharge class		4
Energy absorbs in 2 Shoks	kJ/kV	9.5
Maximum residual voltage (wave impulse 8/20 μ s)		
- 10 kA	kV	476
- 20 kA	kV	530
Pressure relief withstand		
- current	kA	40
- time	ms	200
Minimum admissible static flexion moment	m.daN	350

8.2 220kV SURGE ARRESTER LA (GIS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standard		IEC 60099-4
Type of substation		GIS
Type		Indoor
Surge arrester type		ZnO
Rated system voltage	kV	220
Rated voltage for surge arrester	kV	198
Permanent voltage	kV	154
Nominal discharge current	kA	20
Discharge class		4
Energy absorbs in 2 Shoks	kJ/kV	9.5
Maximum residual voltage (wave impulse 8/20 5)		
- 10 kA	kV	476
- 20 kA	kV	530
Pressure relief withstand		
- current	kA	40
- time	ms	200
Minimum admissible static flexion moment	m.daN	350

9 220kV Circuit Breakers

Indications	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 62271-1, IEC 62271-100, 62271-203
Type		Outdoor
Substation type		AIS
Phase number		3
Rated frequency	Hz	50
Rated insulation voltage	kV	245
Operating voltage	kV	220
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Rated short duration power frequency withstand voltage across isolating distance	kV r.m.s.	460
Rated lightning impulse withstand voltage across isolating distance	kV peak	1050
Rated current	A	1500
Rated short-time withstand current (3sec.)	kA r.m.s.	40
Rated peak withstand current	kA peak	100
Breaking capacity	kA r.m.s.	40
Making capacity	kA peak	100
Breaking mode:		SF6
Rated Operating Cycle		0-0.3s-CO-15s-CO
Rated Auxiliary Voltage	Vdc	110
Out of load transformer current breaking capacity	A	
Operating times - Opening actuation - from current emission on the release coil up to - Separation of contacts (opening time) - Extinguishing of primary arc (breaking time at rated breaking capacity)	ms ms ms	<60 <60
- Closing actuation from current emission on the engagement coil up to - Establishment of current (establishment time) - Start of connecting (closing time)	ms ms	
- Maximum operating difference between poles - At opening - At closing	ms ms	
Rated SF6 pressure for operation	MPa	0.36
SF6 under-pressure first threshold alarm	MPa	
SF6 under-pressure second threshold alarm	MPa	

Operating system - rated pressure - minimum pressure - maximum pressure	MPa % %	
Operating and auxiliary cubicle protection degree		IP 55
Circuit breaker position auxiliary contact - open position make contacts - open position break contacts - closed position make contacts - closed position break contacts		4 4 4 4

10 220KV ISOLATOR, 3 PHASES LIS-X (AIS) (GSS)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 62271-1, 62271-102, 62271-203
Type		Outdoor
Substation type		AIS
Number of phases		3
Two rotating columns		Yes
Rated frequency	Hz	50
Rated insulation voltage	kV	245
Operating voltage	kV	220
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated lightning impulse withstand voltage	kV peak	950
Rated short duration power frequency withstand voltage across isolating distance	kV r.m.s.	460
Rated lightning impulse withstand voltage across isolating distance	kV peak	1050
Insulation medium		Air
Rated current	A	1500
Rated short-time withstand current (3 sec.)	kA r.m.s.	40
Rated peak withstand current	kA peak	100
Rated auxiliary voltage	Vdc	110
Rated control motor auxiliary voltage	Vdc	110

11 NEUTRAL ISOLATOR, CT'S, SURGE ARRESTERS

11.1 Primary Neutral Isolator for 220kV/33kV Auxiliary main Transformer

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Standards		IEC 129
Type		Outdoor
- Number of pole		1
- Rated insulation voltage	kV	245
- Operating voltage	kV	220
Rated short duration power frequency withstand voltage	kV r.m.s.	395
Rated short duration power frequency withstand voltage across isolating distance	kV r.m.s.	460
Rated lightning impulse withstand voltage	kV peak	650
Rated lightning impulse withstand voltage across isolating distance	kV peak	750
Rated frequency	Hz	50
Rated current	A	1000
Rated short time withstand current (3 second)	kA r.m.s.	31.5
Rated peak withstand current	kA peak	80

12 SECONDARY NEUTRAL ISOLATOR FOR 220/33 KV AMT

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Standards		IEC 129
Type		Outdoor
- Number of pole		1
- Rated insulation voltage	kV	36
-Operating voltage	kV	33
-Rated short duration power frequency withstand voltage	kV rms	70
-Rated short duration power frequency withstand voltage across isolating distance	kV rms	95
-Rated lightning impulse withstand voltage	kV peak	170
-Rated lightning impulse withstand voltage across isolating distance	kV peak	185
- Rated frequency	Hz	50
-Rated current	A	1000
- Rated short time withstand current (3 second)	kA r.m.s.	12.5
- Rated peak withstand current	kA peak	40

13 CURRENT TRANSFORMER FOR PRIMARY NEUTRAL (PNCT) FOR 220KV/33KV TRANSFORMER

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Standards		IEC 61869
Type		Outdoor
Insulation Medium		Oil
- Rated insulation voltage	kV	145
- Rated frequency	Hz	50
Actual transformation ratio/ Accuracy class	Core-1 (Protection)	300-150/1A (PS)
	Core-1 (Protection)	300-150/1A 5P20, 50 VA
Rated Output	VA	30
Short-circuit current allowable for 3 seconds	kA	40
Permanent operation without danger	In	
Overheating	In	
Overcurrent class		

* THE VA OF CT MAY BE VARIED as per design

CT for Secondary Neutral (SNCT1, SNCT2) for 220kV/33kV AMT

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Standards		IEC 61869
Type		
- Rated insulation voltage	kV	36
- Rated frequency	Hz	50
Actual transformation ratio	A	1000/1
Accuracy class		5P20
Rated output	VA	50
Short-circuit current allowable for 3 seconds	kA	12.5
Permanent operation without danger	In	
Overheating	In	
Overcurrent class		

* THE VA OF CT MAY BE VARIED as per design

14 PRIMARY NEUTRAL SURGE ARRESTER FOR 220KV/33KV TRANSFORMER

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standard		IEC 60099-4
Type of substation		Open
Type		Outdoor
Surge arrester type		ZnO
Rated system voltage	kV	220
Rated voltage for surge arrester	kV	120
Permanent voltage	kV	84
Nominal discharge current	kA	20
Discharge class		4
Energy absorbs in 2 Strokes	kJ/kV	10.8
Maximum residual voltage (wave impulse 8/20 μ s)	kV	288
- 10 kA	kV	320
- 20 kA		
Pressure relief withstand	kA	40
- current	ms	200
- time		
Minimum admissible static flexion moment	m.daN	350

Secondary Neutral Surge Arrester for 220kV/33kV AMT

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Standards		IEC60099-4
Type		Indoor
Voltage rating	kV	36
Power frequency withstand voltage*	kV rms	70
Lightning impulse voltage (1.2/50 μ s)*	kV peak	170
Line discharge class		4
Nominal discharge current	KA	20
Energy discharge capability	KJ/KV	10.8
Discharge voltage 8/20 μ s wave		
- 1,5 kA	kV peak kV	As per IEC
- 5 kA	peak kV	
- 10 kA	peak kV	
- 20 Ka	peak	

* Its minimum, shall be decided at design stage.

15 SECONDRY NEUTRAL GROUNDING RESISTOR (FOR 220/33KV AMT)

INDICATIONS	U	Values required
Manufacturer		
Place of manufacture		
Material of Encloser		SS 304 with Powder coating
Manufacturer drawing reference		
ELECTRICAL CHARACTERISTICS		
Type		Metal in air
Nature of the active part		
Rated insulation voltage	kV	24
Rated value	Ω	20
Allowable tolerance on measurement (at 20°C in DC)	%	5
Rated frequency	Hz	50
Rated operating cycle - Thermal 43Retardation at $I_n=5A$ - Heating-up at I-20 A, 10 minutes - Heating-up at I-1000 A, 30 seconds	°C °C °C	
Value of the resistance after operating cycle, at 45°C ambient temperature		
DIMENSIONAL CHARACTERISTICS		
Protection degree	IP	55
Dimensions - Length - Height - Depth - Weight	mm mm mm mm kg	

16 220kV 1000 Sq.mm Aluminium Cables

Sr. No	Description	Unit	Expected values
1	Manufacturer		
2	Cable Size	Sq.mm	1000
3	Cable Type		AUXL PE/Corrugated Cu/PE
4	Voltage Grade (U0/U (U2)	kV	127/220 (245)
	Reference standard		IEC 7098 (part 3) A 6206/IEC 60840, IS mended up to date
6	Nominal cross-sectional area of conductor	Sq.mm	1C x 1000 sqmm
7	Conductor material		Aluminium
8	a) Shape b) Type of extrusion		a) Stranded Milliken Compact circular conductor b)
9	Class / Standard		Class 2, IEC 228 I IS 8130
10	Nominal diameter of conductor	mm	
11	Conductor screen materials		Extruded semi-conducting compound layer
12	Nominal thickness of conductor screen	Mm	1
	Electric resistivity of conductor screen	Ohm-m	
	Electric resistivity of Insulation screen	Ohm-m	
13	Insulation material		Cross-linked polyethylene (XLPE)
14	Minimum thickness of insulation	mm	As per IEC 62067 / IS 7098 (Part 3)
15	Nominal diameter over insulation	mm	
	Type of Insulation Curing process		
16	Insulation screen material		Extruded semi-conducting compound layer
17	Minimum thickness of insulation screen	mm	0.8
18	WB swellable tape		Synthetic non-woven semi- conducting water swellable tape
19	Minimum thickness of VVBS tape	mm	0.3
20	Metallic sheath material		Annular corrugated copper sheath seamless I seam welded
21	Nominal thickness of metallic sheath	mm	Conforming to IEC 60502- 2 I 7098 (Part 3) Table 6A/6B
22	Short circuit current rating withstand metallic annular Cu sheath	kA	50kA for 1 second
23	Outer sheath material		PE (ST-7 type) (Graphite coating)
24	Nominal thickness of outer sheath	mm	
25	Minimum thickness of outer sheath	mm	
26	Nominal overall diameter of cable	mm	
27	Approx. weight per meter of cable	Kg/m	
28	Minimum bending radius	mm	
29	Max. DC conductor resistance at 20°C	Ohm/km	
30	Star reactance per phase at 50Hz	Rdi/km	
31	Capacitance per phase	Pf/km	
32	Charging current per phase at U0,50Hz	A/km	

33	Max. Current rating in air	A	
	Max. Current rating in air (In overload condition)	A	
34	Max. Current rating in	A	
	Max. Current rating in ground (In overload)	A	
35	Max. Conductor temperature for continuous	°C	
36	Max. Conductor temperature during short circuit	°C	
37	Max Short Circuit Rating		
	t = 0.1 sec	kA	
	t = 0.2 sec	kA	
	t = 0.5 sec	kA	
	t= 1.0 sec	kA	
38	Max. AC conductor resistance at 90°C	Ohm/km	
39	Permissible Overload temperature	°C	
40	Embossing on Outer sheath		Contractor Name, manufacturer name, BI-RIDE, Voltage grade, 1C X 1000SQMM, Year of Manufacturing / as per employer
Note:- 1. As per IEC 62067, only minimum value shall be measured and Nominal value is only for reference. 2. Cables shall pass through suitable grade High Density Polyethylene (HDPE) of min. diameter equal to at least 1.5 times diameter of cable.			

Marking on the outer sheath of cable:

Embossing - Following details shall be embossed on the cable at regular intervals not exceeding one meter:

- Name & Trade name of manufacturer
- Year of manufacturing
- Voltage / Conductor cross section, i.e. **220,000 V / 1000 Sqmm**
- **K.P.T.C.L.**
- **XLPE**

Sequential length marking shall be provided every meter by inkjet printing.

17 33KV CABLES

Sl. No.	Description	Unit	Values
1	Manufacturer		
2	Cable Size	Sq. mm	120
3	Cable type		Al /XLPE/PVC
4	Voltage Grade (U0/U (U2)	KV	18 / 30 (36)
5	Reference Standard		IEC 60502
6	No. and cross-sectional area of conductor		
7	Conductor Material		Copper
8	Shape		Circular compact stranded
9	Class/Standard		Class 2/IEC 228
10	Nominal Diameter of Conductor	mm	
	Conductor Screen materials		Extruded semi-conducting
12	Nominal thickness of conductor screen	mm	0.7
13	Insulation material		XLPE
14	Nominal thickness of insulation	mm	9
15	Nominal diameter over insulation	mm	
16	Insulation screen material (Non-metallic)		Extruded semi-conducting com'd
17	Nominal thickness of insulation screen	mm	0.8
18	Insulation screen material (metallic)		Copper wires
19	Nominal thickness of tape	mm	
20	No. and Diameter of wires	No. /mm	-
21	Cross sectional area	Sq.mm	
22	Outer sheath material		Flame retardant polyvinyl chloride
23	Minimum thickness of outer sheath	mm	3.1
24	Nominal overall diameter (± 2 mm)	mm	
25	Minimum bending radius	mm	
26	Max. D. C. Conductor resistance at 20°C	Ω /km	
27	Star reactance per phase at 50 Hz	Ω /km	
28	Capacitance per phase	μ F/km	
29	Charging current per phase at U0, 50 Hz	A/km	
30	Max. Current rating in air	A	
31	Max. Current rating in Ground	A	
32	Max. Conductor temperature on continuous		90
33	Max. conductor temperature in short Circuit		250
34	Max. short Circuit current rating		
	t = 0.1 sec	KA	89.7
	t = 0.2 sec	KA	63.4
	t = 0.5 sec	KA	40.1
	t = 1.0 sec	KA	28.4

Length marking: Length shall be marked with number at one meter intervals on the sheath.

18 33KV CABLE

Sl. No.	Description	Unit	Values
1	Manufacturer		
2	Cable Size	Sq. mm	95
3	Cable type		Copper/XLPE/PVC
4	Voltage Grade (U0/U (U2)	KV	18/30 (36)
5	Reference Standard		IEC 60502
6	No. and cross sectional area of conductor		3C x 95 sq. mm
7	Conductor Material		Copper
8	Shape		Circular compact stranded
9	Class/Standard		Class 2/ IEC 228
10	Nominal Diameter of Conductor	mm	
11	Conductor Screen materials		Extruded semi-conducting com'd
12	Nominal thickness of conductor screen	mm	0.7
13	Insulation material		XLPE
14	Nominal thickness of insulation	mm	9
15	Nominal diameter over insulation	mm	
16	Insulation screen material (Non-metallic)		Extruded semi-conducting
17	Nominal thickness of insulation screen	mm	0.8
18	Insulation screen material (metallic)		Copper wires
19	Nominal thickness of tape	mm	
20	No. and Diameter of wires	No./mm	-
21	Cross sectional area	Sq.mm	
22	Outer sheath material		Flame Retardant polyvinyl chloride
23	Minimum thickness of outer sheath	mm	3.1
24	Nominal overall diameter (± 2 mm)	mm	
25	Minimum bending radius	mm	
26	Max. D. C. Conductor resistance at 20°C	Ω /km	
27	Star reactance per phase at 50 Hz	Ω /km	
28	Capacitance per phase	μ F/km	
29	Charging current per phase at U0, 50 Hz	A/km	
30	Max. Current rating in air	A	
31	Max. Current rating in Ground	A	
32	Max. Conductor temperature on continuous	Deg. C	90
33	Max. conductor temperature in short Circuit	Deg. C	250
34	Max. short Circuit current rating		
	t = 3.0 sec	KA	7

Length marking: Length shall be marked with number at one meter intervals on the sheath.

19 25KV CABLES

Sr. No	Particulars / Description	Unit	Data / Values Required	
1	Manufacturer			
2	Place of manufacture			
3	Port of embarkation			
4	Manufacturer drawing reference			
5	Cable Size	Sq.mm	1Cx400	1Cx240
6	Cable Type		Aluminium / XLPE	Copper / XLPE
7	Standards		IEC 60840, IEC 60228, IEC-60502-2	
8	Voltage Grade	kV	26/45 (52)	
9	Operating Voltage	kV	27.5	
10	Shape of Conductor		Stranded Circular Conductor	
11	Conductor material		Class 2 / IEC 60228	
12	Conductor and Insulation Screen Materials		Extruded Semi conducting	
13	Nom. Thickness of conductor screen	mm	0.7	
14	Insulation Material		XLPE	
15	Nom. Thickness of Insulation	mm	10	
16	Nom. Thickness of Insulation Screen	mm	0.8	
17	Conductor screen, insulation and insulation screen shall be extruded in a single process			
18	Insulating Screen Material (Metallic)		Aluminium round wires followed by helically applied aluminium tape. Metallic screen should be able to withstand specified earth fault current (min 14kA for 3 sec)	Copper round wires followed by helically applied copper tape. Metallic screen should be able to withstand specified earth fault current (min 14kA for 3 sec)

19	Polyethylene laminated Aluminium Tape	mm	*	*
20	Inner sheath material		FRLS for ELEVATED & FRLSZH for UNDER GROUND	
21	Min. Thickness of extruded inner sheath	mm	1	1
22	Armouring		Double layer of Al tape (nominal thickness of each type-0.5 mm)	
23	Outer Sheath		FRLS for EL & FRLSZH for UG	
24	Min. Thickness of outer sheath	mm	3.5	3.5
25	Minimum Bending Radius	m	*	*
26	Max. Conductor Temp. (Continuous)	° C	90	90
27	Max. Conductor Temp. (Short Circuit)	° C	250	250
28	Min. Short Circuit Current Rating		14kA for 3 sec	14kA for 3 sec
29	Nominal diameter of conductor	mm	*	*
30	Nominal Overall diameter of cable	mm	*	*
31	No. and Diameter of wires	No/mm	*	*
32	Cross Section area of metallic screen	Sq.mm	*	*
33	Approximate weight of cable	Kg/km	*	*
34	Nominal Thickness of Tape	mm	*	*
35	Max. Rdc of conductor at 20°C	Ω/km	*	*
36	Max. capacitance of cable	μF/k m	*	*
37	Max. current rating in air	A	*	*
38	Max. current rating in ground	A	*	*
39	Charging current, 50 Hz	A	*	*
40	Max. Pulling force for laying		*	*

Length marking: Length shall be marked with number at one-meter intervals on the sheath.

Bi-RIDE

20 3.3 KV CABLE GTP

S. No	Particulars / Description	Unit	Values
1	Manufacturer		
2	Place of manufacture		
3	Port of embarkation		
4	Manufacturer drawing reference		
5	Standards		IEC 60502-1, IEC 60228
6	Voltage Grade	kV	1.9/3.3 (3.6)
7	Operating Voltage	kV	3.3
8	Conductor		1C x 400 sq.mm
9	Conductor Material		Aluminium as per IEC 60228
10	Flexibility class as per IEC 60228		Class 2
11	Shape of conductor		Stranded compacted circular
12	Insulation Material		XLPE
13	Material		Extruded semi conducting compound
14	Nominal thickness of extruded layer	mm	2
15	A semiconducting tape applied over insulation (Water Barrier)		Yes
16	Armouring		Double layer of Al tape with binder tape (FRLS/FRLSZH)
17	Outer Sheath		FRLS for EL & FRLSZH for UG
18	Min. Thickness of outer sheath	m	2
19	Minimum Bending Radius	m	*
20	Max. Conductor Temp. (Continuous)	° C	90
21	Max. Conductor Temp. (Short Circuit)	° C	250
22	Min. Short Circuit Current Rating		14 kA for 3 sec
23	Nominal diameter of conductor	mm	*
24	Nominal Overall diameter of cable	mm	*
25	No. and Diameter of wires	No. /mm	*
26	Approximate weight of cable	Kg/ km	*
27	Max. Rdc of conductor at 20°C	Ω/ km	*
28	Max. capacitance of cable	μF/ km	*
29	Max. current rating in air	A	*
30	Max. current rating in ground	A	*
31	Charging current, 50 Hz	A/ Km	*
32	Max. Pulling force for laying		*

Length shall be marked with number at one meter intervals on the sheath.

21 33 KV CIRCUIT-BREAKER CUBICLES LBCB, LBCCB

INDICATIONS	U	VALUES
Manufacturer		
Place of manufacture		
Standards		IEC 62271-1, -200, -200, IEC60694
- Type		Indoor VCB/SF6 Type
- Rated insulation voltage	kV	36
- Rated operating voltage	kV	33
- Rated frequency	Hz	50
- Rated short time duration power frequency withstand voltage	kV r.m.s.	70
- Rated lightning impulse withstand voltage	kV peak	170
- Rated short time duration power frequency withstand voltage across isolating distance	kV r.m.s.	80
- Rated lightning impulse withstand voltage across isolating distance	kV peak	195
- Cubicle rated current	A	1250
- Bar set rated current	A	2000
- Allowable over-current for 3 second	kA r.m.s.	25
- Instantaneous over-current	kA peak	62.5
- Number of flip-flop contacts for circuit-breaker plugging-in and plugging-out monitoring	minimum	
- Number of flip-flop contact for earthing isolator open/closed position monitoring	minimum	
- Number of flip-flop contacts for isolator open/closed position monitoring	minimum	
- Maximum dimensions of the cubicle		
- Width	mm	
- Depth	mm	
- Height	mm	
- Depth with circuit-breaker plugged-out	mm	
-Protection degree		
-Overall dimension drawing number		

INDICATIONS	U	Values Required
CIRCUIT-BREAKER/ INTERRUPTER (Vacuum Type)		
Three pole type		
Rated insulation voltage	kV	36
Rated operating voltage	kV	33
Rated frequency	Hz	50
Rated short time duration power frequency withstand voltage	kV r.m.s.	70
Rated lightning impulse withstand voltage	kV peak	170
Rated short time duration power frequency withstand voltage across isolating distance	kV r.m.s.	
Rated lightning impulse withstand voltage across isolating distance	kV peak	
Rated current	A	1250
Allowable overcurrent for 3 second	kA r.m.s.	25
Instantaneous overcurrent	kA peak	62.5
Breaking capacity	kA r.m.s	25
Making capacity	kA peak	62.5
Breaking mode:		
Opening time	ms	
Closing time	ms	
Rated operating cycle		0-0.3s-CO-15s-CO
Breaking capacity of cable at no load	A	
Number of auxiliary contact for open/closed position of the circuit-breaker	O/O O/C	
Auxiliary supply voltage	V dc	110
Supply voltage for motor drive circuits	V dc	110
Allowable variation range of supply voltage		+10%, -15%
Power consumption of auxiliary	VA	
- Coils consumption: - engagement coil - release coil	A A	
- Consumption of arming motor	A	

22 33 KV CIRCUIT-BREAKER CUBICLES AT RCCB, LFCB, CB FOR DEPOT FEEDERS

INDICATIONS	U	VALUES
		Required
Manufacturer		
Place of manufacture		
Standards		IEC 62271-1, -200,-200, IEC60694
- Class		Indoor
- Rated insulation voltage	kV	36
- Rated operating voltage	kV	33
- Rated frequency	Hz	50
- Rated short time duration power frequency withstand voltage	kV r.m.s.	70
- Rated lightning impulse withstand voltage	kV peak	170
- Rated short time duration power frequency withstand voltage across isolating distance	kV r.m.s.	80
- Rated lightning impulse withstand voltage across isolating distance	kV peak	195
- Cubicle rated current	A	1250
- Bar set rated current	A	2000
- Allowable over-current for 3 second	kA r.m.s.	25
- Instantaneous over-current	kA peak	62.5
- Number of flip-flop contacts for circuit-breaker plugging-in and plugging-out monitoring	minimum	
- Number of flip-flop contact for earthing isolator open/closed position monitoring	minimum	
- Number of flip-flop contacts for isolator open/closed position monitoring	minimum	
- Maximum dimensions of the cubicle		
- Width	mm	
- Depth	mm	
- Height	mm	
- Depth with circuit-breaker plugged-out	mm	
-Protection degree		
Overall dimension drawing number		

INDICATIONS	U	Values Required
CIRCUIT-BREAKER(Vacuum Type)		
Three pole type		
Rated insulation voltage	kV	36
Rated operating voltage	kV	33
Rated frequency	Hz	50
Rated short time duration power frequency withstand voltage	kV r.m.s.	70
Rated lightning impulse withstand voltage	kV peak	170
Rated short time duration power frequency withstand voltage across isolating distance	kV r.m.s.	
Rated lightning impulse withstand voltage across isolating distance	kV peak	
Rated current	A	1250
Allowable overcurrent for 3 second	kA r.m.s.	25
Instantaneous overcurrent	kA peak	62.5
Breaking capacity	kA r.m.s	25
Making capacity	kA peak	62.5
Breaking mode		
Opening time	ms	
Closing time	ms	
Rated operating cycle		0-0.3s-C0-15s-C0
Breaking capacity of cable at no load	A	
Number of auxiliary contact for open/closed position of the circuit-breaker	O/O O/C	
Auxiliary supply voltage	V dc	110
Supply voltage for motor drive circuits	V dc	110
Allowable variation range of supply voltage		+10%, -15%
Power consumption of auxiliary	VA	
- Coils consumption: - engagement coil - release coil	A A	
- Consumption of arming motor	A	

23 33 KV CIRCUIT-BREAKER CUBICLES AT LVATCB

INDICATIONS	U	VALUES
Manufacturer		
Place of manufacture		
Standards		IEC 62271-1, -200, -200, IEC60694
- Class		Indoor
- Rated insulation voltage	kV	36
- Rated operating voltage	kV	33
- Rated frequency	Hz	50
- Rated short time duration power frequency withstand voltage	kV r.m.s.	70
- Rated lightning impulse withstand voltage	kV peak	170
- Rated short time duration power frequency withstand voltage across isolating distance	kV r.m.s.	80
- Rated lightning impulse withstand voltage across isolating distance	kV peak	195
- Cubicle rated current	A	1250
- Bar set rated current	A	2000
- Allowable over current for 3 second	kA r.m.s.	25
- Instantaneous overcurrent	kA peak	62.5
- Number of flip-flop contacts for circuit-breaker plugging-in and plugging-out monitoring	minimum	
- Number of flip-flop contact for earthing isolator open/closed position monitoring	minimum	
- Number of flip-flop contacts for isolator open/closed position monitoring	minimum	
- Maximum dimensions of the cubicle		
- Width	mm	
- Depth	mm	
- Height	mm	
- Depth with circuit-breaker plugged-out	mm	
-Protection degree		
Overall dimension drawing number		

INDICATIONS	U	Values Required
CIRCUIT-BREAKER (Vacuum Type)		
Three pole type		
Rated insulation voltage	kV	36
Rated operating voltage	kV	33
Rated frequency	Hz	50
Rated short time duration power frequency withstand voltage	kV r.m.s.	70
Rated lightning impulse withstand voltage	kV peak	170
Rated short time duration power frequency withstand voltage across isolating distance	kV r.m.s.	
Rated lightning impulse withstand voltage across isolating distance	kV peak	
Rated current	A	1250
Allowable overcurrent for 3 second	kA r.m.s.	25
Instantaneous overcurrent	kA peak	62.5
Breaking capacity	kA r.m.s	25
Making capacity	kA peak	62.5
Breaking mode:		
Opening time	ms	
Closing time	ms	
Rated operating cycle		0-0.3s-CO-15s-CO
Breaking capacity of cable at no load	A	
Number of auxiliary contact for open/closed position of the circuit-breaker	O/O O/C	
Auxiliary supply voltage	V dc	110
Supply voltage for motor drive circuits	V dc	110
Allowable variation range of supply voltage		+10%, -15%
Power consumption of auxiliary	VA	
- Coils consumption: - engagement coil - release coil	A A	
- Consumption of arming motor	A	

24 33 KV CURRENT TRANSFORMER LBCT AND LBCCT

INDICATIONS	U	VALUES
Manufacturer		
Place of manufacture		
Port of embarkation		
Standards		IEC 61869, IEC62869-1,2
- Rated insulation voltage	kV	36
- Operating voltage	kV	33
- Rated frequency	Hz	50
- Rated power frequency short duration withstand voltage	kV	70
- Rated lightning impulse withstand voltage	kV	170
Actual transformation ratio	A	800-400/5
Measuring secondary (Core-1) - Accuracy class - Rated output	VA	0.2 20
Protection secondary (Core- 2) - Accuracy class - Rated output	VA	5P15 20
Protection secondary (Core-3) only for LBCT - Accuracy class - Rated output	VA	PS
Short-circuit current allowable for 3 seconds	kA	25
Permanent operation without danger	In	
Overheating	In	
Overcurrent class		

* THE VA OF CT MAY BE VARIED as per design

25 33 KV CURRENT TRANSFORMER FOR LFCB AND RCCB

INDICATIONS	U	VALUES
Manufacturer		
Place of manufacture		
Port of embarkation		
Standards		IEC 61869, IEC62869-1,2
- Rated insulation voltage	kV	36
- Operating voltage	kV	33
- Rated power frequency short duration withstand voltage	kV	70
- Rated lightning impulse withstand voltage	kV	170
- Rated frequency	Hz	50
Actual transformation ratio	A	800-400/5
Protection secondary - Accuracy class - Rated output	VA	5P15 20
Measuring secondary - Accuracy class - Rated output	VA	0.2 20
Short-circuit current allowable for 3 seconds	kA	25
Permanent operation without danger	In	
Overheating	In	
Overcurrent class		

* THE VA OF CT MAY BE VARIED as per design

* One additional core of PS class for feeders feeding Underground Stations.

26 33 KV CURRENT TRANSFORMER FOR AT LVATCB

INDICATIONS	U	VALUES
		Required
Manufacturer		
Place of manufacture		
Port of embarkation		
Standards		IEC 61869
- Rated insulation voltage	kV	36
- Operating voltage	kV	33
- Rated power frequency short duration withstand voltage	kV	70
- Rated lightning impulse withstand voltage	kV	170
- Rated frequency	Hz	50
Actual transformation ratio	A	40-20/5
Protection secondary - Accuracy class - Rated output	VA	5P15 20
Measuring secondary - Accuracy class - Rated output	VA	0.2 20
Short-circuit current allowable for 3 seconds	kA	25
Permanent operation without danger	In	
Overheating	In	
Overcurrent class		

* THE VA OF CT MAY BE VARIED as per design

27 33 KV VOLTAGE TRANSFORMERS (IN ALL 33 KV CB INCLUDING COUPLING CB)

INDICATIONS	U	VALUES
Manufacturer		
Place of manufacture		
Port of embarkation		
Standards		IEC 61869, IEC62869-1,3
- Primary insulation voltage	kV	36
- Operating voltage	kV	33
- Rated frequency	Hz	50
- Rated short-time duration power frequency withstand voltage	kV	70
- Rated lightning impulse withstand voltage	kV	170
Actual transformation ratio - Primary winding	kV	33/'/3
- 1 st secondary winding -	V	110/'/3
2 nd secondary winding	V	110/'/3
Accuracy class		
- 1 st secondary winding - 2 nd secondary winding		0.2 3P
Rated output		
- 1 st secondary winding - 2 nd secondary winding	VA VA	20 20

THE VA OF VT MAY BE VARIED as per design

28 25 KV CB (GIS)

INDICATIONS	Unit	VALUES
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 62271-1, IEC 62271-100, 62271-203
Type		Indoor
Substation type		GIS
Phase number		1
Rated frequency	Hz	50
Operating/service voltage	kV	27.5
Rated voltage	kV	27.5
Rated current		2000A
Rated impulse level		200 kVp
Rated power freq withstand voltage		95kV
Breaking capacity		31.5KA
Closing time		95 ms
Opening time		65 ms
Rated short-time withstand current (3 seconds)	kA r.m.s.	16
Making capacity	kA peak	40
Breaking mode:		SF6
Rated operating cycle		0-0.3s-CO-15s-CO
Rated auxiliary voltage	Vdc	110
Out of load transformer current breaking capacity	A	
Operating times		
- Opening actuation from current emission on the release coil up to		
- Separation of contacts (opening time)	ms	
- Extinguishing of primary arc (breaking time at rated breaking capacity)	ms	

29 25 KV CB (AIS)

INDICATIONS	U	VALUES
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 62271-1, IEC 62271-100, 62271-203
Type		Outdoor
Substation type		AIS
Phase number		1
Rated frequency	Hz	50
Operating/service voltage	kV	27.5
Rated voltage	kV	52
Rated current		2000A
Rated impulse level		200 kVp
Rated power freq withstand voltage		95kV
Breaking capacity		31.5KA
Closing time		95 ms
Opening time		65 ms
Rated short-time withstand current (3 seconds)	kA r.m.s.	16
Making capacity	kA peak	40
Breaking mode:		Vaccum
Rated operating cycle		0-0.3s-CO-15s-CO
Rated auxiliary voltage	Vdc	110
Out of load transformer current breaking capacity	A	
Operating times		
- Opening actuation from current emission on the release coil up to		
- Separation of contacts (opening time)	ms	
- Extinguishing of primary arc (breaking time at rated breaking capacity)	ms	

30 25 KV ISOLATOR (GIS)

INDICATIONS	U	VALUES
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 62271-1, 62271-102, 62271-203, EN 50163, IEC 60850
Type		Indoor
Substation type		GIS
Number of phases		1
Two rotating columns		
Rated frequency	Hz	50
Rated voltage	kV	27.5
Operating voltage	kV	27.5
Rated short duration power frequency withstand voltage	kV r.m.s	95
Rated lightning impulse withstand voltage	kV peak	200
Rated short duration power frequency withstand voltage across isolating distance	kV r.m.s	
Rated lightning impulse withstand voltage across isolating distance	kV peak	
Insulation medium		SF6
Rated current	A	2000
Rated short-time withstand current (3 seconds)	kA r.m.s	16
Rated peak withstand current	kA peak	
Rated auxiliary voltage	Vdc	110
Rated control motor auxiliary voltage	Vdc	110
EARTHING ISOLATOR		
Electrical values		As above
Making capacity		

31 25 KV ISOLATOR (AIS)

INDICATIONS	U	VALUES
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 62271-1, 62271-102, 62271-203, EN 50163, IEC 60850
Type		Indoor/outdoor
Substation type		AIS
Number of phases		1
Two rotating columns		
Rated frequency	Hz	50
Rated insulation voltage	kV	52
Operating voltage	kV	27.5
Rated short duration power frequency withstand voltage	kV r.m.s.	95
Rated lightning impulse withstand voltage	kV peak	200
Rated short duration power frequency withstand voltage across isolating distance	kV r.m.s.	
Rated lightning impulse withstand voltage across isolating distance	kV peak	
Insulation medium		SF6/Air
Rated current	A	2000
Rated short-time withstand current (3 seconds)	kA r.m.s.	16
Rated peak withstand current	kA peak	
Rated auxiliary voltage	Vdc	110
Rated control motor auxiliary voltage	Vdc	110

32 25KV CURRENT TRANSFORMERS (GIS)

INDICATIONS		U	VALUES Required
Manufacturer			
Place of manufacture			
Standards			IEC 61869 , IEC 60850, EN 50163
Operating Voltage		kV	27.5
Frequency		Hz	50
Type of substation			GIS
Erection			Indoor
Rated Impulse withstand (1.2/50 microsecond)		kV peak	200
Rated Power frequency withstand voltage-one minute		kV r.m.s.	95
System voltage		kV	27.5
Secondary Core (The core to be used for differential protection should be of PS Class)	CT between Transformer and 25kV Busbar (TcTx), I/C CTs.	Core 1	2500-1250-625/1 CL PS
		Core 2	2500-1250-625/1, 5P15, 40VA Protection Class
		Core 3	2500-1250-625/1, 0.2CL, 20VA Measurement Class
	CT between 25kV Busbar and OHE (TcCBxx) O/G CTs	Core 1	2000-1000-500/1, 5P15, 30VA Protection Class
		Core 2	2000-1000-500/1 , 5P15, 30VA Protection Class
		Core 3#	2000-1000-500/1, CL PS
	CT between 25kV Busbar and OHE (TcCBxx) O/G CTs for depot feeder	Core 1	2000-1250-625/1, 5P15, 30VA Protection Class
		Core 2	2000-1250-625/1, 5P15, 30VA Protection Class
		Core 3	1600-800/1, 0.2CL,20VA Measurement class
Withstand Over-current (3s /peaks)		kA	16/ 41
Degree of protection for auxiliary circuit			

* THE VA OF CT MAY BE VARIED as per design #
Only for feeders, feeding to underground stations

33 25KV CURRENT TRANSFORMERS (AIS)

INDICATIONS		U	VALUES
6.		7.	Required
Manufacturer			
Place of manufacture			
Standards			IEC 61869, IEC 60850, EN 50163
Operating Voltage		kV	27.5
Frequency		Hz	50
Type of substation			AIS
Erection			outdoor
Rated Impulse withstand (1.2/50 microsecond)		kV peak	200
Rated Power frequency withstand voltage-one minute		kV r.m.s.	95
System voltage		kV	27.5
Secondary Core <i>(The core to be used for differential protection should be of PS Class)</i>	CT between Transformer and 25kV Busbar (TcTx), I/C CTs.	Core 1	2000-1000/1,cl PS
		Core 2	2000-1000/1, 5P15, 30VA Protection class
		Core 3	2000-1000/1, 0.2Cl ,20VA Measurement class
	CT between 25kV Busbar and OHE (TcCBxx) O/G CTs	Core 1	1600-800/1, 5P15, 30VA Protection class
		Core 2	1600-800/1, 5P15, 30VA Protection class
		Core 3#	1600-800/1, CL PS
	CT between 25kV Busbar and OHE (TcCBxx) O/G CTs for depot feeder	Core 1	1600-800/1, 5P15, 30VA Protection class
		Core 2	1600-800/1, 5P15, 30VA Protection class
		Core 3	1600-800/1, 0.2Cl,20VA Measurement class
Withstand Over-current (3s /peaks)		kA	16/ 41
Degree of protection for auxiliary circuit			IP55

*** THE VA OF CT MAY BE VARIED AS PER****DESIGN # Only for feeders, feeding to underground stations**

34 25 KV VOLTAGE TRANSFORMER (GIS)

INDICATIONS	U	VALUES REQUIRED
Manufacturer		
Place of manufacture		
Standards		IEC61869 , IEC 60850, EN 50163
Type of substation		GIS
Erection		Indoor
Service frequency	Hz	50
Rated Impulse withstand (1.2/50 micro second)	KV peak	200
Rated Power frequency withstand voltage-one minute	kV r.m.s.	95
Voltage / earth insulation: (max permanent)	kV	27.5
System voltage	kV	27.5
Resistance of Primary winding		
Secondary core		110 V
Transformation ratio		27.5kV/110V
Precision Power	VA	30
Protection Class	CI	1
Degree of protection for auxiliary circuit		--

* For PT's connected between OHE and earth (Line Indication type)

35 25 KV VOLTAGE TRANSFORMER (AIS)

INDICATIONS	U	VALUES REQUIRED
Manufacturer		
Place of manufacture		
Standards		IEC61869 , IEC 60850, EN 50163
Type of substation		AIS
Erection		outdoor
Service frequency	Hz	50
Rated Impulse withstand (1.2/50 micro second)	KV peak	200
Rated Power frequency withstand voltage-one minute	kV r.m.s.	95
Operating Voltage	kV	27.5
voltage (Maximum non - permanent)	kV	52
Resistance of Primary winding		
Secondary core		110 V
Transformation ratio		27.5kV/110V
Precision Power	VA	30
Protection Class	CI	1
Degree of protection for auxiliary circuit		IP55

* For PT's connected between OHE and earth (Line Indication type)

36 25 KV LIGHTNING ARRESTOR (GIS)

INDICATIONS	U	VALUES REQUIRED
Manufacturer		
Place of manufacture		
Manufacturing Drawing reference		
Standards		IEC60099-4, IEC 60850, EN 50163
Type of Substation		GIS
Type		Indoor
Lightning Arrestor Type		Non-Linear Metal Oxide Resistor Type, gapless
Nominal System Voltage		
Phase – to- Earth	KV	27.5
Phase – to- Phase	kV	52
Rated Voltage for Lightning Arrestor	kV	42
Line discharge class		2
Nominal discharge current	kA	10
Max. discharge Voltage at nominal discharge current	kVp	125
Power frequency withstand voltage for arrester housing	kV	105
Pressure Relief Class		A

37 25 KV LIGHTNING ARRESTOR (AIS)

INDICATIONS	U	VALUES REQUIRED
Manufacturer		
Place of manufacture		
Manufacturing Drawing reference		
Standards		IEC60099-4, IEC 60850, EN 50163
Type of Substation		AIS
Type		outdoor
Lightning Arrestor Type		Non-Linear Metal Oxide Resistor Type, gapless
Nominal System Voltage		
Phase – to- Earth	KV	27.5
Phase – to- Phase	kV	52
Rated Voltage for Lightning Arrestor	kV	42
Line discharge class		2
Nominal discharge current	kA	10
Max. discharge Voltage at nominal discharge current	kVp	125
Power frequency withstand voltage for arrestor housing	kV	105
Pressure Relief Class		A

38 25kV 630sq.mm Cu cable GTP

Sr. No	Description	Unit	Values
1	Manufacturer		
2	Reference Standard		IEC 60840, 60853-2
3	Voltage Grade(U0/U (U2))	kV	26/45 (52)
4	Operating voltage	kV	27.5
5	Cable type		Cu/XLPE/PVC
6	Cable Size	Sq.mm	630
7.1	Conductor material		Annealed Copper
7.2	Conductor Diameter	mm	
8.1	Core Screen		Extruded Semiconducting
8.2	Thickness f core Screen	mm	
9.1	Insulation		Extruded semi- conducting Comp'd
9.2	Thickness of insulation	mm	
10.1	Insulating Envelope screen		Non-Metallic part of semiconducting materials plis metallic part consisting of standard wir and copper tape, rated to carry a short circuit current of 16kV
10.2	Thickness of insulation screen	mm	
11.1	Outer sheath		PVC
11.2	Thickness of outer sheath	mm	
12	Nominal Overall diameter of cable	mm	
13	Approx. weight of cable		
14	Minimum bending radius	mm	
15	Conductor SCC (3Sec)	kA	16

39 3.3kV 630SQ MM CU CABLE

Sr. No	Description	Unit	Values
1	Manufacture	-	
2	Cable size	Sq.mm	630
3	Cable type	-	Copper/XLPE/PVC
4	Voltage Grade(U0/U (Um))	kV	1.8/3.0 (3.6)kV
5	Reference Standard	-	IEC 60502-1, 60853-2
6	No. and Cross sectional area of	Sq.mm	630sq mm
7	Conductor Material	-	Copper
8	Shape	-	Circular compact stranded
9	Class/Standard	-	Class2/ IEC 228
10	Nominal Diameter of Conductor	mm	
11	Conductor Screen Materials	-	Extruded semi-Conducting Com'd
12	Nominal thickness of conductor	mm	
13	Insulation material	-	XLPE
14	Nominal thickness of insulation	mm	2
15	Nominal diameter over insulation		
16	Insulation Screen material	-	Extruded semi- Conducting com'd
17	Nominal thickness of outer	mm	
18	Cross sectional area	Sq.mm	630
19	Outer sheath material		Flame retardant polyvinyl chloride
20	Minimum thickness of outer	mm	
21	Nominal overall diameter (±2mm)	mm	
22	Minimum bending radius	Mm	
23	Max. DC Conductor resistance at 20 °C	S/km	

24	Star reactance per phase at 50Hz	rdikm	
25	Capacitance per phase	pF/lon	
26	Charging current per phase at U0,50Hz	A/km	
27	Max. Current rating in air	A	
28	Max. Current rating in Ground	A	90
29	Max. Conductor temperature on	°C	250
30	Max. Conductor temperature in	°C	
31	Max. Short Circuit current rating t=3 sec	KA	16

40 FO CABLE

Sr. No	Description	Unit	Values
1	Cable Description	-	48F LT – SM – Single Sheath Armored FO Cable
2	Type of Fiber	-	Single Mode
3	Number of Fiber / Tube	Nos	9 Fiber / tube
4	Number of loose tube	Nos	6 loose tube
5	Central strength number	-	Fiber Reinforced Plastic – FRP (Non-Metallic)
6	Water blocking compound	-	Water blocking yarn & water blocking tape
7	Armouring	-	Corrugated ECCS tape armouring over the core (armour tape thick: 0.15mm nominal & thick. Of Co-polymer layer or coating (each side): 0.05mm nominal.)
8	Rip Cord	-	Two Rip cord below armouring
9	Outer Sheath	-	High density polyethylene (UV) – Black Colour (Thick: 1.8mm nominal)
10	Cable Outer Dia	Mm	12 approx.
11	Attenuation	Nm	1310
12	Cable Cut-Off Wavelength	nm	≤1260nm
13	Cable Weight	Kg	

14	Cable Length	m	
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Note:

FO Cable mechanical and environmental properties shall comply with IEC 60794.

Bi-RIDE