

Nepal Electricity Authority
Electricity Grid Modernization Project
Design, Supply, Installation, Testing and Commissioning of Pangtan 132/33/11 kV Substation Project
OCB NO:PMD/EGMP/PSSP-077/78-01

Clarification-1

S. No	Reference Section and Clause	Description in Bid Document	Bidders Query/ Comments	NEA's Clarification
1	Vol I , Section 3, Clause No. 2.4 Experience 2.4.1 Contracts of Similar Size and Nature	Participation in at least 2 (two) Contracts that have been successfully or substantially completed within the last 10 (Ten) years and that are similar to the proposed Contract, where the value of the Bidder's participation under each Contract exceeds US\$ 4.52 Million. The similarity of the Bidder's participation shall be based on Design, Supply, Installation, Testing and Commissioning of 132 kV or higher voltage Substation.	As per this clause, we understand that if the bidder has experience 132 kV or higher voltage Substation either GIS or AIS within last 10 years and whose contract value exceeds US \$ 4.52 Million then the bidder will meet this clause. Please confirm	Confirmed as per Bidders query.
2	Vol I , Section 3, Clause No. 2.4 Experience 2.4.2 Experience in Key Activities	For the above or other Contracts executed during the period stipulated in 2.4.1, a minimum experience in the following key activities: A. One Contract of Design, Supply, Installation, Testing and Commissioning of 132 kV or higher voltage Air Insulated Substation involving installation and commissioning of Power Transformer of 132 kV or higher voltage rating with minimum capacity of 30 MVA within last 10 years. B. One Contract of Design, Supply, Installation, Testing and Commissioning of 132 kV or higher voltage Gas Insulated Switchgear (GIS) bay extension/substation. C. Design, Supply, Installation, Testing and Commissioning of Substation Automation System/ SCADA in 132 kV or higher voltage Substation within last 10 years	As per our understanding, substantially completed experience is applicable for key activities in points A, B, C also. Please Confirm	Confirmed as per Bidders query.
3	VOL II, Section 26	Section-26, Substation Equipment Data Sheet TDS	We had gone through the Tender documents but didn't find the section- 26	Substation Equipment Data Sheet TDS has been provided.
4	VOL III, Price Schedule BoQ, Pangtan, Telecommunication equipments	S.No 3.2 (A) of Schedule for Telecommunication equipments	We request you to kindly provide the technical specification for FOTE and also provide the details of telecommunication equipment's installed at Bahrabise Substation End (Make/ Model).	General Technical Requirement- Fibre Optics Communication has been provided in section- 27.
5	VOL III, Price Schedule BoQ, Bahrabise	S.No 1 Schedule- 1 for GIS equipments	We request you to kindly provide the details of GIS equipments installed at Bahrabise substation End (Make/ Model). SLD, Layout for designing and commissioning purpose.	Bidders are encouraged for site visit to clarify the details by themselves. All related details shall be made available to the successful bidder at the later stage.
6	VOL III, Price Schedule BoQ, Bahrabise	S No 16.1 of Schedule-1 for Tools and Testing equipments	We request you to kindly provide the technical Specification for the same.	Technical Specification has been provided in VOL II, Section- 28.
8	VOL-II, Section 24		Bahrabise Layout not provided	Bidders are encouraged for site visit to clarify the details by themselves. All related details shall be made available to the successful bidder at the later stage.
9	VOL-II, Section 25		Contour layout of Pangtan Substation is not provided	Bidders are encouraged for site visit to clarify the details by themselves. All related details shall be made available to the successful bidder at the later stage.
10	VOL II, Section- 1		Make List is not provided	Make list has been provided in VOL II, Section-1, Annex-I



11	VOL II, Section-1, 4.1 132/33/11 kV Pangtan Substation	<p>A. Control and Power Cable</p> <p>a) 12 kV, 400 SQmm, single core XLPE power cable including termination joints for both ends with all accessories complete from LV side of 33/11 kV power transformer to indoor 11 kV switchgear room.</p> <p>b) 12 kV, 240 SQmm, three core XLPE power cable armoured including termination joints for both ends , double pole structure and with all accessories complete for 4 Nos of outgoing feeders.</p> <p>c) 33 kV HT armoured Copper Cable (1CX240 SQmm) for 2 nos of 33 kV feeder line along with accessories including flexible pipe and termination equipments and structure at both end.</p>	Route Detail of cable and transmission line is required for further understanding the modalities of this tender as shown in the highlighted extract below.	Bidders are encouraged for site visit to clarify the details by themselves.
12	VOL II, Section-2, 2.6 (A) Salient Features of 132/33/11 kV Pangtan Substation. (f)	f) Two (2) numbers two (2) km long 33 kV overhead lines on steel poles from Pangtan Substation including LILO connection as required.	Route Detail of cable and transmission line is required for further understanding the modalities of this tender as shown in the highlighted extract below.	Bidders are encouraged for site visit to clarify the details by themselves.

VOLUME - II OF III
SECTION -26
TECHNICAL SCHEDULE
FOR
132/33/11 kV PANGTAN SUBSTATION AND BAHRABISE SUBSTATION



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26 TECHNICAL SCHEDULE FOR SUBSTATION

26.1 General

The bidder shall submit four (4) sets [One (1) original + Three (3) Copies] of filled up Technical Schedule along with the bid. Any alterations necessary due to errors etc. in the filled up data shall be initiated by the bidder.

26.1.1 Type Test Report

Type test Reports, as specified in section-3 (Evaluation and Qualification Criteria) of Volume-I, shall be submitted along with the technical schedules.

26.2 Guaranteed Technical Particular for Power and distribution transformer

26.2.1 Technical Particular for 132/33 kV Power Transformer

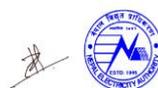
DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			
Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			
Manufacturer's sales record submitted	Yes/No	Yes	
1. Service		Outdoor	
2. Type (Core or Shell)		Core	
3. Applicable Standard		IEC	
4. Number of winding per phase	No.	2	
5. Type of cooling		ONAN/ONAF	
6. Rating			
a) Rated capacity			
- ONAN	MVA	24	
- ONAF1		27	
- ONAF2		30	
b) Rated voltage			
- Primary	kV	132	
- Secondary		33	



c) Rated frequency	Hz	50	
7. Noise level			
a) On ONAN rating	dB	<73	
c) On ONAF- rating	dB	<75	
8. Temperature rise			
a) Temperature rise above 40°C ambient			
-In oil by thermometer	deg.C	50	
-In winding by resistance	deg.C	55	
b) Hottest spot temperature in winding limited to	deg.C	55	
9. Connection			
a) High voltage		<i>star</i>	
b) Low voltage		<i>star</i>	
c) Vector group reference in accordance with IEC 60076		<i>YNyn0</i>	
10. Magnitude of 3 rd harmonics voltage as of fundamental frequency	%	<2	
11. Taps			
a) Type of tap changer		<i>ON-LOAD</i>	
b) Tap steps	No.	<i>17</i>	
c) Tap range	%	<i>+/- 10%</i>	
12. Cooling equipment (for ONAF1)			
a) Manufacturer and type			
b) Number of Fans	Nos.		
c) Rated power	kW		
d) Rated voltage	V, AC	230/400	
13. Cooling equipment (for ONAF2)			
a) Manufacturer and type			
b) Number of Fans	Nos.		
c) Rated power	kW		
d) Rated voltage	V, AC	230/400	
14. On-load tap changing gear & control- system			
a) Manufacturer and type		<i>MR Germany/ ABB Sweden or equivalent</i>	



b) Rating			
-Rated voltage	kV	72	
-Step voltage	V		
-Rated current (normal)	A	150	
-Number of steps	Nos.	17	
c) Control suitable for:			
-Remote/local operation		<i>Remote & local</i>	
-Auto/manual operation		<i>Auto & manual</i>	
-Parallel operation	Yes/No	<i>Yes</i>	
d) Rated voltage of drive motor	V, AC	400/230	
15. Guaranteed losses			
a) No-load loss at rated voltage and frequency on maximum MVA base	kW		
b) Load loss at rated current and 75 deg C on maximum MVA base	kW		
c) Cooler loss for full load operation on maximum MVA base	kW		
d) Total losses	kW		
16. Impedance at rated current and frequency at 75 deg.C winding temperature and normal tapping			
a) on maximum MVA base in ONAN	%		
b) on maximum MVA base in ONAF	%	11	
17. Efficiency at 75 deg.C winding Temperature at PF=0.9			
a) At 100 % load	%		
b) At 75 % load	%		
c) At 50 % load	%	Above 99%	
18. No load current in % of rated current referred to HV side & 50Hz			
a) At 90 % rated voltage	%		
b) At 100 % rated voltage	%		
c) At 110 % rated voltage	%		
19. Minimum clearance in air HV/LV			
-Between phases	mm		



-Between phase and ground	mm		
20. Insulation level			
a) Power frequency withstand voltage (1 min. rms)			
-Primary	kV	325	
-Secondary	kV	95	
b) Impulse withstand			
-Primary	kV	750 (crest)	
-Secondary	kV	250 (crest)	
22. Detail of oil preservation system			
a) Type of oil preservation system furnished	type	Conservator type	
b) If conservator type, urethane air cell provided	Yes/No	Yes	
21. Minimum pressure of pressure relief device set to operate at			
	kg/cm2		
22. Details of bushings HV/LV/ HV neutral			
a) Manufacturer / Model No.			
b) Type			
c) Voltage class	kV	145/36/36	
d) Creepage distance	mm	4650/1300/1300	
e) Reference standard		IEC	
f) Dry flash over voltage	kV		
g) Wet flash over voltage	kV		
h) Impulse withstand voltage	kV peak	750/250	
23. Insulating oil			
a) Approximate volume of oil	liter		
b) Whether first fill of oil with 5 % excess furnished	Yes/No	Yes	
24. Bushing current transformer			
a) Type			
b) Voltage class (HV/LV)	kV/kV	132/33	



c) Number of cores			
-HV	No.	1	
-LV	No.	1	
-HV Neutral	No.	1	
-LV Neutral	No.	2	
d) Ratio			
-HV (phase)	A		
-HV (Neutral)	A		
-LV (phase)	A		
- LV (Neutral)	A		
e) Accuracy class		5P20	
25. Lightning arresters mounted on			
a) HV side	Yes/No	No	
b) LV side	Yes/No	Yes	
26. Approximate overall dimension (L * W * H)	mm		
27. Approximate weight			
a) Core and coils	kg		
b) Tank and fittings	kg		
c) Oil	kg		
d) Total weight	kg		
28. Delivery of equipment in month following award of contract (Allowing time for approval of drawings)	months		

26.2.2 Technical Particular for 33/11kV Distribution Transformer

DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			



Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			
Manufacturer's sales record submitted	Yes/No	Yes	
1. Service		Outdoor	
2. Type (Core or Shell)		Core	
3. Applicable Standard		IEC	
4. Number of winding per phase	No.	2	
5. Type of cooling		ONAN/ONAF	
6. Rating			
a) Rated capacity			
- ONAN	MVA	6	
- ONAF		8	
b) Rated voltage			
- Primary	kV	33	
- Secondary		11	
c) Rated frequency	Hz	50	
7. Noise level			
a) On ONAN rating	dB	<73	
c) On ONAF- rating	dB	<75	
8. Temperature rise			
a) Temperature rise above 40°C ambient			
-In oil by thermometer	deg.C	50	
-In winding by resistance	deg.C	55	
b) Hottest spot temperature in winding limited to	deg.C	55	
9. Connection			
a) High voltage		star	
b) Low voltage		star	
c) Vector group reference in accordance with IEC 60076		YNyn0	
10. Magnitude of 3 rd harmonics voltage as of fundamental frequency	%	<2	
11. Taps			



a) Type of tap changer		<i>ON-LOAD</i>	
b) Tap steps	No.	17	
c) Tap range	%	+/- 10%	
12. Cooling equipment (for ONAF)			
a) Manufacturer and type			
b) Number of Fans	Nos.		
c) Rated power	kW		
d) Rated voltage	V, AC	230/400	
15. On-load tap changing gear & control- system			
b) Manufacturer and type		<i>MR Germany ABB Sweden/or equivalent</i>	
b) Rating			
-Rated voltage	kV		
-Step voltage	V		
-Rated current (normal)	A		
-Number of steps	Nos.		
c) Control suitable for:			
-Remote/local operation		<i>Remote & local</i>	
-Auto/manual operation		<i>Auto & manual</i>	
-Parallel operation	Yes/No	<i>Yes</i>	
d) Rated voltage of drive motor	V, AC	400/230	
16. Guaranteed losses			
c) No-load loss at rated voltage and frequency on maximum MVA base	kW		
d) Load loss at rated current and 75 deg.C on maximum MVA base	kW		
c) Cooler loss for full load operation on maximum MVA base	kW		
d) Total losses	kW		
17. Impedance at rated current and frequency at 75 deg.C winding temperature and normal tapping			
a) on maximum MVA base in ONAN	%		
b) on maximum MVA base in ONAF	%	8	
18. Efficiency at 75 deg.C winding			



Temperature at PF=0.9			
a) At 100 % load	%		
b) At 75 % load	%		
c) At 50 % load	%	Above 99%	
19. No load current in % of rated current referred to HV side & 50Hz			
a) At 90 % rated voltage	%		
b) At 100 % rated voltage	%	<1	
c) At 110 % rated voltage	%		
20. Minimum clearance in air HV/LV			
-Between phases	mm		
-Between phase and ground	mm		
21. Insulation level			
a) Power frequency withstand voltage (1 min. rms)			
-Primary	kV	95	
-Secondary	kV	28	
b) Impulse withstand			
-Primary	kV	250 (crest)	
-Secondary	kV	95 (crest)	
22. Detail of oil preservation system			
a) Type of oil preservation system furnished	type	Conservator type	
b) If conservator type, urethane air cell provided	Yes/No	Yes	
23. Minimum pressure of pressure relief device set to operate at	kg/cm2		
24. Details of bushings HV/LV/LV HV neutral			
a) Manufacturer / Model No.			
b) Type			
c) Voltage class	kV	36/12/36	
d) Creepage distance	mm		



e) Reference standard		<i>IEC</i>	
f) Dry flash over voltage	kV		
g) Wet flash over voltage	kV		
h) Impulse withstand voltage	kV peak		
25. Insulating oil			
a) Approximate volume of oil	liter		
b) Whether first fill of oil with 5 % excess furnished	Yes/No	Yes	
26. Bushing current transformer			
a) Type			
b) Voltage class (HV/LV)	kV/kV	<i>33/11</i>	
c) Number of cores			
-HV	No.	<i>1</i>	
-LV	No.	<i>1</i>	
-HV Neutral	No.	<i>1</i>	
-LV Neutral	No.	<i>2</i>	
d) Ratio			
-HV (phase)	A		
-HV (Neutral)	A		
-LV (phase)	A		
- LV (Neutral)	A		
e) Accuracy class		5P20	
27. Lightning arresters mounted on			
a) HV side	Yes/No	<i>No</i>	
b) LV side	Yes/No	Yes	
28. Approximate overall dimension (L * W * H)	mm		
29. Approximate weight			
a) Core and coils	kg		
b) Tank and fittings	kg		
c) Oil	kg		



d) Total weight	kg	
30. Delivery of equipment in month following award of contract (Allowing time for approval of drawings)	months	

26.2.3 Technical Particulars of Insulating oil for Transformers

Sr. No.	Characteristics	Specification	To be filled by bidder
1.	Electric Strength (BDV)	60 kV (min)	
2.	Dielectric dissipation factor	0.01 (Max.) (Ten Delta)	
3.	Specific resistance (Resistivity)	1500x10 ¹² (Min.) at 27 ⁰ C (ohm-cm)	
4.	Flash point pensky-Mortion	1400C (Min.) (Closed)	
5.	Inter facial tension at 270C	0.04 N/m (Min.)	
6.	Total activity	0.04 mg koh/gm (Max.)	
7.	Water Content	50 (Max)	

Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

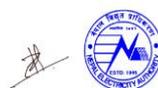
Date:



26.3 Guaranteed technical particular for circuit breakers

26.3.1 Technical Particulars of 132kV SF6 Circuit Breaker

DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			
Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			
Manufacturer's sales record submitted	Yes/No	Yes	
1. Manufacturer's designation as per submitted catalogue/ Model No.		To be furnished	
2. Applicable standard		IEC	
3. Type / Class		SF6 / outdoor	
4. Poles	No.	3	
5. Local and remote operations		Both Required	
6. Rated maximum voltage	kV	145	
7. Rated current	A		
a) Normal current	A	2000/1250	
b) Short time for 1 sec	kA	25	
8. Frequency	Hz	50	
9. Insulation level			
a) Impulse withstand voltage	kV	750(crest)	
b) Power frequency withstand voltage (1 min, rms)	kV	325	
10. Rated short circuit breaking current	kA	25	
11. Rated short circuit making current	kAp		
12. Interrupting time at 100% capacity			
a) Max. opening time	ms		
b) Total interrupting time	ms	60	
13. Closing time	ms		
14. Make Time	ms	120	
15. Rated			
a. Line-charging breaking current	A		



DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
16. First pole to clear factor		1.3	
17. Operating mechanism			
a) Type		Spring operated	
b) Number of mechanisms per breaker set		3 for Line CB 1 for BC & Transformer CB	
c) single/three phase auto reclosure		<i>Single for 132 kV line</i>	
d) enclosure protection		IP55W	
e) Nominal Operating voltage of Closing/ Tripping coil	V, DC	110	
f) Operating voltage range	% of rated voltage		
- Closing		85-110%	
- Tripping		70-110%	
g) Spring charging Motor rating			
- Capacity	kW		
- Rated voltage	V	110 V, DC	
h) Time required by motor to charge the spring completely	Sec	30	
18. Push button for local operation	Yes/No	Yes	
19. Selection switch for local/ remote control	Yes/No	Yes	
20. Anti pumping device provided	Yes/No	Yes	
21. Trip-free feature provided	Yes/No	Yes	
22. Gas density detector provided	Yes/No	Yes	
23. Operation counter provided	Yes/No	Yes	
24. Space heater provided for cubicle	Yes/No	Yes	
25. Operating duty cycle		O-0.3 sec-CO-3 min-CO	
26. Thickness of sheet steel of cubicle	mm	min 2	
27. Number of Auxiliary Contacts	No.	8NO, 8 NC	
28. Number of possible operations without maintenance :			
<u>for contacts</u>			
- Rated short circuit breaking current	No.	Not less than 10	
- Rated normal current	No.	Not less than 2,000	
- for mechanism	No.	Not less than 2,000	



DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
29. Rated SF6 gas pressure	kgf/cm ²		
30. Guaranteed SF6 gas loss per annum	% / annum	<0.1	
31. Porcelain insulator			
a) Manufacturer			
b) Creepage distance	mm	4650	
32. Padlocking provision for local cubicle	Yes/No	Yes	
33. Gas pressure gauge provided	Yes/No	Yes	
34. Total weight of circuit breaker	kg		

26.3.2 Technical Particulars of 33kV Vacuum Circuit Breaker

DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			
Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			
Manufacturer's sales record submitted	Yes/No	Yes	
1. Manufacturer's designation as per submitted catalogue/ model no		To be furnished	
2. Applicable standard		IEC	
3. Type / Class		Vacuum / outdoor	
4. Poles	No.	3	
5. Local and remote operations		Both Required	
6. Rated voltage	kV	36	
7. Rated current			
a) Normal current	A	2000/1250	
b) Short time for 1 sec	kA	25	
8. Frequency	Hz	50	
9. Insulation level			
a) Impulse withstand voltage	kV	250(crest)	
c) Power frequency withstand voltage (1 min, rms)	kV	95	



DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
10. Rated short circuit breaking current	kA	25	
11. Rated short circuit making current	kAp		
12. Interrupting time			
a) Max. opening time	ms		
b) Total interrupting time	ms	60	
13. Closing time	ms		
14. Make Time	ms	120	
15. Rated			
a. Line-charging breaking current	A		
b. Cable-charging breaking current	A		
c. Capacitor bank breaking current	A		
d. Capacitor bank inrush current	KAp		
e. Rated Back to Back Capacitor Bank Breaking current	KAp		
16. First pole to clear factor		1.3	
17. Operating mechanism			
a) Type		Spring operated	
b) Number of mechanisms per breaker set		1	
c) single/three phase auto re-closure		(three phase)	
d) enclosure protection		IP55W	
e) Nominal Operating voltage of Closing/ Tripping coil	V, DC	110	
18. Padlocking provision for local cubicle	Yes/No	Yes	
19. Total weight of circuit breaker	kg		

Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

Date:



26.4 Guaranteed Technical particular for disconnecting switches

26.4.1 Technical Particulars of 132kV Disconnecting Switch with & Without Grounding Switch

DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			
Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			
Manufacturer's sales record submitted	Yes/No	Yes	
1. Manufacturer's designation as per submitted catalogue / Model no.		To be furnished	
2. Applicable standard		IEC	
3. Type		3-Pole; Center break	
4. Local and remote both operations		Required	
5. Frequency	Hz	50	
6. Rated maximum voltage	kV	145	
7. Rated current			
a) Normal current	A	2000/1250	
b) Short time for 1 sec	kA	25	
8. Insulation level			
a) Impulse withstand voltage	kV crest	750	
b) Power frequency withstand voltage (1 min, rms)	kV	325	
9. Maximum current the switch can safely interrupt			
a. Bus/line charging current	A	0.5 min	
b. Potential transformer magnetizing current	A	0.5 min	
10. Clearance			
a. Between live parts and ground	mm		
b. Between fixed contact and blade in open position	mm		
11. Main contacts			
- Material of contacts		copper alloy	



DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
- Coating of contacts		Silver plated	
- Material of the contacts of the earthing switch		copper alloy	
- Coating of the contacts of the earthing switch		silver plated	
12. Material of terminals			
13. Coating of terminals			
14. Operating mechanism		<i>Electrical & Manual</i>	
15. Local operating device provided	Yes/No	Yes	
16. Auxiliary contacts			
a) Type (convertible or fixed)		convertible	
b) Continuous current rating at 110V DC	A		
c) Material		Copper	
d) Contacts silver-plated?	Yes/No	Yes	
17. No of operations switch can withstand without deterioration of contacts	Nos.		
18. Type of interlocks furnished:		Electrical & Mechanical	
19. Are the disconnectors and the earthing switches mechanically interlocked to each other	Yes/No	Yes	
20. Weight of disconnecting switch	kg		
21. Auxiliary power supply			
a) DS operating motor supply voltage	V/ Phase	400V / 3Ph	
b) DS operating motor power	WT		
c) Space heater and cubicle	V/ Phase	230V / 1Ph	
d) Control circuit	V	110V, DC	
22. Insulator			
a) Manufacturer			
b) Creepage distance in air	mm	4650	
23. Number of NC. Contacts (minimum)	No.	8	
24. Number of NO. contacts (minimum)	No.	8	
25. Enclosure protection		IP-55W	



DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
26. Thickness of sheet (minimum)	mm	2	
27. Earthing switch			
a) Operating mechanism		Manual	
b) Type of interlocks furnished		Electrical & Mechanical	
28. Number of NC. Contacts (minimum)	No.	4	
29. Number of NO. contacts (minimum)	No.	4	
30. Weight of earthing switch	kg		
31. Delivery of equipment in months following award of contract. (Allowing time for approval of drawing.)	month		

26.4.2 Technical Particulars of 33kV Disconnecting Switch with & Without Grounding Switch

DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			
Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			
Manufacturer's sales record submitted	Yes/No	Yes	
1. Manufacturer's designation as per submitted catalogue / Model no.		To be furnished	
2. Applicable standard		IEC	
3. Type		3-Poles; Center break / Double Break	
4. Local and remote both operations		Required	
5. Frequency	Hz	50	
6. Rated maximum voltage	kV	36	
7. Rated current			
a) Normal current	A	1250	
b) Short time for 1 sec	kA	25	
8. Insulation level			
a) Impulse withstand voltage	kV crest	250	



DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
b) Power frequency withstand voltage (1 min, rms)	kV	95	
9. Maximum current the switch can safely interrupt			
a. Bus/line charging current	A	0.5 min	
b. Potential transformer magnetizing current	A	0.5 min	
10. Clearance			
a. Between live parts and ground	mm		
b. Between fixed contact and blade in open position	mm		
11. Main contacts			
- Material of contacts		copper alloy	
- Coating of contacts		Silver plated	
- Material of the contacts of the earthing switch		copper alloy	
- Coating of the contacts of the earthing switch		silver plated	
12. Material of terminals			
13. Coating of terminals			
14. Operating mechanism		<i>Electrical & Manual</i>	
15. Local operating device provided	Yes/No	Yes	
16. Auxiliary contacts			
a) Type (convertible or fixed)		convertible	
b) Continuous current rating at 110V DC	A		
c) Material		Copper	
d) Contacts silver-plated?	Yes/No	Yes	
17. No of operations switch can withstand without deterioration of contacts	Nos.		
18. Type of interlocks furnished:		Electrical & Mechanical	
19. Are the disconnectors and the earthing switches mechanically interlocked to each other	Yes/No	Yes	
20. Weight of disconnecting switch	kg		



DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
21. Auxiliary power supply			
a) Space heater and cubicle	V/ Phase	230V / 1Ph	
b) Control circuit	V	110V, DC	
22. Insulator			
a) Manufacturer			
b) Creepage distance in air	mm	1,300	
23. Number of NC. Contacts (minimum)	No.	8	
24. Number of NO. contacts (minimum)	No.	8	
25. Enclosure protection		IP-55W	
26. Thickness of sheet (minimum)	mm	2	
27. Earthing switch			
a) Operating mechanism		Manual	
b) Type of interlocks furnished		Electrical & Mechanical	
28. Number of NC Contacts (minimum)	No.	4	
29. Number of NO Contacts (minimum)	No.	4	
30. Weight of earthing switch	kg		
31. Delivery of equipment in months following award of contract. (Allowing time for approval of drawing.)	month		

Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

Date:



26.5 Guaranteed Technical Particular For instrument transformer

26.5.1 Technical Particulars of 132kV Current Transformer

DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			
Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			
Manufacturer's sales record submitted	Yes/No	Yes	
1. Manufacturer's designation as per submitted catalogue / Model No.		To be furnished	
2. Applicable standard		IEC	
3. Type		<i>outdoor</i> <i>oil immersed</i>	
4. Number of phases	No.	single	
5. Number of cores in each CT	No.	5	
6. Frequency	Hz	50	
7. Rated Primary Voltage	kV	132	
8. Insulation level			
a) Impulse withstand voltage	kV,(crest)	750	
b) Power frequency withstand voltage (1 min. rms)	kV	325	
19. Rated peak withstand current	kA		
10. Creepage distance	mm		
11. Short time thermal rating (1 Sec)	kA	25	
12. Ratings			
13. Current ratio	A	1200-600/1 A (for line and bus coupler bay) 600-300-150/1A (for transformer bay)	
14. Rated VA burden for each core	VA	30	
15. Accuracy class / No. of Cores		5P20 – 2 Nos. CL:X – 2 Nos. for protection & CL:0.2 - 2 Nos. for metering	
16. Dimension (L x W x H)	mm		



DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
17. Weight	kg		
18. Delivery of equipment in months following award of contract (Allowing time for approval of drawings.)	month		

26.5.2 Technical Particulars of 33kV Current Transformer

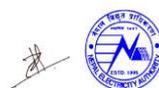
DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			
Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			
Manufacturer's sales record submitted	Yes/No	Yes	
1. Manufacturer's designation as per submitted catalogue / Model No.		To be furnished	
2. Applicable standard		IEC	
3. Type		outdoor Epoxy resin encapsulated	
4. Number of phases	No.	single	
5. Number of cores in each CT	No.	2	
6. Frequency	Hz	50	
7. Rated Primary Voltage	kV	33	
8. Temperature rise above 40 degree C ambient	°C		
9. Insulation level			
a) Impulse withstand voltage	kV,(crest)	250	
b) Power frequency withstand voltage (1 min. rms)	kV	95	
10. Rated peak withstand current	kA		
11. Creepage distance	mm		
12. Short time thermal rating (1 Sec)	kA	25	
13. Ratings			
14. Current ratio:	A		
For incomer		800-600/1 A	
For feeders		400-200/1 A	



DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
15. Rated VA burden for each core	VA	20	
16. Accuracy class / No. of Cores		5P20 – 1 No. for protection & CL :0.2 - 1 No. for metering	
17. Dimension (L x W x H)	mm		
18. Weight	kg		
19. Delivery of equipment in months following award of contract (Allowing time for approval of drawings.)	month		

26.5.3 Technical Particulars of 132kV Capacitive Voltage Transformer

DESCRIPTION	UNIT	REQUIREMET	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			
Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			
Manufacturer's sales record submitted	Yes/No	Yes	
1. Manufacturer's designation as per submitted catalogue /Model No.			
2. Applicable standard		IEC	
3. Type		Outdoor oil immersed	
4. Frequency	Hz	50	
5. Rated primary voltage			
a) Nominal	kV	$132/\sqrt{3}$	
b) Maximum voltage	kV	$145/\sqrt{3}$	
6. Insulation level			
a) Impulse withstand voltage (primary)	kV	750	
b) Power frequency withstand (1 min. rms) (primary)	kV	325	
7. Creepage distance	mm		
8. High voltage capacitor			
a) Number of capacitor			



DESCRIPTION	UNIT	REQUIREMET	OFFERED DATA
b) Capacitance of each stack	pF		
c) Manufacturing tolerance	(+/-%)		
d) Total value of the high voltage capacitor	pF		
9. Intermediate voltage capacitor			
a. Number of stacks			
b. Capacitance of each stack	pF		
c. Manufacturing tolerance	+/-%)		
d. Total value of intermediate voltage capacitor	pF		
e. Equivalent capacitance for carrier coupling	pF		
f. Capacitance of CCVT	pF		
10. Value of the equivalent capacitance	pF		
11. Open circuit intermediate voltage	V		
12. Rating			
a) Voltage ratio	kV	132/ $\sqrt{3}$: 0.11/ $\sqrt{3}$ and 0.11/ $\sqrt{3}$	
b) Rated burden	VA	100 for protection & 50 for metering	
c) Accuracy class		3P & 0.2 for metering	
d) Overvoltage factor			
- Continuous		1.1	
- 30 seconds		1.5	
e) Connection			
f) Secondary fuse			
- Type			
- Manufacturer			
- Amp rating	A		
g) Power factor		0.85	
h) Number of secondary windings		2	
13. Knife switch and fuse on secondary provided	Yes/No		
14. Dimension (LxWxH)	mm		
15. Weight	kg		



DESCRIPTION	UNIT	REQUIREMET	OFFERED DATA
16. Delivery of equipment in months following award of contract (allowing time for approval of drawing)	month		

Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

Date:



26.5.4 Technical Particulars of 33 kV Voltage Transformer

DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			
Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			
Manufacturer's sales record submitted	Yes/No	Yes	
1. Manufacturer's designation as per submitted catalogue			
2. Applicable standard		IEC	
3. Type		Outdoor epoxy resin encapsulated	
4. Frequency	Hz	50	
5. Rated primary voltage	kV	33	
6. Insulation level			
a) Impulse withstand voltage (primary)	kV	250	
b) Power frequency withstand (1 min. rms) (primary)	kV	95	
7. Creepage distance	mm	850	
8. Rating			
a) Voltage ratio	kV	$33/\sqrt{3}/0.11/\sqrt{3}$ /0.11	
b) Rated burden	VA	50	
c) Accuracy class		3P & 0.2 for metering	
d) Overvoltage factor			
- Continuous		1.1	
- 30 seconds		1.5	
e) Connection			
f) Secondary fuse			
- Type			
- Manufacturer			
- Amp rating	A		
g) Power factor		0.85	



DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
h) Number of secondary windings		2	
9. Knife switch and fuse on secondary provided	Yes/No		
10. Dimension (LxWxH)	mm		
11. Weight	kg		
12. Delivery of equipment in months following award of contract (allowing time for approval of drawing)	month		

Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

Date:



26.6 Guaranteed Technical Particular for Lightning Arresters

26.6.1 Technical Particulars of 120kV Lightning Arrester

DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			
Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			
Manufacturer's sales record submitted	Yes/No	Yes	
1. Manufacturer's designation as per submitted catalogue / Model No.		To be furnished	
2. Applicable standard		IEC	
3. Type		Gap less metal – oxide / Outdoor	
4. Rated voltage rating of L.A.	kV	120	
5. Impulse withstand voltage, (crest)	kV	750	
6. Power frequency withstand voltage	kV	325	
7. Rated frequency	Hz	50	
8. Nominal discharge current	kA	10	
9. Surge counter with insulating base furnished?	Yes/No	Yes	
10. Leakage current measuring instrument furnished?	Yes/No	Yes	
11. Porcelain creepage distance	mm		
12. Line terminal with accessories provided	Yes/No	Yes	
13. Earth terminal with accessories provided	Yes/No	Yes	
14. Has manufacturer exported such units?	Yes/No	Yes	

26.6.2 Technical Particulars of 30kV Lightning Arrester

DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's name			
Country of Origin			
Applicable Standard			
Years of Manufacturing Experience	Years	Minimum 7	
ISO Certificate Submitted			



DESCRIPTION	UNIT	REQUIREMENT	OFFERED DATA
Manufacturer's sales record submitted	Yes/No	Yes	
1. Manufacturer's designation as per submitted catalogue / Model No.		To be furnished	
2. Applicable standard		IEC	
3. Type		Gap less metal – oxide / Outdoor	
4. Rated voltage rating of L.A.	kV	30	
5. Impulse withstand voltage, (crest)	kV	250	
6. Power frequency withstand voltage	kV	95	
7. Rated frequency	Hz	50	
8. Nominal discharge current	kA	10	
9. Surge counter with insulating base furnished?	Yes/No	Yes	
10. Leakage current measuring instrument furnished?	Yes/No	Yes	
11. Porcelain creepage distance	mm		
12. Line terminal with accessories provided	Yes/No	Yes	
13. Earth terminal with accessories provided	Yes/No	Yes	
14. Has manufacturer exported such units?	Yes/No	Yes	

Deviations from technical requirements and reasons for such deviations :

Signed:

As Representative for:

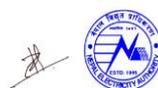
Address:

Date:



26.7 Technical particular for 132 kV Line, Bus coupler, Transformer Control & Relay Panels

DESCRIPTION	UNIT	REQD. Line/ Bus Coupler Panel	Offered Line / Bus Coupler Panel	REQD. Transformer Panel	Offered Transformer Panel
Manufacturer's name					
Country of Origin					
Applicable Standard					
Years of Manufacturing Experience	Years	Minimum 7		Minimum 7	
ISO Certificate Submitted					
Manufacturer's sales record submitted	Yes/No	Yes		Yes	
1. Type (simplex/duplex)					
2. Applicable standard		IEC		IEC	
3. Control panels furnished as per specification?	Yes/No	Yes		Yes	
4. Enclosure protection class	IP	IP 43		IP 43	
5. Thickness of sheet metal used					
a) Front and rear portion	mm	>=3		>=3	
b) Side, top & bottom covers	mm	>=2		>=2	
c) Doors	mm	>=3		>=3	
6. All instruments, meters, relays and control switches flush or semi-flush type?		flush type		flush type	
7. Ground bus					
a) Material		copper		copper	
b) Size	mm x mm	25 x 6		25 x 6	
8. Overall dimension of control boards (LxWxH)	mm				
9. Shipping data					
a) Size of the large package (LxWxH)	mm				
b) Weight of the heaviest package	Kg				
10. Delivery of equipment in months following award of contract. (Allowing time for approval of drawing)	month				
11. Indicating Instruments					



DESCRIPTION	UNIT	REQD. Line/ Bus Coupler Panel	Offered Line / Bus Coupler Panel	REQD. Transformer Panel	Offered Transformer Panel
a) Ammeter					
Manufacturer's designation / Model No.					
Type					
Accuracy class		0.5		0.5	
Scale					
- Type of scale	linear / non-linear				
- Range of indication (...../1 A CT operated)	A				
b) Voltmeter					
Manufacturer's designation / Model No.					
Type					
Accuracy class		0.5			
Scale					
- Range of indication	kV	0-150			
- Linear / non-linear					
c) Active power meter					
Manufacturer's designation / Model No.					
Type					
Manufacturer's designation	type				
Applicable standard		IEC		IEC	
Rated voltage	kV	132/√3: 0.11/√3		132/√3: 0.11/√3	
Rated current	A				
Current range (Transducer operation)	mA				
Accuracy class					
Scale					
- Type		Digital		Digital	



DESCRIPTION	UNIT	REQD. Line/ Bus Coupler Panel	Offered Line / Bus Coupler Panel	REQD. Transformer Panel	Offered Transformer Panel
- Range of indication	MW	100-0-100 200-0-200		0-30 0-60	
- Linear / non-linear					
d) Frequency meter				-	
Manufacturer's designation / Model No.				-	
Range of indication	Hz	47-53		-	
e) Energy Meter					
Manufacturer / Model No.					
Type		electronic 3- ph, 4 wire		electronic 3- ph, 4 wire	
Applicable standard		IEC		IEC	
Class of accuracy		0.2		0.2	
Import and export meter provided	Yes/No	Yes		Yes	
Rated voltage	kV	132/√3: 0.11/√3		132/√3: 0.11/√3	
Rated current	A				
VA burden	VA				
f) ANNUNCIATORS					
Manufacturer's designation / Model No.					
Type		numeric		numeric	
Number of inputs (annunciator /event)					
Number of active points	No.	18		24	
Number of rows	No.	3		3	
Number of columns	No.	6		8	
Type of mounting		flush		flush	
Replacement of individual inscription plates and lamps from front panel possible?	Yes/No	Yes		Yes	
Sequence of operation as per specifications	Yes/No	Yes		Yes	



DESCRIPTION	UNIT	REQD. Line/ Bus Coupler Panel	Offered Line / Bus Coupler Panel	REQD. Transformer Panel	Offered Transformer Panel
g) PHASE OVERCURRENT RELAYS: (Directional & Non-directional)					
Manufacturer's designation / Model No.					
Type		<i>numeric</i>		<i>numeric</i>	
Applicable standards		<i>IEC</i>		<i>IEC</i>	
Triple pole or single pole		<i>Triple pole</i>		<i>Triple pole</i>	
Continuous overload capacity	x In				
Current setting range	% of rated current	<i>20 - 200%</i>		<i>20 - 200%</i>	
Operating time at 10 times current setting	sec	<i>3</i>		<i>3</i>	
Reset time	ms				
Characteristics					
- IDMT(standard inverse)					
- IDMT(very inverse)					
- IDMT(extremely inverse)					
- Definite time					
Instantaneous unit provided	Yes/No	<i>Yes</i>		<i>Yes</i>	
- Current setting range	% of rated current				
Operating time	ms				
h) GROUND OVER CURRENT RELAYS (Directional & Non-directional)					
Manufacturer's designation / Model No.					
Type		<i>numeric</i>		<i>numeric</i>	
Applicable standards		<i>IEC</i>		<i>IEC</i>	
Single pole/Triple pole		<i>three pole</i>		<i>three pole</i>	
Continuous overload capacity	x In				



DESCRIPTION	UNIT	REQD. Line/ Bus Coupler Panel	Offered Line / Bus Coupler Panel	REQD. Transformer Panel	Offered Transformer Panel
Current setting range	% of rated current	10 - 80%		10 - 80%	
Operating time at 10 times current setting	sec	3		3	
Reset time	ms				
Characteristics					
- IDMT(standard inverse)		IDMT		IDMT	
- IDMT(very inverse)		(standard inverse)		(standard inverse)	
- IDMT(extremely inverse)					
Definite time					
Instantaneous unit provided	Yes/No	Yes		Yes	
- Current setting range	% of rated current				
Operating time	ms				
i) BUS / TRANSFORMER DIFFERENTIAL RELAY					
Manufacturer's designation / Model No.					
Applied standards		IEC		IEC	
Type		numeric		numeric	
Current magnitude difference setting range	% of rated secondary current				
j) SYNCHRO-CHECK RELAY					
Manufacturer's designation / Model No.					
Applied standards		IEC			
Type		numeric			
Rated input measuring voltage	V				
Voltage magnitude difference setting range	% of Vn	5%-30% of Vn			



DESCRIPTION	UNIT	REQD. Line/ Bus Coupler Panel	Offered Line / Bus Coupler Panel	REQD. Transformer Panel	Offered Transformer Panel
Phase angle difference setting range	Degrees	5 ⁰ - 30 ⁰			
Frequency difference setting range	Hz	0.05 - 0.5			
Operating time	ms				
Reset time	ms				
Specify whether each relay incorporate with the following options of reclosing on:					
- Dead bus-live line	Yes/No	Yes			
- Dead line - live bus	Yes/No	Yes			
If the options of reclosing on dead bus- live line and dead line- live bus are separately furnished and mounted, specify: - type.					
-Voltage rating	V				
k) AUXILIARY TRIPPING & LOCKOUT RELAYS					
Manufacturer's designation / Model No.					
Applicable standards		IEC		IEC	
Type		numeric		numeric	
Operating time	ms				
l) BREAKER FAILURE RELAY					
Manufacturer's designation / Model No.					
Applicable standards		IEC		IEC	
Type		numeric		numeric	
Setting range	A				



DESCRIPTION	UNIT	REQD. Line/ Bus Coupler Panel	Offered Line / Bus Coupler Panel	REQD. Transformer Panel	Offered Transformer Panel
- number of trip steps	No.				
- adjustable time of 1st step	ms				
- adjustable time of 2nd step	ms				
- both in steps	ms				
Operating times					
- maximum operating time	ms				
- reset time	ms				
m) DISTANCE RELAY					
Manufacturer's designation / Model No.					
Applicable standards		IEC			
Type		numeric			
No of zones				-	
- forward direction		3			
- reverse direction		1			
- Zone reach setting ranges including steps				-	
- Zone 1	Ω/phase			-	
- Zone 2	Ω/phase			-	
- Zone3	Ω/phase			-	
- Reverse Zone	Ω/phase			-	
Zone timer setting ranges including steps				-	
- Zone 2	sec			-	
- Zone 3	sec			-	
- Reverse Zone	sec			-	
Directional sensitivity				-	
- Single phase and phase to phase faults				-	
- Three phase faults				-	
Are the following features incorporated in each distance relay?				-	



DESCRIPTION	UNIT	REQD. Line/ Bus Coupler Panel	Offered Line / Bus Coupler Panel	REQD. Transformer Panel	Offered Transformer Panel
Instantaneous tripping when closing on three phase zero volt bolted fault	Yes/No	Yes		-	
Carrier auxiliary relays for additional following carrier transfer trip schemes				-	
- Zone acceleration	Yes/No	Yes		-	
- Permissive under reaching	Yes/No	Yes		-	
- Permissive overreaching	Yes/No	Yes		-	
Auxiliary tripping relays	Yes/No	Yes		-	
Single pole tripping and reclosing scheme	Yes/No	Yes		-	
Operation indicators for each function	Yes/No			-	
Alarm for auxiliary DC voltage failure	Yes/No			-	
Built-in test facilities	Yes/No			-	
Power swing blocking facility	Yes/No	Yes		-	
VT supply supervision facility	Yes/No	Yes		-	
Specify whether the distance relay is insensitive to:				-	
-Frequency changes	Yes/No			-	
-Power swing (Hunting)	Yes/No			-	
-Capacitive loading	Yes/No			-	
FAULT LOCATOR (inbuilt / separate)		Inbuilt in distance relay		-	
Accuracy	%	< 3 %		-	
Calculating time	ms	< 20		-	
Does the fault locator incorporate following features:				-	
- Independent of the fault type	Yes/No	Yes		-	
- phase selection indication	Yes/No	Yes		-	
Mis-operation protection for loss-of-potential due to short circuit in the secondary of CVT	Yes/No	Yes		-	



DESCRIPTION	UNIT	REQD. Line/ Bus Coupler Panel	Offered Line / Bus Coupler Panel	REQD. Transformer Panel	Offered Transformer Panel
m) Multifunction Meter					
Manufacturer designation / Model No.					
Applicable Standard					
Type					
Functions available					
Communication with SCADA / RTU					

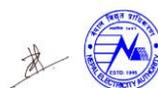
Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

Date:



26.8 Technical particular for 33 kV Line Control & Relay Panels

DESCRIPTION	UNIT	REQD. Line Panel	Offered Line Panel	REQD. Transformer Panel	Offered Transformer Panel
Manufacturer's name					
Country of Origin					
Applicable Standard					
Years of Manufacturing Experience	Years	Minimum 7		Minimum 7	
ISO Certificate Submitted					
Manufacturer's sales record submitted	Yes/No	Yes		Yes	
1. Type (simplex/duplex)		simplex		simplex	
2. Applicable standard		IEC		IEC	
3. Control panels furnished as per specification?	Yes/No	Yes		Yes	
4. Enclosure protection class	IP	IP 43		IP 43	
5. Thickness of sheet metal used					
a) Front and rear portion	mm	>=3		>=3	
b) Side, top & bottom covers	mm	>=2		>=2	
c) Doors	mm	>=3		>=3	
6. All instruments, meters, relays and control switches flush or semi-flush type?		flush type		flush type	
7. Ground bus					
a) Material		copper		copper	
b) Size	mm x mm	25 x 6		25 x 6	
8. Overall dimension of control boards (LxWxH)	mm				
9. Shipping data					
a) Size of the large package (LxWxH)	mm				
b) Weight of the heaviest package	Kg				
10. Delivery of equipment in months following award of contract. (Allowing time for approval of drawing)	month				
11. Indicating Instruments					



DESCRIPTION	UNIT	REQD. Line Panel	Offered Line Panel	REQD. Transformer Panel	Offered Transformer Panel
a) Ammeter					
Manufacturer's designation / Model No.					
Type					
Accuracy class		0.5		0.5	
Scale					
- Type of scale	linear / non-linear				
- Range of indication (...../1 A CT operated)	A				
b) Voltmeter					
Manufacturer's designation / Model No.					
Type					
Accuracy class		0.5			
Scale					
- Range of indication	kV	0-40			
- Linear / non-linear					
c) Active power meter					
Manufacturer's designation / Model No.					
Type					
Manufacturer's designation	type				
Applicable standard		IEC		IEC	
Rated voltage	kV	$33/\sqrt{3}$: $0.11/\sqrt{3}$		$33/\sqrt{3}$: $0.11/\sqrt{3}$	
Rated current	A				
Current range (Transducer operation)	mA				
Accuracy class					
Scale					
- Type		Digital		Digital	



DESCRIPTION	UNIT	REQD. Line Panel	Offered Line Panel	REQD. Transformer Panel	Offered Transformer Panel
- Range of indication	MW				
- Linear / non-linear					
d) Energy Meter					
Manufacturer's designation / Model No.					
Type		electronic 3- ph, 4 wire		electronic 3- ph, 4 wire	
Applicable standard		IEC		IEC	
Class of accuracy		0.2		0.2	
Import and export meter provided	Yes/No	Yes		Yes	
Rated voltage	kV	$33/\sqrt{3}$: $0.11/\sqrt{3}$		$33/\sqrt{3}$: $0.11/\sqrt{3}$	
Rated current	A				
VA burden	VA				
f) ANNUNCIATORS					
Manufacturer's designation / Model No.					
Type		numeric		numeric	
Number of inputs (annunciator /event)					
Number of active points	No.				
Number of rows	No.				
Number of columns	No.				
Type of mounting		flush		flush	
Replacement of individual inscription plates and lamps from front panel possible?	Yes/No	Yes		Yes	
Sequence of operation as per specifications	Yes/No	Yes		Yes	
g) PHASE OVERCURRENT RELAYS: (Non-directional)					
Manufacturer's designation / Model No.					



DESCRIPTION	UNIT	REQD. Line Panel	Offered Line Panel	REQD. Transformer Panel	Offered Transformer Panel
Type		numeric		numeric	
Applicable standards		IEC		IEC	
Triple pole or single pole		Triple pole		Triple pole	
Continuous overload capacity	x In				
Current setting range	% of rated current	20 - 200%		20 - 200%	
Operating time at 10 times current setting	sec	3		3	
Reset time	ms				
Characteristics					
- IDMT(standard inverse)		IDMT		IDMT	
- IDMT(very inverse)		(standard		(standard	
- IDMT(extremely inverse)		inverse)		inverse)	
- Definite time					
Instantaneous unit provided	Yes/No	Yes		Yes	
- Current setting range	% of rated current				
Operating time	ms				
h) GROUND OVER CURRENT RELAYS (Directional & Non-directional)					
Manufacturer's designation / Model No.					
Type		numeric		numeric	
Applicable standards		IEC		IEC	
Single pole/Triple pole		three pole		three pole	
Continuous overload capacity	x In				
Current setting range	% of rated current	10 - 80%		10 - 80%	
Operating time at 10 times current setting	sec	3		3	



DESCRIPTION	UNIT	REQD. Line Panel	Offered Line Panel	REQD. Transformer Panel	Offered Transformer Panel
Reset time	ms				
Characteristics - IDMT(stand. inverse) - IDMT(very inverse) - IDMT(extm. inverse) Definite time		IDMT (standard inverse)		IDMT (standard inverse)	
Instantaneous unit provided	Yes/No	Yes		Yes	
- Current setting range	% of rated current				
Operating time	ms				
i) TRANSFORMER DIFFERENTIAL RELAY					
Manufacturer's designation / Model No.					
Applied standards				IEC	
Type				numeric	
Current magnitude difference setting range	% of rated sec. current				
k) AUXILIARY TRIPPING & LOCKOUT RELAYS					
Manufacturer's designation / Model No.					
Applicable standards		IEC		IEC	
Type		Numerical		Numerical	
Operating time	ms				
l) BREAKER FAILURE RELAY					
Manufacturer's designation / Model No.					
Applicable standards		IEC		IEC	
Type		Numerical		Numerical	
Setting range	A				



DESCRIPTION	UNIT	REQD. Line Panel	Offered Line Panel	REQD. Transformer Panel	Offered Transformer Panel
Trip steps	No.				
- number of trip steps	ms				
- adjustable time of 1st step	ms				
- adjustable time of 2nd step					
- both in steps	ms				
Operating times					
- max. operating time	ms				
- reset time	ms				
j) OVERVOLTAGE PROTECTION RELAY					
Manufacturer's designation / Model No.					
Applied standards	IEC				
Type	numeric				
Operating Range					
Operating time					

Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

Date:





26.9 Guarantee technical particular for battery and battery charger

26.9.1 Technical Particulars of 110V & 48V Battery

DESCRIPTION	UNIT	REQD.110 V	OFFERED DATA 110 V	REQD. 48 V	OFFERED DATA 48 V
Manufacturer’s name					
Country of Origin					
Applicable Standard					
Years of Manufacturing Experience	Years	Minimum 7		Minimum 7	
ISO Certificate Submitted					
Manufacturer’s sales record submitted	Yes/No	Yes		Yes	
1. Type of battery		Maintenance free valve regulated lead Acid		Maintenance free valve regulated lead Acid	
2. Applicable standards		IEC		IEC	
3. Number of cells	No.				
4. Number of units	No.				
5. Number of cells in a unit	No.				
6. Nominal voltage rating	V	110		48	
7. Nominal capacity at 27°C at 10 h discharge time to cell end voltage 1.85	AH				
8. Ampere capacity at 27°C at 15 min discharge time to cell end voltage 1.75	A				
9. Battery construction (type)					
10. Type of plates					
a) Positive (flat or tubular)					
b) Negative					
11. Type of rack					
- Rack dimensions					
12. Float charging voltage	V				
13. Equalizing charging voltage	V				
14. Internal resistance of one cell	ohm				
15. Short circuit current withstand capacity	A				
16. Float charging current	A				



DESCRIPTION	UNIT	REQD.110 V	OFFERED DATA 110 V	REQD. 48 V	OFFERED DATA 48 V
17. Charging current of a fully discharged battery at 8 hour charging rate	A				
18. End voltage of each cell	V				
19. Charging efficiency of the battery	%				
10. Max. duration in month, the battery can be kept without charging	month				
20. Battery life (guaranteed value)	years				
		Yes		Yes	
21. Delivery of equipment in months following award of contract (allowing time for approval of drawings)	month				

26.9.2 Technical Particulars of 110V & 48V Battery Chargers

DESCRIPTION	UNIT	REQD.110 V	OFFERED DATA 110 V	REQD. 48 V	OFFERED DATA 48 V
Manufacturer’s name					
Country of Origin					
Applicable Standard					
Years of Manufacturing Experience	Years	Minimum 7		Minimum 7	
ISO Certificate Submitted					
Manufacturer’s sales record submitted	Yes/No	Yes		Yes	
1. Type of charger		constant voltage		constant voltage	
2. Applicable standard		IEC		IEC	
3. Manufacturer’s designation as per submitted catalogue		To be Furnished		To be Furnished	
4. Output rating	A				
5. Range of DC voltage variation	±V				



DESCRIPTION	UNIT	REQD.110 V	OFFERED DATA 110 V	REQD. 48 V	OFFERED DATA 48 V
6. Maximum AC input	kVA				
7. Input Voltage / phase	V	400 V, 3 ph		400 V, 3 ph	
8. Ripple	%	< 2%		< 2%	
9. Efficiency of charger at 100 % output	%				
10. Temperature rise above ambient of 40 degree C					
a) Solid state elements	°C				
b) Wound elements	°C				
11. Voltage regulation	%	+3% -2% max		+3% -2% max	
12. Float voltage adjustment					
13. Equalizing voltage adjustment					
14. Auto equalizing charge provided?	Yes/No	Yes		Yes	
15. Timer for equalizing charge Provided?	Yes /No	Yes		Yes	
16. End switching to limit equipment	type				
17. Manual over-ride switch for selection of float/equalizing charge provided?	Yes /No	Yes		Yes	
18. Delivery of equipment in months following award of contract (allowing time for approval of drawings)	month				

Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

Date:



26.10 Guaranteed technical particular for station grounding system

26.10.1 Technical Particular for Station Grounding System

DESCRIPTION	Size	Material	OFFERED DATA
Main ground grid conductor material	Min 100 sq mm	Copper	
Main Earthing Conductor to be buried in ground	Min 100 sq mm	Copper	
Conductor above ground& earthing leads (for equipment)	>100 sq mm	Copper	
Conductor above ground& earthing leads(for columns & aux. structures)	>100 sq mm	Copper	
Earthing of indoor LT panels, Control panels and out door marshalling boxes, MOM boxes, Junction boxes& Lighting Panels etc.	>100 sq mm	Copper	
Rod Earth Electrode	16 mm dia, 3000 mm long	Copper Clad Steel	
. Pipe Earth Electrode (in treated earth pit) as per IS.	40 mm dia, 3000mm long	Copper Clad Steel	
Earthing for motors	100 sq mm	Copper	
Earthing conductor along outdoor cable trenches	100 sq mm	Copper	
Earthing of Lighting Poles	20 mm dia 3000 mm long	Copper Clad steel	
Earthing system designed for	≤ 1 ohm		



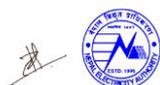
26.11 Guaranteed technical particular for GIS EQUIPMENTS

132kV GIS (132kV CIRCUIT BREAKER)				
	DESCRIPTION	UNIT	NEA REQ	DATA to be Filled By Bidders
				132kV
1	Manufacturer and Country of Origin			
2	Year of manufacturing experience	Years	7	
3	Manufacturing's Designation as per submitted catalogue			
4	Applicable standard		IEC	
5	Type		GIS	
6	Poles		Three pole	
8	Rated Voltage	kV	132	
9	Rated current			
9.1	Continuous at 50 degree ambient	A	1250 (B/C)	
9.2	Short time for 1 sec at max. kV	kA	31.5	
10	Frequency	Hz	50	
11	Temperature rise above 45 degree C ambient		As per IEC	
11.1	Contacts	°C	65	
11.2	Terminals	°C	65	
12	Rated short circuit breaking current	kA	31.5	
13	Rated short circuit making current			
13.1	Peak	kA	80	
14	Interrupting time at 100% capacity			
14.1	Maximum opening time	mS		
14.2	Total interrupting time	mS		
15	Closing time	mS		
17	Maximum capacitive current breaking capacity (rms)	A		
18	Insulation level			
18.1	Impulse withstand voltage (crest)	kV	650	
18.2	Power frequency withstand voltage	kV	275	
19	Operating mechanism			
19.1	Type		Spring operated	
19.2	Number of mechanism per breaker		1	
19.3	Single/three phase auto-reclosure		3	
19.4	Operating voltage of closing and tripping coil	V DC	220	
19.5	Operaing voltage range -Closing -Tripping	% of rated voltage	85-110% 70-110%	
19.6	Closing and tripping current	A		
19.7	Spring charging motor rating -Capacity -Rated voltage	kW V	220V DC	
19.8	Time required by motor to charge the spring completely	Sec	<30	
20	Anti pumping device provided	Yes/No	Yes	



21	Trip-free feature provided	Yes/No	Yes	
22	Number of N.C. contacts	No.	8	
23	Number of N.O. contacts	No.	8	

132kV DISCONNECTING SWITCH & EARTH SWITCH				
	DESCRIPTION	UNIT	NEA REQ	DATA to be Filled
			132kV	132kV
1	Applicable standard		IEC	
2	Type		3 pole group operated	
4	Rated Voltage			
4.1	Nominal	kV	132	
4.2	Maximum	kV	145	
5	Rated current			
5.1	Continuous at 50°C ambient	A	1250 / 2000	
5.2	Short time for 1 sec at max. kV	kA	31.5	
6	Temperature rise above 45 degree C ambient at normal rated current		As per IEC	
6.1	Contacts	°C		
6.2	Current carrying parts	°C		
7	Insulation level			
7.1	Impulse withstand voltage(peak)	kV	650	
7.2	Power frequency withstand voltage (1min, rms)	kV	275	
8	Main contacts			
	- Material of fixed contacts		Provide	
	- Material of moving contacts		Provide	
	- Material of the contacts of the earthing switch		Provide	
9	Auxiliary power supply			
9.2	Control circuit	V, DC	220V DC	
9.3	Operating motor	V, phase	220V DC	
10	Number of N.C. contacts	No.	4 min	
11	Number of N.O. contacts	No.	4 min	
12	Operating mechanism		Motor & Manual Operated	
	Operating motor	W		
13	Types of interlocks furnished		Electrical and manual	
14	Earthing Switch			
14.1	Operating Mechanism		Manual and Motor Operated	
	Operating motor	W		
14.2	Type of Interlocks		Electrical and manual	
15	Number of N.C. contacts	No.	4	
16	Number of N.O. contacts	No.	4	
17	Operating duty cycle		O - 0.3sec – CO - 3min – CO	



132kV CURRENT TRANSFORMER				
	DESCRIPTION	UNIT	NEA REQ	DATA to be Filled
			132kV	132kV
1	Type		Indoor, Metal enclosed	
2.	Number of cores in each CT	NO.	5	
3.	Rated Primary Voltage			
3.1	Nominal	kV	132	
3.2	Maximum	kV	145	
4.	Insulation level			
4.1	Impulse withstand voltage(peak)	kV	650	
4.2.	Power frequency withstand voltage (1min, rms)	kV	275	
5.	Short time thermal rating	kA	31.5	
6.	Rated Peak Short circuit Current	kA	80	
7.	Rated VA burden for each core	VA	As per PSR	
8.	Accuracy class	5P20 for protection 0.2 for metering PS for diff / Bus		
9.	Current Ratio	A	As per Technical Data in specification	
10.	Overvoltage factor		1.1	
10a	Rated continuous thermal current		1.2x	

132kV VOLTAGE TRANSFORMER				
	DESCRIPTION	UNIT	NEA REQ	DATA to be Filled
1	Applicable standard		IEC	
2	Type		Indoor Metal enclosed	
3	Rated primary voltage			
3.1	Nominal	kV	132/√3	
3.2	Maximum voltage	kV	145/√3	
4	Insulation level			
4.1	mpulse withstand voltage (primary)	kV	650	
4.2	Power frequency withstand (1 min. rms) (primary)	kV	275	
5	Rating			
5.1	Voltage ratio	kV	132/√3: 0.11/√3	
5.2	Rated burden	VA	50	
5.3	Accuracy class		3P & 0.2 for metering	
5.4	Overvoltage factor			
	- Continuous		1.1	
	- 30 seconds		1.5	
5.5	Number of secondary windings		2/3	

132 kV LIGHTNING ARRESTOR				
	DESCRIPTION	UNIT	NEA REQ	DATA to be Filled
			132kV	132kV
1	Type		Outdoor, gapless, Metal-Oxide	



2	Voltage rating of L.A	kV	120	
3	Nominal discharge current	kA	10	
4	Surge counter with insulating base furnished	Yes/No	Yes	
5	Insulation level			
	a) Impulse withstand voltage(peak)	kV	650	
	b) Power frequency withstand voltage (1min, rms)	kV	275	

26.11.6 GAS INSULATED BUS				
1	Bus arrangement formation		Horizontal	
2	Bus Duct Proposed	1 or 3 Phase		

GENERAL				
1	Gas density detector provided	Yes/No	Yes	
2	Operation counter provided	Yes/No	Yes	
3	Space heater provided for cubicle	Yes/No	Yes	
4	Enclosure Protection		IP55W	
5	Number of possible operations without maintenance under: Rated short circuit breaking current Rated normal current	No No	10 2000	
6	Rated SF6 pressure	kgf/cm2		
7	Guaranteed SF6 losses/year	kg	0.5% per Annum	
8	Padlocking provision for local cubicle	Yes/No	Yes	
9	UHF sensors for PD detection	Yes/No	Yes	
10	Numbers of sensors			
10.1	Total weight of the circuit breaker	Kg		
10.2	Mechanical dimension(LXWXH)	mm x mm x mm		
10.3	Delivery of equipment in months following award of contract	(Allowing time for approval of drawing)		
10.4	Is manufacturer is ISO 9001 holder?	Yes/No	Yes	
11	Type test certificate submitted?	Yes/No	Yes	
12	Has manufacturer exported units?	Yes/No	Yes	
13	Technical literature / drawings submitted?	Yes/No	Yes	

Deviations from technical requirements:

Signed..... As representative for.....
 Address..... Date.....



This schedule contains GTP for all the possible parameters of SCADA Equipments BCU generally have. Instead of simply confirming, the Bidder shall fill in the particulars against appropriate items in respect of each rating and type of equipment offered in the broad categories listed below along with supporting authentic technical documents. However the years of manufacturing experience shall be minimum 7 years.

(In the absence of GTP in the below mentioned format, the purchaser has every right to evaluate the product accordingly and bidder cannot raise any objection against any point of the technical scrutiny.)

GUARANTEED TECHNICAL PARTICULARS		
SUBSTATION AUTOMATION SYSTEM		
Sr. No.	Parameters	To be filled by bidder
A	BCU	
1	Make and Type	
2	Numerical Technology	
3	Modular design	
4	Nos of Analogue Input	
5	Nos of Digital Input	
6	Nos of Output	
7	Data Storage	
8	Self- monitoring	
9	Power supply	
10	IEC 61850 Protocol Compatibility	
11	Binary Input processing & Nos	
12	Analogue Input processing & Nos	
13	Measured value acquisition	
14	Derived values	
15	Digital Outputs	
16	Sub-station/bay inter-locking	
17	Trip Circuit Supervision	
18	Event Logging Nos	
19	Disturbance files & record of wave forms , storage capacity	
20	Gateway support	
21	Local control, Operation and Display	
22	Contact bouncing in digital inputs shall not be assumed as change of state	



23	I/O processing capacities	
24	Internal Ethernet switches	
	Nos of port –	
26	Environmental conditions	
27	Mounting & design	
28	Warranty	
	Bay control functions	
	Control mode selection	
	Command supervision	
	Commands for	
32	Local communication facility through HMI	
	Local communication facility provided on front side for	
34	Compatibility with owner’s SCADA for remote control	
35	Extension possibilities with additional I/O's inside the unit or via fiber-optic communication and process bus.	
B	Gateway	
1	Power supply	
2	Processor Type	
3	Chipset	
4	Memory Type	
5	Standard memory	
6	Memory slots	
7	Internal hard disk drive	
8	Hard disk drive speed	
9	Optical drives	
10	Video adapter, bus	
11	Expansion slots	
12	Network Interface	
13	External I/O ports	
14	Operating system installed.	
15	Make	
16	Antivirus s/w	



TECHNICAL DATA SHEET (To Be Completed By the Tenderer)		
SUBSTATION AUTOMATION SYSTEM		
D	HMI SERVER	
1	Power supply	
2	Processor Type	
3	Chipset	
4	Memory Type	
5	Standard memory	
6	Memory slots	
7	Memory upgrade	
8	Internal hard disk drive	
9	Hard disk drive speed	
10	Optical drives	
11	Flexible disk drives	
12	Chassis type	
13	Video adapter, bus	
14	Expansion slots	
15	Audio	
16	Modem	
17	Network Interface	
18	External I/O ports	
19	Monitor	
20	Keyboard	
21	Pointing Device	
22	Operating system installed.	
23	Other	
24	Warranty	
25	UPS	
26	Make	
27	Antivirus s/w	



SUBSTATION AUTOMATION SYSTEM		
E	DR WORK STATION	
1	Power supply	
2	Processor Type	
3	Chipset	
4	Memory Type	
5	Standard memory	
6	Memory slots	
7	Memory upgrade	
8	Internal hard disk drive	
9	Hard disk drive speed	
10	Optical drives	
11	Flexible disk drives	
12	Chassis type	
13	Video adapter, bus	
14	Expansion slots	
15	Audio	
16	Modem	
17	Network Interface	
18	External I/O ports	
19	Monitor	
20	Keyboard	
21	Pointing Device	
22	Operating system installed.	
23	Other	
24	Warranty	
25	UPS	
26	Make	
27	Antivirus s/w	



TECHNICAL DATA SHEET (To Be Completed By the Tenderer)		
SUBSTATION AUTOMATION SYSTEM		
F	LINE INTERFACE UNIT	
1	Area Network Type	
2	Power Supply	
3	Protocol/ Network	
4	Module	
5	No. of Ports	
6	Ports/Interfaces	
7	Features	
8	Make	
9	Manufacturer Warranty	
10	Suitability for Nos of F.O. Inlet/Outlet	
11	IEC 61850 Compatibility	
G	COLOUR LASER JET PRINTER	
1	Model	
2	Power Supply	
3	Black Print Speed	
4	Black Print Resolution	
5	Print Memory	
5	Processor	
6	Supported paper sizes	
7	Print technology	
8	Pages quantity	
9	Paper handling	
10	Connectivity	
11	Manufacturer Warranty	
12	Networking:	
13	Supporting OS	
14	Make	
15	Suitability to print all types of drafts and graphics	



SUBSTATION AUTOMATION SYSTEM		
H	LASER JET PRINTER	
1	Model	
2	Power Supply	
3	Black Print Speed	
4	Black Print Resolution	
5	Print Memory	
6	Processor	
7	Supported paper sizes	
8	Print technology	
9	Pages quantity	
10	Paper handling	
11	Connectivity	
12	Manufacturer Warranty	
13	Networking:	
14	Supporting OS	
15	Make	
16	Suitability to print all types of drafts and graphics	

Deviations from technical requirements and reasons for such deviations:

Signed.....

As representative for.....

Address.....

Date.....





26.12 General technical particular for Power & Control cable**26.12.1 Technical Particular for Fiber Optic Cable**

S.N.	DESCRIPTION	UNIT	OFFERED DATA
1	Galvanized steel wires/Aluminium Clad Steel wire		
1.1	No. of and Diameter	Nos/mm	
1.2	Lay Outer layer	Mm	
1.3	Steel Quality (Grade)		
1.4	Normal Cross Sectional area	mm ²	
1.5	Weight	Kg/m	
2	Overall diameter	mm	
3	Ultimate tensile strength	Kg	
4	Tension in steel air at every day temperature	kg	
5	Equivalent modulus of elasticity	kg/m ²	
6	Maximum Working tension	kg	
7	Coefficient of linear expansion	/°C	
8	Standard length on each drum	km	
9	Maximum weight of Cable drum	kg	
10	Optical Ground Wire		
10.1	Optical fiber type	mode	
10.2	No. of optical fiber	nos	
10.3	Lay of outmost layer		
10.4	Cross sectional area	mm ²	
10.5	Fiber Diameter	µm	
	a. Mode field diameter		
	b. Cladding diameter		
10.6	Standard		
	a. Single mode fiber		
	b. Optical fiber cable		
	c. Stranding part		
11	Optical attenuation at wave length		
11.1	a. 1310nm	dB/km	
11.2	b. 1550nm	dB/km	



S.N.	DESCRIPTION	UNIT	OFFERED DATA
12	Short circuit carrying capacity	kA*sec	
13	Fiber optic fitting and accessories		
13.1	a. Suspension assembly		
13.2	b. Tension assembly		
14	Vibration dampers		
14.1	a. Type		
14.2	b. Weight	kg	
14.3	Distance from clamp mouth to attachment point	mm	
	a. 1 st damper		
	b. 2 nd damper (if required)	mm	

26.12.2 Technical Particular for Low Voltage Power Cable

DESCRIPTION	UNIT	REQ.	DATA
Manufacturer and Country of Origin			
Type		Armoured	
Applicable standard		IEC	
Voltage rating			
a) Suitable for max. system voltage	kV	1.1	
Conductor material		Copper	
Insulation			
- Material		XLPE	
Overall jacket			
- Fire retardative		Yes	
- Moisture resistant		Yes	
- Rodent Protection		Yes	
- Anti termite Protection		Yes	

26.12.3 Technical Particular for Control Cable

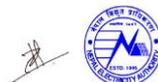
DESCRIPTION	UNIT	REQ.	DATA
Manufacturer and Country of Origin			
Type		Armoured	



DESCRIPTION	UNIT	REQ.	DATA
Applicable standard		IEC	
Voltage rating			
a) Suitable for max. system voltage	kV	1.1	
Conductor material		Copper	
Insulation			
- Material		Polyethylene	
Overall jacket			
- Fire retardative		Yes	
- Moisture resistant		Yes	
Rodent Protection		Yes	
Anti termite Protection		Yes	

26.12.4 Technical Particular for 11 kV Power Cable (i) 400 sq mm single core

DESCRIPTION	UNIT	REQ.	DATA
Manufacturer and Country of Origin			
Type		Armoured	
Applicable standard		IEC	
Voltage rating			
a) Suitable for max. system voltage	V	12,000	
b) Voltage grade of the cable (U _o /U)	kV	17/10	
Conductor		Copper	
Conductor Screen		XLPE	
Insulation		Extruded Semi-conducting	
Insulation Screen		Extruded Semi-conducting + Copper tape	
Inner Sheath		PVC	
Armour		Hard Drawn Aluminium round wire	
Overall jacket		PVC, Black Colour	



DESCRIPTION	UNIT	REQ.	DATA
- Fire retardative		Yes	
- Moisture resistant		Yes	
-Rodent Protection		Yes	

Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

Date:

26.12.5 Technical Particular for 11 kV Power Cable (ii) 240 sq mm three core

DESCRIPTION	UNIT	REQ.	DATA
Manufacturer and Country of Origin			
Type		Armoured	
Applicable standard		IEC	
Voltage rating			
a) Suitable for max. system voltage	V	12,000	
b) Voltage grade of the cable (Uo/U)	kV	17/10	
Conductor		Copper	
Conductor Screen		XLPE	
Insulation		Extruded Semi-conducting	
Insulation Screen		Extruded Semi-conducting + Copper tape	
Inner Sheath		PVC	
Armour		Hard Drawn Aluminium round wire	



DESCRIPTION	UNIT	REQ.	DATA
Overall jacket		PVC, Black Colour	
- Fire retardative		Yes	
- Moisture resistant		Yes	
-Rodent Protection		Yes	

Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

Date:

132 kV POWER CABLE

DESCRIPTION	UNIT	REQD.	OFFERED DATA
1. Manufacturer & country of origin			
2. Years of manufacturing experience	Years	7	
3. Type			
4. Reference standard		IEC	
5. Number of cores		single core	
6. Voltage rating			
a) Nominal System Voltage	kV	132	
b) Maximum system voltage	kV	145	
c) Voltage grade of cable (U ₀ /U)			
d) Rated voltage between conductor and screen	kV	145/√3	
e) Rated voltage between two conductors	kV	145	
f) Lightning impulse withstand voltage	kV,crest	650	
g) Power frequency withstand voltage	kV	275	
7. Maximum conductor temperature			
a) Continuous	°C	90	
b) Short time	°C		
8. Conductor material		Copper	



9. Conductor			
a) Cross section of conductor	mm ²	800	
b) Cross section of each wire	mm ²		
c) No. & diameter of wire in each conductor	No./ mm		
d) Class of stranding			
e) Insulation			
- Material		XLPE	
- Thickness	mm		
f) Overall jacket			
- Material		PVC	
- Thickness	mm		
g) Approximate overall diameter	mm		
h) Standard drum length	meter		
i) Net weight of cable in drum	kg		
j) Continuous current rating at 40 deg. C ambient	A		
-In ground	A		
-In duct	A		
k) Short circuit current			
DESCRIPTION	UNIT	REQD.	OFFERED DATA
- 0.1 sec.	kA	50	
- 2.0 sec. (Minimum kA)	kA	25	
l) Electrical parameter			
- Resistance / km	ohm		
- Reactance / km	ohm		
- Capacitance / km	micro F		
10. Armor sheath provided?	Yes/No	Yes	
11. Is manufacturer an ISO 9001 holder?	Yes/No	Yes	
12. ISO 9001 certificate submitted	Yes/No		
13. Delivery of equipment in months following award of contract (allowing time for approval of drawing)	month		



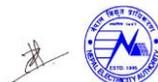
Deviations from technical requirements and the reasons for such deviations:

Signed _____

As representative for _____

Address _____

Date _____



33 kV POWER CABLE

	DESCRIPTION	UNIT	REQD.	OFFERED DATA
1	Manufacturer and Country of Origin			
2	Years of manufacturing experience		7	
3	Manufacturer's type designation			
4	Type		Armoured	
5	Applicable standard		IEC	
6	Voltage rating			
	a) Suitable for max. system voltage	kV	36	
	b) voltage grade of this cable	kV	19/33	
	c) Rated voltage between each conductor and screen	kV	$33/\sqrt{3}$	
	d) Rated voltage between two conductors	kV	33	
7	Conductor material		copper	
8	Insulating material		XLPE	
	Thickness			
9	Overall jacket material		PVC	
	Thickness			
10	Overall Cross sectional Area of the conductor of cable	Sq.mm	240	
11	Type of Cable		Single Core	
12	Continuous Current Rating at 45DegC Ambient Temperature in Duct	A		
13	Short Circuit Current rating	kA	> 25	
14	Fire Retardive	Yes	Yes	
15	Mositure Resistant	Yes	Yes	
16	Technical Leaflets provided	Yes / No	Yes	
17	Delivery of equipment in months following award of contract (Allowing time for approval of drawing)	month		

Deviations from technical requirements and the reasons for such deviations:

Signed _____

As representative for _____

Address _____



26.13 General technical particular for LT Transformer

26.13.1 Technical Particular for Station Service Transformer

DESCRIPTION	UNIT	REQ.	DATA
Manufacturer and Country of Origin			
Rated power	kVA	300	
Rated voltage		IEC	
Voltage rating			
a) Primary	kV	33	
b) Secondary	V	400/230	
Max system Voltage			
a) Primary	kV	36	
b) Secondary	V	400	
Conection			
-Primary / secondary		Delta /Y	
Cooling		ONAN	
Vector group		Dyn 11	
Rated impedance voltage		4.5 %	
Withstand Voltage			
-Primary	kV	95	
-Secondary	kV	3	
BIL of winding (primary)	kVpeak	250	
Off circuit tap changer		+/- 5%	
Max. noise level	dB		
No load loss	W		
Load loss	W		
Applicable standard		IEC	

Deviations from technical requirements and reasons for such deviations:

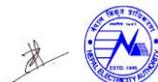


Signed:

As Representative for:

Address:

Date:



26.14 Guaranteed technical particular for 11kV Switchgear

26.14.1 Technical Particular for 11 kV Switchgear

S. No.	General Performance	Unit	Value	Bidder Data
Bus Bar				
	Years of Manufacturing Experience	Years	7	
1	Rated Frequency	Hz	50	
2	Voltage rating: a) Nominal system voltage b) Rated maximum voltage Rated Voltage	kV kV	11 12	
3	Insulation level a) Impulse withstand voltage b) Power-frequency withstand voltage (1 min.)	kV peak kV rms	95 28	
4	Rated Continuous Current	A	800	
5	Rated Short Time Current	kA	25	
6	Rated Duration of Short Circuit time	Sec	1	
7	Auxiliary supply a) Control circuit b) Space heater and auxiliary equipment.	V DC V AC	110 230/400V, 50 Hz	
8	Attitude at site	m	2200	
Circuit Breaker				
1	Rated Frequency	Hz	50	
2	Voltage rating: a) Nominal system voltage b) Rated maximum voltage Rated Voltage	kV kV	11 12	
3	Insulation level a) Impulse withstand voltage b) Power-frequency withstand voltage (1 min.)	kV peak kV rms	95 28	
4	Rated Continuous Current	A		
5	Rated Short Time Current	kA	25	
6	Rated Duration of Short Circuit time	Sec	1	
7	Internal Arc Fault Performance Time Standard	kA Sec	25 0.1 IEC 62271:200	
8	Operating Cycle		0-0.3s -CO-3 Min-	



S. No.	General Performance	Unit	Value	Bidder Data
9	Number of possible operations without maintenance : For breaker contact with: - Rated short circuit breaking current (25 kA) - Rated normal current - For mechanism			
10	Total maximum break time	ms	60	
11	Maximum make time	ms	120	
12	Additional Auxiliary Contacts		8 NO, 8 NC	
13	Spring charging motor	V DC	110	

Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

Date:



26.15 Technical particular for 132 kV BUS, Fittings and Insulators

DESCRIPTION	UNIT	REQ.	OFFERED DATA 132 KV	OFFERED DATA 33 KV
Years of Manufacturing Experience	Years	7		
1. ACSR CONDUCTOR				
Manufacturer and Country of Origin				
Type		<i>Twin Cardinal</i>		
Applicable standard				
No. of wires				
a) Aluminum	No.	54		
b) Steel	No.	7		
Cross section				
a) Aluminum	sq mm	484.5		
b) Steel	sq mm	62.81		
c) Complete conductor	sq mm	547.3		
Overall diameter				
a) Steel core	mm			
b) Complete conductor	mm			
Ultimate tensile strength	kg	15,381		
Weight	kg/km	1834		
2. SHIELD WIRE (If Applicable)				
Manufacturer and Country of Origin				
Type				
Applicable standard				
		<i>IEC</i>		
No. of wires	No.	7		
Nominal cross sectional area	sq mm	61.7		
Overall diameter	mm	10.05		
Ultimate tensile strength	kg	7,400		
Zinc coating	g/sq.m			
Equivalent modulus of elasticity	kg/mm ²	19,000		
Weight	kg/km			
3. ALUMINUM TUBULAR BUS				



DESCRIPTION	UNIT	REQ.	OFFERED DATA 132 KV	OFFERED DATA 33 KV
Manufacturer and Country of Origin				
Applicable standard				
Cross-section	mm ²			
Diameter inner / outer	mm			
Material				
4. FITTINGS				
Manufacturer and Country of Origin				
Applicable standards				
Material				
5. SUSPENSION/ TENSION INSULATOR STRING				
Manufacturer and Country of Origin				
Applicable standards				
Size of disc				
- Diameter	mm			
- Height	mm			
Number of units per string	No			
Combined mechanical and electrical failing load	kN			
Creepage distance per unit	mm			
Impulse withstand voltage	kV, crest			
Dry power frequency withstand voltage	kV			
Wet power frequency withstand voltage	kV			
Puncture voltage	kV			
6. POST INSULATOR				
Manufacturer				
Applicable standards		IEC		
Rated system voltage	kV			
Max. rated voltage	kV			
Unit size (Diameter)	mm			
Unit size (length)	mm			



DESCRIPTION	UNIT	REQ.	OFFERED DATA 132 KV	OFFERED DATA 33 KV
Creepage distance	mm			
Insulation level				
a) Impulse withstand voltage	kV, crest			
b) Power frequency withstand voltage (1 min rms)	kV			
Failing load (bending)	kg			
Failing load (torsion)	kg-m			

Deviations from technical requirements and reasons for such deviations:

Signed:

As Representative for:

Address:

Date:



VOLUME II OF III
SECTION-27-GENERAL TECHNICAL REQUIREMENT-FIBER OPTICS
COMMUNICATION



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SECTION - 27

FIBRE OPTIC BASED COMMUNICATION EQUIPMENTS

27.1 Introduction, General Information and General Requirement

This document describes the technical specifications for Communication Equipment which includes Fibre Optic Terminal Equipment for Establishment of Fibre Optic Communication System under the contract. This specification describes the functional and performance requirements of the system.

27.1.1 Scope and General Requirements

The broad scope of the procurement of this part includes the survey, planning, design, engineering, supply, transportation, and insurance, delivery at site, unloading, handling, storage, installation, termination, testing, training, and demonstration for acceptance, commissioning and documentation for:

- (i) SDH Equipment (STM-4 MADM upto 4 MSP Protected directions) along with suitable optical line interfaces & tributary cards.
- (ii) Local Craft Terminal (Laptop) with full operational programming software and data cables.
- (iii) All cabling, wiring, Digital Distribution Frame patch facilities, equipment MDF's and interconnections to the supplied equipment at the defined interfaces.
- (iv) MDF & DDF cross connects required to route and activate circuits.
- (v) System integration of the supplied subsystems and also integration with existing communication equipment such as SDH, MUX etc.
- (vi) System integration of the supplied equipments (termination equipment system) with existing equipments for seamless transmission of communication channel
- (vii) Integration of supplied system with the User equipments such as RTU/SASs, SCADA system, PLCC equipment etc.
- (viii) Maintenance of the supplied system

All other associated works/items described in the technical specifications for a viable and fully functional communication network.

27.1.2 General Requirements

The Contractor is encouraged to offer standard products and designs. However, the Contractor must conform to the requirements and provide any special equipment necessary to meet the requirements stated herein.



It should be noted that preliminary design information and bill of quantity (BOQ) specified in these specifications are indicative only. The Contractor shall verify the design data during the site surveys & detail engineering and finalise the BOQ as required for ultimate design & system performance.

The Bidder's proposal shall address all functional and performance requirements within this specification and shall include sufficient information and supporting documentation in order to determine compliance with this specification without further necessity for inquiries.

An analysis of the functional and performance requirements of this specification and/or site surveys, design, and engineering may lead the Contractor to conclude that additional items are required that are not specifically mentioned in this specification. The Contractor shall be responsible for providing at no added cost to the Employer, all such additional items and services such that a viable and fully functional communication equipment system is implemented that meets or exceeds the capacity, and performance requirements specified. Such materials and services shall be considered to be within the scope of the contract. To the extent possible, the Bidders shall identify and include all such additional items and services in their proposal.

All equipment provided shall be designed to interface with existing equipment and shall be capable of supporting all present requirements and spare capacity requirement identified in this specification.

The communication equipment shall be designed and provisioned for expansions and reconfigurations without impairing normal operation, including adding and removing circuits. The offered items shall be designed to operate in varying environments. Adequate measures shall be taken to provide protection against rodents, contaminants, pollutants, water & moisture, lightning & short circuit, vibration and electro-magnetic interference etc.

The Bidders are advised to visit sites (at their own expense), prior to the submission of a proposal, and make surveys and assessments as deemed necessary for proposal submission. The successful bidder (Contractor) is required to visit all sites. The site visits after contract award shall include all necessary surveys to allow the contractor to perform the design and implementation functions. The Contractor shall inform their site survey schedule to the Employer well in advance. The site survey schedule shall be finalised in consultation with the Employer. The Employer may be associated with the Contractor during their site survey activities.

After the site survey, the Contractor shall submit to the Employer a survey report on each link and site. This report shall include at least the following items:

- (a) Proposed layout of Equipment in the existing rooms and buildings.
- (b) Proposed routing of power, earthing, signal cables and patch cords etc.
- (c) Confirmation of adequacy of Space and AC/DC Power supply requirements
- (d) Proposals for new rooms/buildings if required



- (e) Identification of facility modifications if required
- (f) Identify all additional items required for integration for each site/location.

27.1.2.1 Synchronization of the Communication Network

The Contractor shall be responsible for synchronization of new communication equipment with existing network utilizing the existing clock (if available). The Contractor shall make an assessment of additional clock requirement for synchronization of the communication equipment.

27.1.2.2 Contractor's Responsibilities and Obligations

The Contractor shall be responsible for all cables and wiring associated with the equipment provided, both inside and outside buildings in accordance with technical specifications. The Contractor shall also be responsible for determining the adequacy of the local power source for the equipment and for wiring to it, with adequate circuit protective breakers. In addition, the Contractor shall be responsible for shielding equipment and cabling to eliminate potential interference to or from the equipment, and for earthing all cabinets and shields.

Contractor's obligations include, but are not limited to, the following:

- (1) Site visits, and surveys, necessary to identify and provide all equipment needed to implement the network.
- (2) Equipment Engineering and design specific to each location including review of, and conformance with local environmental and earthing considerations.
- (3) Overall integration of communication equipments/subsystem procured in present and existing network.
- (4) All cabling, wiring including supply, laying and termination etc of the cables, and distribution frame at wideband nodes required for full interconnectivity and proper operation of the telecommunications network including equipment supplied under this package and the connectivity and interfacing of user equipment.
- (5) Installation and integration of network management software, hardware and firmware (as applicable).
- (6) Project management, project scheduling, including periodic project reports documenting progress, review meeting during the contract period.
- (7) Engineering and technical assistance during the contract and warranty period.
- (8) Implement all minor civil works and identify any major civil works i.e., expansion or construction of rooms, trenches necessary for installation of proposed equipment and provide the details of such work to the Employer.



- (9) Factory and site testing of all hardware, software, and firmware provided.
- (10) Provide documented evidence of satisfactory Type Test performance to the Employer and if required by The Employer, conduct type test.
- (11) Provide a Quality Assurance Plan, ensuring the Employer access to the manufacturing process.
- (12) Training of the Employer personnel.
- (13) Hardware, software, and firmware maintenance, debugging, and support of the equipment through final acceptance, and maintenance on all new equipment through out the warranty period and for a period of six (6) years after warranty period.
- (14) Availability of service, spare and expansion parts for the supplied items for the designed life of the equipment or seven (7) years after the declaration of withdrawal of equipment from production, whichever is earlier. However, the termination of production shall not occur prior to Operational Acceptance of the system by the Employer.

Detailed descriptions of the Contractor's obligations, in relation to individual items and services offered, are delineated in other sections of this specification.

27.1.2.3 The Employer Responsibilities and Obligations

The Employer will provide the following items and services as part of this Project:

- (1) Overall project management of the project
- (2) Review and approval of the Contractor's designs, drawings, and recommendations.
- (3) Communication network configuration data, including:
 - (a) Channel assignments for voice and data
 - (b) Interconnection drawings for existing equipment
- (4) Review and approval of test procedures.
- (5) Participation in and approval of "Type", factory and site acceptance tests where testing is required.
- (6) Review and approval of training plans.
- (7) Providing support and access to facilities at the sites.
- (8) Implement the major civil works such as expansions or construction of rooms, trenches etc. as required for the equipment to be provided by the Contractor.
- (9) Coordination of the Contractor's activities with the Employer's and constituents' concerned departments.



- (10) Provide to the extent possible drawings for existing sites and facilities for which equipment installations are planned.
- (11) Approval of the key personnel for the project

27.1.3 Applicable Standards

The following standards and codes shall be generally applicable to the equipment and works supplied under this Contract:

- (i) IEEE 802.3
- (ii) ITU-T/CCITT Recommendations, G.652, G.701, G.702, G.703, G.711/ 12/ 14/ 35/ 36, G.721, G.742, G.811 and G.823
- (iii) ITU-T/CCITT Recommendations, G.801, G.821, G.822, G.823, G.826.
- (iv) ITU-T/CCITT Recommendations of the V Series
- (v) ITU-T/CCITT Recommendations R35, R37, and R38A (or R38B)
- (vi) ITU-T/CCITT Recommendations M3010, G771
- (vii) Internet Activities Board, RFC-1157 (SNMP)
- (viii) International Electrotechnical Commission standards, IEC801-2/3/4/5, IEC-255-4, IEC-255-5, IEC-870-2-1, IEC-721-3-3, IEC-529.
- (ix) International Electrotechnical Commission standards, IEC 1000-4-xx series.
- (x) IEC publication 68, 68-2-2, 68-2-3, 68-2-14, 68-2-27, 68-2-32.
- (xi) ITU-T/CCITT Recommendations K.11, K.17, K.20.
- (xii) International CISPR standards

Specifications and codes shall be the latest version, inclusive of revisions, which are in force at the date of the contract award. Where new specifications, codes, and revisions are issued during the period of the contract, the Contractor shall attempt to comply with such, provided that no additional expenses are charged to the Employer without Employer's written consent.

In the event the Contractor offers to supply material and/or equipment in compliance to any standard other than Standards listed herein, the Contractor shall include with their proposal, full salient characteristics of the new standard for comparison.

In case values indicated for certain parameters in the specifications are more stringent than those specified by the standards, the specification shall override the standards.



27.2 Network Configuration and Equipment Characteristics

27.2.1 Introduction

This section describes the Fibre Optic Communication network configuration and the equipment characteristics for communication system to be installed under the project. The sub-systems addressed within this section are:

- (1) Fibre Optic Transmission System (FOTS)
- (2) Termination Equipment Subsystems
- (3) MDF, DDF and Cabling

The requirements described herein are applicable to and in support of network requirements. The equipment supplied shall support existing network for Power system operational requirements.

The security related requirements of the equipment shall be as per relevant agency and shall be followed/complied by the vendor.

The manufacturer shall allow the Employer and/or its designated agencies to inspect the hardware, software, design, development, manufacturing, facility and supply chain and subject all software to a security/threat check any time during the supplies of equipment.

The contractor shall ensure that the supplied equipments have been got tested as per relevant contemporary International Security Standards e.g. IT and IT related elements against ISO/IEC 15408 standards, for Information Security Management System against ISO 27000 series Standards, Telecom and Telecom related elements against 3GPP security standards, 3GPP2 security standards etc. from any international agency/ labs of the standards e.g. Common Criteria Labs in case of ISO/IEC 15408 standards until 31st March 2013. From 1st April, 2013, the certification shall be got done from authorized and certified agency.

The Contractor shall also ensure that the equipment supplied has all the contemporary security related features and features related to communication security as prescribed under relevant security standards. A list of features, equipments, software etc. supplied and implemented in the project shall be given for use by the Employer.

In case of any deliberate attempt for a security breach at the time of procurement or at a later stage after deployment/installation of the equipment or during maintenance, liability and criminal proceedings can be initiated against the Contractor as per guidelines of Government department.

27.2.2 General Network Characteristics

27.2.2.1 Description

The fibre optic network shall be based on the Synchronous Digital Hierarchy (SDH) having bit rate of STM-4 as indentified in the BOQ. The network shall consist of overhead fibre optic links



with a minimum bit rate of Synchronous Transport Module-4 (STM-4). The Contractor can propose a system based on higher bit rate systems, if required, so as to meet the link budget requirements or any other specification requirement. The detailed BOQ is described in appendices.

The contractor can propose equipment based on MPLS-TP technology with network capacity, number of MSP protected directions, tributary card capacity and other facilities similar to the employer's requirement. However, the contractor shall be fully responsible for the establishment of reliable communication network for such equipment from the substation upto LDC, Kathmandu. In addition, the contractor shall guarantee the performance of such equipment for power system protection implementations.

27.2.2.2 Functional Requirement

The primary function of the communication network is to provide a highly reliable voice and data communication system for grid operation in support of the SCADA/EMS/RTU/SASs/PMUs. The communications support requirement for SCADA/EMS/RTU/SASs/PMUs system is for low & high-speed data, express voice circuits and administrative voice circuits as defined in appendices. A brief summary of the communication system requirements is as follows:

- (a) High speed E1 channel support
- (b) Data transport supporting Network Management channels
- (c) The connectivity envisaged between RTU/SASs and Control Centre over TCP-IP using Ethernet interface.

27.2.2.3 General Systems Requirements

Required characteristics are defined and specified herein at the system level, subsystem level, and equipment level.

I. System Synchronization

The Contractor shall synchronize the existing equipments and all the new equipments under the contract using existing Master clock, if available. The Contractor shall provide the additional clocks as required under the set of clocks indicated in BOQ. In addition to GPS input reference, the synchronization clock must have provision to take INPUT reference coming from other clock. The contractor shall submit the synchronisation plan as per standard ITU-T G.811. All sync equipments proposed under this contract should meet ITU-T G.811 criterion. The holdover quality of slave clock, if any, shall meet ITU-T G.812 standard requirements.

The Contractor shall provide system wide synchronization fully distributed throughout the telecom network and connected to all equipments new & existing. The Contractor shall submit the synchronization plan for the entire network meeting the requirement of ITU-T G.803. The



synchronization plan shall clearly indicate the requirement of additional clocks with full justification.

The system equipment requiring “clock” shall be connected to the master clock using external clocking. For this purpose, appropriate interfaces(s) in the transmission & termination equipment being supplied and all other associated hardware shall be provided by the Contractor.

II. System Maintainability

To facilitate performance trending, efficient diagnosis and corrective resolution, the system shall permit in-service diagnostic testing to be executed both locally and from remote locations, manually and/or initiated under TMN control (if provided). Such testing shall not affect the functional operation of the system.

III. System Upgradeability and Expandability

Equipment supplied shall be sized (though not necessarily equipped) to support system/ subsystem expansion to full capacity as provided by specified aggregate transmission rates. Equipment units provisioned for equipped subunits shall be terminated at appropriate patching facilities or termination blocks. Power supplies shall be sized for maximum equipped system capacity.

IV. Equipment Availability

The calculated availability of each fibre optic link (E1 to E1) shall be at least 99.999%. The calculated availability is defined as the theoretical availability determined by a statistical calculation based on the mean-time-between-failure (MTBF) and the mean-time-to-repair (MTTR) of the components and subsystems comprising the FOTS. For this analysis, an MTTR of at least 4 hours shall be assumed. The down time of the fibre optic cable shall not be considered in the aforesaid availability calculations. The calculated failure rates of the units and the calculated availabilities of the equipment being offered shall be provided by the Contractor during detailed engineering.

V. Revision Levels and Modifications

All hardware, firmware and software delivered as part of the communications network shall be field proven and at the most of current revision level. All modifications and changes necessary to meet this requirement shall be completed prior to the start of the factory tests or under special circumstances, on written approval by Employer, prior to the completion of SAT.

VI. Equipment Capacities

Equipment supplied shall be sized and equipped with sufficient capacity to support BoQ and configuration requirements as identified in the appendices. Each subsystem supplied shall be sized (to be equipped as specified) to support full subsystem expansion.



VII. Software Upgrades

The Contractor shall provide antivirus software along with all the computer hardware/software which shall be upgraded periodically till the maintenance services contract in the bid. Further, to meet all the specifications requirements during implementation and maintenance, if upgrade in the hardware/software of supplied item is required, the same shall be done by the contractor without any additional cost to the Employer.

VIII. General Site Considerations

All fiber optic links up to 100 kms transmission line length shall be implemented by the Contractor without repeaters. In order to meet the link budget requirement, the Contractor shall provide all the necessary equipments only in the end stations. The contractor may provide the optical amplifier, wave length translator, optical cards or high capacity SDH equipment with suitable rack/subrack to meet the maximum distance limit. All the provided equipments shall be monitored/managed by Craft Terminal.

IX. Proposed Optical Fibre Characteristics

The link budget calculations and equipment design shall be based on the specified fibre parameters. The optical cables shall have Dual Window Single Mode (DWSM) fibres conforming to ITU-T Recommendations G.652D and the major parameters of these optical fibre(s) are defined in Table below.

Optical Fibre Characteristics	
Fibre Description:	Dual-Window Single-Mode (DWSM)
Mode Field Diameter:	8.6 to 9.5 μm ($\pm 0.6 \mu\text{m}$)
Cladding Diameter:	125.0 $\mu\text{m} \pm 1 \mu\text{m}$
Mode field Concentricity Error:	$\leq 0.6 \mu\text{m}$
Core-Clad concentricity error:	$\leq 1.0 \mu\text{m}$
Cladding non-circularity	$\leq 1\%$
Cable Cut off Wavelength:	$\leq 1260 \text{ nm}$
1550 loss performance	As per G.652D
Proof Test Level	$\geq 0.69 \text{ Gpa}$



Optical Fibre Characteristics	
Attenuation coefficient	@1310nm ≤ 0.35 dB/Km @1550nm ≤ 0.21 dB/Km
Attenuation variation with wavelength 1285 nm - 1330 nm 1525 nm – 1575 nm	Attenuation coefficient @1310 ± 0.05 dB Attenuation coefficient @1550 ± 0.05 dB
Point discontinuities	≤ 0.1 dB
Chromatic Dispersion; Max.: Zero Dispersion Wavelength: Zero Dispersion Slope:	18.0 ps/(nm x km) @ 1550 nm 3.5 ps/(nm x km) @ 1288-1339nm 5.3 ps/(nm x km) @ 1271-1360nm 1300 to 1324nm 0.092 ps/(nm ² xkm) maximum
Polarization mode dispersion coefficient	≤ 0.2 ps/km ^{1/2}
Temperature Dependence:	Induced attenuation ≤ 0.05 dB (-60 deg C - +85 deg C)
Bend performance:	@1310nm (75 \pm 2 mm dia Mandrel), 100 turns; Attenuation rise ≤ 0.05 dB @1550nm (30 \pm 1 mm dia Mandrel), 100 turns; Attenuation rise ≤ 0.10 dB @1550nm (32 \pm 0.5 mm dia Mandrel), 1 turn; Attenuation rise ≤ 0.50 dB



27.2.2.4 Fibre Optic Link Lengths

The fiber optic route lengths are as specified in appendices. The lengths specified in Appendices are the transmission line route lengths; however, the actual fiber cable length shall exceed the route lengths on account of extra cable requirement due to sag, jointing & splicing, approach cabling etc. For bidding purposes, the Contractor may assume an additional cable length of 5% of given route length + 1Km towards approach cable for calculating the link length. The exact cable lengths shall be determined by the Contractor during the survey. The same shall be used by the Contractor for final link design during the detailed engineering of the project.

27.2.3 Fibre Optic Transmission System

The Fibre Optic Transmission System (FOTS) is defined herein to include ETSI digital optical line termination equipment. The FOTS shall be based on SDH technology. Minimum aggregate bit rate shall be STM-4 equipped with two nos. of minimum 8 port E1 interface card, two nos. of minimum 4 port Ethernet interface (IEEE 802.3/IEEE 802.3u) card supporting layer 2 switching as tributaries. The Ethernet interfaces shall support VLAN (IEEE 802.1P/Q), spanning tree (IEEE 802.1D) quality of service. Protection scheme for Ethernet traffic should be ERPS based (Ethernet ring protection scheme) as per ITU-T G.8032.

The Contractor shall provide (supply and install) connectorised jumpers (patch cords) for FODP-to-equipment and equipment-to-equipment connection. Two number spare jumpers shall be provided for each equipment connection. Fiber jumpers shall be of sufficient lengths as to provide at least 0.5m of service loop when connected for their intended purpose.

The contractor shall provide SDH Equipment as per BOQ for following substation:

- Pangtan Substation

It is the responsibility of contractor to design, supply and install the above mentioned optical equipments in the respective place and integrate with existing communication equipments in adjacent substations. During intergration of Pangtan substation, the exisiting data and voice shall be as it is as previous and it should not malfunction the existing NMS (Network Manangement system) functionality of those equipments upto LDC. The contractor is advised to study the existing communication network in Bahrabise and adjacent substations in the region for successful integration.



27.2.3.1 SDH Equipment

A. Functional Requirement

There is a requirement for different types of equipment under this project which are described in this section. The Drawing is provided in the appendices. For the purpose of BOQ, the SDH Equipment is considered to be divided in three parts i.e. Optical interface/SFP, Tributary Cards (Electrical tributaries such as E1 & Ethernet 10/100 Mbps) and Base Equipment (Consisting of Common Cards, Control Cards, Optical base card, Power supply cards, sub-rack, cabinet, other hardware and accessories required for installation of equipment i.e. everything besides optical interface/SFP and tributary cards).

If bidder is offering equipment with multifunction cards such as cross-connect or control card with optical interface/SFP or tributary interface, such type of multifunction card shall be considered as Common control card and shall be the part of base equipment. In case optical interface/SFP is embedded with control card, the adequate number of optical interface/SFPs shall be offered to meet the redundancy requirements of the specifications.

The equipment shall be configurable either as Terminal Multiplexer (TM) as well as ADM with software settings only.

B. Redundancy and Protection

Two fibre rings shall be implemented wherever the network permits. On linear sections of the network, protected links using 4 fibres shall be implemented.

C. Service Channel

Service channels shall be provided as a function of the SDH equipment and shall be equipped with Service Channel Muldem's that shall provide at a minimum: One voice channel (order wire) with analog interface (0.3 to 3.4 kHz) and one data channel. Both omnibus and selective calling facilities shall be provided. There shall be a facility to extend the line system order-wire to any other system or exchange lines on 2W/4W basis.

D. Supervision and Alarms

ISM (In Service Monitoring) circuitry shall be provided as a function of the SDH equipment. Local visual alarm indicators shall be provided on the equipment, as a rack summary alarm panel. Alarms shall be as per ITU-T Standards G.774, G.783 and G.784. Additionally, F2/Q2 interfaces for a local craftsperson terminal interface and remote equipment monitoring is required.

The Equipment shall support collection of at least four (4) external alarms for monitoring and control of station associated devices by the TMN.



E. Synchronisation

The equipment shall provide synchronisation as per Table given above. One 2MHz synchronisation output from each equipment shall be provided.

F. Electrical and Optical I/O Characteristics and General Parameters

Table below provides the electrical and optical characteristics as well as other general parameters for SDH equipment.

Electrical and Optical I/O Characteristics and General Parameters	
Optical Wavelength NOTE (1)	1310/1550nm
Optical Source NOTE (2)	Laser
Optical Source Lifespan	Better than 5 X10 ⁵ hours
Optical Fibre Type	G.652 D
Optical Connectors	Type FC-PC



Transmission Quality	Per ITU-T G.821, G.823, G.826
Source Primary Power	-48 Vdc
Equipment Specifications	Per ITU-T G.783
Tributary, Electrical Interface	Per ITU-T G.703, 75 Ω
Ethernet Interface	10/100 Mbps
SDH Bit Rates	Per ITU-T G.703
Optical Interfaces	Per ITU-T G.957, G.958
Frame and Multiplexing Structure for SDH	Per ITU-T G.707
Synchronization	Per ITU-T G.813
Management Functions	Per ITU-T G.774, G.784
Protection Architectures	Per ITU-T G.841
Built In Testing and Alarms	Per ITU-T G.774, G.783, G.784

- NOTE (1)** Optical wavelength shall be selected considering the characteristics of the optical fibre and the link budget.
- NOTE (2)** **Eye Safety for Laser Equipment:** To avoid eye damage, when a receiver detects a line interruption, it is required that the optical power of the laser shall be reduced to safe limits on the transmitter in the opposite direction as per ITU-T G.958.
- NOTE (3)** In case other than FC-PC connector is provided in the equipment, suitable patch cord with matching connector are to be provided to connect with FODP.



27.2.3.2 Optical Link Performance Requirements

The optical fibre link performance requirements are specified as follows:

A. Link Budget Calculations

The fibre optic link budget calculations shall be calculated based upon the following criteria:

- (1) Fibre attenuation: The fibre attenuation shall be taken to be the guaranteed maximum fibre attenuation i.e. 0.21 dB/Km @1550nm and 0.35 dB/km @1310nm.
- (2) Splice loss: Minimum 0.05 dB per splice. One splice shall be considered for every 3 kms.
- (3) Connector losses: Losses due to connectors shall be considered to be minimum 1.0 dB per link.
- (4) Equipment Parameters: The equipment parameters to be considered for link budget calculations shall be the guaranteed “End of Life (EOL)” parameters. In case, the End of Life parameters are not specified for the SDH equipment, an End of Life Margin of at least 2 dB shall be considered and a similar margin shall be considered for optical amplifiers.
- (5) Optical path Penalty: An optical path penalty of at least 1 dB shall be considered to account for total degradations due to reflections, inter symbol interference, mode partition noise and laser chirp.
- (6) Maintenance Margin: A maintenance margin of at least 2.5 dB/100Km shall be kept towards cabling, repair splicing, cable ageing and temperature variations etc.
- (7) Other losses: Other losses, if any required specifically for system to be supplied shall also be suitably considered.
- (8) Dispersion: The fibre dispersion shall be taken to be the guaranteed maximum dispersion i.e. 18 ps/nm.Km @1550 nm & 3.5 ps/nm.km @ 1310 nm for DWDM fibres.
- (9) Bit Error Rate: The link budget calculations shall be done for a BER of 10^{-10} .

The bidders shall determine the total link loss based on the above parameters and shall submit the system design (including link budget calculations) for each category of fibre optic link during detailed engineering.

For finalising the FOTS system design & BOQ, above methodology shall be adopted taking into account fibre attenuation, dispersion and splice loss determined during the detailed engineering. Accordingly, additions and deletions from the contract shall be carried out based on unit rates indicated in the contract

B. Link Performance

The Link performance for ES, SES and BER for the fibre optic links shall correspond to National Network as defined in ITU-T G.826.



C. FODP to SDH Equipment

The Contractor shall be responsible for connectivity between the FODP and the SDH equipment. The Contractor shall provide patch cords as per FODP types. The patch-cord length between the FODP & equipment rack shall be suitably protected from rodents, abrasion, crush or mechanical damage.

27.2.4 MDF, DDF and Cabling

For the purposes of the specification, the contractor shall provide cabling, wiring, DDF patching facilities and MDFs interfacing to the wideband telecommunications system. Equipment and material components for MDF, DDF and cabling are also part of this procurement. It shall be the Contractor's responsibility to provide all cable support required for full supplied equipment interconnection with the MDF and shall be in accordance with communications industry standard practices and the requirements mentioned in the technical specifications.

27.2.4.1 Digital Distribution Frame Functional Requirements

The Contractor shall provide DDF for Digital Signal Cross connect (DSX) Broadband-quality (better than 20 MHz) patching facilities configured "normally-thru" with Equipment, Line and Monitor Patch Jacks. DDFs shall provide the following basic functions:

- (i) "Normally thru" circuit routing
- (ii) Circuit rerouting via patch cord assemblies
- (iii) Circuit disconnects and termination

All DDFs shall be sized and equipped to support the offered configuration of the provided equipment. Independent Transmit and Receive patch jack assemblies (line and equipment) shall provide for separate transmit and receive single-plug patching. Transmit and receive patch jack assemblies shall be located side-by-side such that dual-plug patch cord assemblies may be used to route both transmit and receive for the same circuit.

27.2.4.2 Main Distribution Frames

The Contractor shall make provision for cross connection of subscriber services to the subscribers utilizing Krone type or equivalent and shall provide full connectivity up to and terminated on the equipment side of the appropriate DDFs and line side of MDFs. The Contractor shall terminate on the equipment side of patching facilities provided by other contracts and shall provide DSX type patching facilities supporting aggregate bit streams (i.e. dataplexers and E-1 Channel Banks). Separate Patch panels or MDFs shall be provided for Data and Voice. All cross connects shall be accomplished utilizing one, two or three pair patch cords. Patch plugs are permissible for direct one-to-one circuit "cut-thru".



27.2.5 Patch Cords

The Contractor has to supply Patch cords as described in BOQ. The Patch cord return loss shall be equal to or better than 40 dB and insertion loss equal to or less than 0.5 dB.

27.2.6 Telecommunication Management Network / Network Management System

(As Applicable)

The Contractor shall provide a Telecommunications Management Network System (TMN) for operational support to the FOTS and associated Termination equipment subsystems. This TMN shall provide the capability to monitor, reconfigure, and control elements of the telecommunications network from a centralized location and at each node of the network where equipment is located. This TMN system shall assist Employer/Owner in the operations and maintenance of the wideband communication resources of the network including detection of degraded circuits, system performance, the diagnosis of problems, the implementation of remedial actions and the allocation or reallocation of telecommunications resources and addition/deletion of network elements.

The contractor shall supply preferably a single TMN for all the NEs (Network Elements) such as SDH equipment, Mux, Drop-Insert, DACS etc. In case a single TMN can not be provided for all the NEs, the contractor may supply separate TMNs. Each of the offered TMN shall meet the requirements indicated in this section. The bidder shall provide details of the offered TMN in the bid.

A. Applicable Standards

The TMN design concept, functional and informational architecture and physical architecture, shall be in compliance with ITU-T Recommendation M.3010. The offered TMN system shall be capable of integration to other supplier's Network Management System (NMS) upwardly through North bound interfaces. The north bound interface in the EMS shall be CORBA/TMF-814 compliant.

B. TMN Architecture

The TMN shall provide

- a. Collection of Management data from all Network Elements (NEs) supplied under this package. The minimum monitoring and control requirements for the communication equipment shall be as defined in this section.
- b. Processing of above management data by using processor(s) located at control Centre and additional intermediate station processor(s), wherever required.
- c. Monitoring and control of the NEs as defined below:
 - I) TMN system at LDC (including local operator console, if applicable) shall support management of all equipments supplied and monitoring of the entire regional network supplied under this package at a minimum functions of Network management layer (NML)



and Element management layer (EML) as defined in CCITT M3010. The detailed functions are listed in TS.

- II) Monitoring and control of NEs using Craft Terminals as defined in this Section.
- d. Supervisory monitoring and control of the following station associated devices:
 - I) Intrusion Detection Alarms
 - II) Power Failure
 - III) Fire and Smoke Detection
 - IV) Environmental Control (Temperature, Humidity etc.)
- e. Communication channel support for TMN System as specified in Technical Specifications (TS).

The supplied TMN system shall be capable of handling all management functions for at least 150% of the final network elements. Further, the centralised TMN system shall also have provision for addition of at least two remote operator consoles. The TMN hardware shall be so designed that failure of a single processor/component (router, switch, converter etc.) shall not inhibit any of the functionality of the TMN at control centre. The Contractor shall submit for Employer's approval the TMN architecture describing in detail the following subsystems/features:

- a. Database used in TMN
- b. Master Processor, server/workstation, LAN, Peripherals and hardware
- c. Software and operating system
- d. Local Consoles/remote consoles
- e. Craft Terminals
- f. Data communication between NEs, Remote/Local Consoles and TMN Processor(s)
- g. Routers/Bridges
- h. Expansion Capabilities

C. Management Functions

The TMN shall support following Management functions:

I. Configuration Management

Configuration management is concerned with management, display, and control of the network configuration. Minimum specific requirements that shall be satisfied include the following:



- a. Provide tools to establish and maintain the backbone topology and configuration information and provide graphical maps depicting the configurations.
- b. Gather descriptive information about the current configuration of the equipment, provide operator displays, and prepare reports.
- c. Provide tools for planning, establishing, and changing the static equipment configuration. Provide for changes to the equipment configuration in response to equipment failures, planned upgrades, and operator requests to take equipment offline for testing.
- d. Provide verification testing to support new equipment installation

II. Fault Management

Fault management is concerned with detecting, diagnosing, bypassing, directing service restoration, and reporting on all the backbone network equipment, systems, and links. Minimum specific requirements that shall be satisfied include the following:

- a. Display equipment status in a consistent fashion regardless of the source of the data on a graphical topological, map-type display. Status shall be displayed through the use of colours on links and nodes as well as through text.
- b. Obtain status and detect faults through periodic polling, processing of unsolicited alarms and error events, and periodic testing for connectivity.
- c. Maintain an alarm summary of unacknowledged alarm events on the management station display and maintain a log of all received alarms. The operator shall be able to acknowledge and clear alarms individually and as a group. The use of alarm correlation techniques is encouraged to minimize the proliferation of alarms caused by a single, common event. All alarms shall be configurable as critical alarms, major alarms and minor alarms with different colours.
- d. Provide the capability to diagnose and isolate failures through analysis of error and event reports and through the use of both on-line and off-line diagnostic tests and display of monitored data.
- e. The criteria for fail over shall be configurable as automatic fail over to redundant equipment wherever possible and through operator-initiated actions where automatic fail over is not possible. The status of fail over shall be reported to the NMS.
- f. Track network equipment failure history.



III. Performance Management

Performance management is concerned with evaluation of the use of network equipments and their capability to meet performance objectives. Minimum specific requirements that shall be satisfied include the following:

- a. Provide support for an operator to initiate, collect, and terminate performance metrics under both normal and degraded conditions. For example, BER of each link, together with other data measured at each node, shall be available on operator request (atleast for SDH).
- b. Monitor point to point & end to end signal quality and history. Provide operator controls to monitor performance of specified events, measures, and resources (atleast for SDH). Specifically provide displays to permit the operator to:
 1. Select/deselect network equipments, events, and threshold parameters to monitor
 2. Set monitoring start time and duration or end time
 3. Set monitoring sampling frequency
 4. Set/change threshold values on selected performance parameters
 5. Generate alarm events when thresholds are exceeded.
 6. Set multiple thresholds on certain performance parameters. Alarm categories include as a minimum a warning and a failure.
 7. Calculate selected statistical data to measure performance on selected equipment based on both current and historical performance data maintained in performance logs. Performance data provided is limited to what is available from the equipment Contractors.
 8. Provide graphical displays of point to point and end to end current performance parameter values. Provide tabular displays of current, peak, and average values for performance parameters.
 9. Generate reports on a daily, weekly, monthly, and yearly basis containing system statistics.

IV. Security Management

The TMN shall be provided with security features to limit access to monitoring and control capabilities to only authorized personnel. One access level of System Administrator and at least two levels of operator access shall be provided - read (view) only, and write (configure). The system administrator shall be able to create, define and modify operators with different access levels, network domains and perform all kind of maintenance and up gradation of the TMN system. With "read only" access level, network parameters should only be viewed. Access to database maintenance, command control and test functions shall be



available with "write" access level. Means shall be provided to ensure only one authorized user has write capability for a selected domain of the network. It shall be possible to define multiple domains for purposes of monitoring and control.

Human error and conflict detection are also required. Such errors and access violations shall be reported to the offending user as error messages and warnings.

27.2.7 Communication Channel Requirement and Integration

Communication requirements for TMN system have not been considered in Appendices and the Contractor shall provide these as a part of TMN system. The Contractor shall provide all required interface cards / devices, LAN, routers/bridges, channel routing, cabling, wiring etc. and interfacing required for full TMN data transport.

The TMN data transport shall utilize the wideband communications transmission system service channel in the overhead whenever possible. This will provide inherent critical path protection

Should the configuration requirements dictate multiple TMN station processors, the TMN Master Station shall require bidirectional data transport with its station processor(s). This communications interfacing shall be via critically protected data channels. It shall be the Contractor's responsibility to provide for and equip all necessary critically protected TMN data channel support.

In case supervisory channels are not available, the Contractor shall provide suitable interfaces in their supplied equipment for transport of TMN data. The Contractor shall also be responsible for providing suitable channels with appropriate interfaces to transport the TMN data.

The NMS information of existing PDH & SDH system shall be transported through the new communication network, wherever required, up to the NMS location. The NMS information of the new SDH & PDH system being procured under the package shall be transported through the existing communication network using 64 kbps/2Mbps (G.703) interfaces. Any hardware required for above interfacing shall be provided by the Contractor.

The bidders shall describe in the proposal the TMN data transport proposed to be used by the bidder in detail including capacity requirements and various components/equipment proposed to be used.

27.2.8 Craft Terminal

Each equipment (SDH equipment, Mux, Drop/Insert and DACS etc.) on the fibre optic communication network shall include provision for connecting a portable personal computer (PC) to be known as craft terminal to support local commissioning and maintenance activities. Through the use of this PC and local displays/controls, the operator shall be able to:

- a. Change the configuration of the station & the connected NEs.
- b. Perform tests



- c. Get detailed fault information

The craft terminal shall be connected to the interface available in the communication equipment. Portable (laptop) computers (Craft terminals), each complete with necessary system and application software to support the functions listed above, shall be supplied to the employer as per BOQ given in the appendices

27.2.9 Hardware Requirements

A. Master Processor, Server/Workstation and Craft Terminal

The server/workstation and craft terminal shall have suitable processor(s) which shall be sufficient to meet all the functional requirement and expansion capabilities stipulated in this specification. Only reputed make like Dell, IBM, HP, Compaq make shall be supplied.

The server shall have minimum configuration of 3GHz for CISC based or 1.6GHz for RISC based processor, 8 GB RAM, DVD-ROM drive, redundant 500 GB internal Hard Disk Drive, 101-Enhanced style keyboards, mouse, parallel, serial, USB(3.0) ports and hot swap redundant power supply. VDUs shall be 17" TFT active matrix color LCD with a minimum resolution of 1024 X 768. Appropriate network drive card shall also be provided wherever required. However, the internal hard disk drive for the server shall be redundant and all the data shall be mirrored. Further, the TMN software shall support data mirroring on redundant disk drives.

The workstation shall have minimum configuration of 2.4GHz for CISC or 1.4GHz for RISC based processor, 4 GB RAM, DVD-RW drive, 160 GB Hard Disk Drive, 101-Enhanced style keyboards, mouse, parallel, serial and USB (3.0) ports. VDUs shall be 19" TFT active matrix color LCD with a minimum resolution of 1024 X 768. Appropriate network drive card shall also be provided wherever required.

CPU enclosures shall be desktop type and shall include available expansion slots except for the Craft Terminal which shall be a laptop. The craft terminal shall have minimum configuration of 2.4 GHz, 4 GB RAM, 2 GB Graphics, 256 MB VRAM, DVD RW drive, 500 GB Hard Disk Drive, keyboard, mouse/trackball etc., parallel, serial/USB (3.0) ports to accommodate printers, and Internal/external Data/Fax modem and a battery back-up of at least 180 minutes. VDUs shall be 15" TFT active matrix color LCD with a minimum resolution of 1024 X 768.

B. Peripherals and hardware

TMN system shall be provided with laser printer. The laser printer shall have a minimum print speed of 17 pages per minute and a minimum resolution of 1200 x 1200 dpi. The laser printer shall have parallel and LAN ports for connecting to TMN system.

The laser printer under this specification shall be black & white and include print enhanced buffering to prevent loss of print data in the event of a print failure.



C. Local/Remote Operator Consoles (As Applicable)

The Contractor shall provide operator consoles sized and equipped to support the subsystem(s) furnished and in compliance with the specification. The console shall provide hardware interfacing for the TMN users to the software operating support systems. At a minimum, a console shall include the hardware similar to a workstation.

D. Power Supplies

The TMN system shall use 220 volts 50 Hz A.C or -48 volt D.C as available at site for its operation as available at site.

27.2.10 General Software/Firmware Requirements

Due to various alternative design approaches, it is neither intended nor possible to specify all software and firmware characteristics. It is the intent herein to provide design boundaries and guidelines that help to ensure a demonstrated, integrated program package that is maintainable and meets both hardware systems requirements and the customer's operational requirements.

A. Operating System Software

Operating system software shall be provided to control the execution of system programs, application programs, and management devices, to allocate system resources, and manage communications among the system processors. The contractor shall make no modifications to the OEM's operating system, except as provided as USER installation parameters.

B. Applications Software

All applications software shall be written in a high-level programming language unless developed using industry proven application programs and development tools provided with the system. The contractor shall make no modifications to the applications program except as provided as USER development tools.

C. Software Utilities

A utility shall be provided to convert all reports into standard PC application formats such as excel.

D. Revisions, Upgrades, Maintainability

All firmware and software delivered under this specification shall be the latest field proven version available at the time of contract approval. Installed demonstration for acceptance shall be required. All firmware provided shall support its fully equipped intended functional requirements without additional rewrite or programming.

All software shall be easily user expandable to accommodate the anticipated system growth, as defined in this specification. Reassembly recompilation or revision upgrades of the software or components of the software, shall not be necessary to accommodate full system expansion.



Software provided shall be compliant with national and international industry standards.

E. Database(s)

The contractor shall develop all the databases for final wideband network following the global acronyms for all stations. Database(s) to be provided shall contain all structure definitions and data for the integrated functional requirements of TMN system.

TMN operator Groups shall share the same virtual database. This means that they shall share the same database and database manager, whether or not physically separate databases are maintained.

27.3 Inspection

Access to the Contractor's facilities during system manufacturing and testing and to any facility where systems/ equipments are being produced/ tested/ integrated for the fibre optic communication network, shall be available to the Employer. At all times the Employer shall have full facilities for unrestricted inspection of such materials or equipment. To facilitate this, the Contractor shall submit for the Employer approval, a comprehensive Quality Assurance Plan using ISO 9000 as a general guideline. In addition, the Quality Assurance Plan shall satisfy the following:

- (a) Sufficient office facilities, equipment, and documentation necessary to complete all inspections and to verify that the equipment is being fabricated and maintained in accordance with the Specification shall be provided by the Contractor to the Employer.
- (b) Inspections to be performed by the Employer will include visual examination of hardware, cable dressings and labeling. Contractor's documentation will also be examined to verify that it adequately identifies and describes all offered items and spare parts.
- (c) Access to inspect the Contractor's standards, procedures, and records that are applicable to the supplied equipment shall be provided to the Employer. Documents will be inspected to verify that the Contractor has performed the required quality assurance activities.
- (d) The inspection rights described above shall also apply to sub-Contractors who are responsible for supplying major components described in this Specification. These items shall be inspected and tested at the sub-Contractor factory by the Employer's representatives prior to shipping this equipment to the Contractor's facility or directly to the Employer.
- (e) The above inspection rights shall also apply to sub-Contractors supplying assemblies, subassemblies and components. However, such items will normally be inspected and tested by the Employer's representatives at the Contractor's site before acceptance.

27.4 Test Plans and Procedures

Test plans and test procedures for both factory and site acceptance tests shall be provided by the Contractor. Test plans and test procedures shall ensure that each factory and site test is comprehensive and



verify all the features of the equipment to be tested. Test plans and test procedures shall be modular to allow individual test segments to be repeated upon request.

The Contractor shall submit a Test Schedule for the Employer's approval within one (1) week after the award of contract for Type Tests and three (3) months after the award of contract for all other tests. The test schedule shall list the tests to be carried out, and the approximate test duration. The test periods shall also be indicated in the PERT chart or equivalent for the work.

The Contractor shall give the Employer twenty one (21) days written notice of any material being ready for testing. Fifteen days prior to the scheduled testing, the Employer shall provide written notice to the Contractor of any drawings, equipment, material, or workmanship which, in the Employer's opinion, are not compliant to the specification. The Contractor shall give due consideration to such objections, if valid, effecting the corrections as necessary or shall prove, in writing, that said modifications are unnecessary for contract compliance.

27.4.1 Factory and Site Test Plans

A test plan for factory and site acceptance tests shall be submitted for approval, at least four (4) weeks before the start of testing. The test plan shall be a single overview document that defines the overall schedule and individual responsibilities associated with conducting the tests, documenting the test results, and successfully completing the test criteria. Test Plans shall include, at a minimum, the information contained in Table below.

Item:	Description:
1.	Test schedule
2.	Record-keeping assignments, procedures and forms
3.	Procedures for monitoring, correcting and retesting variances
4.	Procedures for controlling and documenting all changes made to the communications equipment after the start of testing

27.4.2 Test Procedures

Test procedures for factory and site testing shall be submitted for the Employer approval at least four (4) weeks before each individual test. Fully approved test procedures shall be submitted to the Employer at least four weeks prior to the commencement of testing. Testing shall not commence without approved test procedures. At a minimum, test procedures shall include the items listed in Table below.



All test equipment and/or instruments shall bear calibration stickers indicating valid calibration on and beyond the testing date. The time lapsed since last calibration shall not exceed the test equipment/ jig manufacturer recommended calibration interval or the interval recommended in the test lab's internal quality procedures.

The Contractor shall ensure that all testing will be performed by qualified testing personnel well experienced in performing such tests.

Item:	Description:
1.	Test Title and Revision Level, if applicable
2.	List of Standard(s) complied with
3.	Function(s) / parameter(s) to be tested
4.	Purpose of each test segment
5.	List of required test equipment
6.	Description of any special test conditions or special actions required. This includes complete descriptions, listings and user interface procedures for all special hardware and software tools and/or display formats to be used during the test.
7.	Test setup including test configuration block diagrams and/or illustrations.
8.	Test procedures to be followed.
9.	Required inputs and expected outputs for each test segment
10.	Acceptance criteria for each test segment.
11.	List of test data to be supplied by the Contractor(s) and copies of any certified data to be used
12.	Format of test reports.

27.4.3 Test Records

Complete and indexed records of all factory and site acceptance tests results shall be maintained and provided to the Employer by the Contractor in hardcopy. The records shall be keyed to the steps



enumerated in the test procedures. The minimal items required in test records are described in Table below.

Item:	Description:
1.	Test Title and Revision Level, if applicable; contract references
2.	Date and time for test start and test completed
3.	Test title and reference to the appropriate section of the test procedures
4.	Description of any special test conditions or special actions taken (Includes test-case data).
5.	Test results for each test segment including an indication of Passed, Conditional Pass, Incomplete or Failed.
6.	Test procedure modifications made during testing.
7.	Variance Report(s) tracking information and copies (if variance(s) was detected).
8.	Contractor's test engineer(s) identification, signature and remarks
9.	Employer's test witness identification, signature and remarks
10.	List of all attachments
11.	Attachments (including system logs, printouts, variances, hard copies of visual test result displays, etc.)

All principle test records, test certificates and performance curves shall be supplied for all tests carried out as proof of compliance with the specifications and/or each and every specified test. These test certificates, records and performance curves shall be supplied for all tests, whether or not they have been witnessed by the Employer within the specified duration after the completion of test. Information given on such test certificates and curves shall be sufficient to identify the material or equipment to which the certificates refer, and shall also bear the Contractor's reference and heading.



27.4.4 Rejection of Elements

Any item or component which fails to comply with the requirements of this Specification in any respect, at any stage of manufacture, test, and erection or on completion at site may be rejected by the Employer either in whole or part as considered necessary.

Material or components with defects of such a nature that do not meet the requirements of the Specification by adjustment or modification shall be replaced by the Contractor at his own expense. After adjustment or modification, the Contractor shall submit the items to the Employer for further inspection and/or tests.

27.4.5 Test Periods Defined

The terminology used in Volume I, General Conditions of Contract and their correlation with the tests requirements described within this section is as follows:

Pre-Commissioning & Commissioning Period - The Site Acceptance Test (SAT)

Operational Acceptance - Successful completion of SAT

27.4.6 Type Testing

"Type Tests" shall be defined as those tests which are to be carried out to prove the design, process of manufacture and general conformity of the materials to this Specification. Type Testing shall comply with the conditions specified in Chapter 2- GTR.

List of Type Tests

The type testing shall be conducted on the following equipment

- (a) SDH Equipment with all types of cards (optical card, Tributary card or any other equipment as part of repeater less links)

A. List of type test to be conducted on Telecom equipment

The type tests for SDH Equipment with all types of cards are described below:

I. Temperature and Humidity Tests

The tests listed below are defined in IEC Publication 60068

(a) Low Temperature Test: Operation to Specifications

Low temperature tests shall be conducted as defined in IEC Publication 60068-2-1, test method Ad, with the following specifications:

- (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for sixteen (16) hours. Its performance is checked during the test.
- (2) Degree of Severity: Test shall be done at 0°C



- (3) Acceptance Criteria: No degradation of performance during and after the test.

(b) Low Temperature Test: Operation without Damage

Low temperature tests shall be conducted as defined in IEC Publication 60068-2-1, test method Ad, with the following specifications:

- (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 72 hours. Its performance is checked during the test and after the test as soon as the thermal equilibrium is reached at the room temperature (*Post-test*).
- (2) Degree of Severity: Test shall be done at -10°C
- (3) Acceptance Criteria: Degradation of performance is allowable during the test, however there shall be no degradation of performance in the *post-test*.

(c) Dry Heat Test: Operation to Specifications

Dry heat test shall be done as defined in IEC Publication 60068-2-2, test method Bd, with the following specifications:

- (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 96 hours. Its performance is checked during the test.
- (2) Degree of Severity: As per operation to specification range.
- (3) Acceptance Criteria: No degradation of performance during and after the test.

(d) Dry Heat Test: Operation without Damage

Dry heat tests shall be done as defined in IEC Publication 60068-2-2, test method Bd, with the following specifications:

- (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 96 hours. Its performance is checked during the test and after the test as soon as the thermal equilibrium is reached at the room temperature (*Post-test*).
- (2) Degree of Severity: Test shall be done at 55°C .
- (3) Acceptance Criteria: Degradation of performance is allowable during the test, however there shall be no degradation of performance in the *post-test*.

(e) Damp Heat Test

Damp heat testing reveals aging with respect to the humidity level and applies basically to electronic equipment. This test shall be done as defined in IEC Publication 60068-2-3 with the following specifications:



- (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 10 days. Its performance is checked during the test.
- (2) Acceptance Criteria: The equipment shall meet the specified requirement and there shall not be any degradation in BER.

(f) Temperature Variation Test

Temperature variation testing shall be as per IEC Publication 60068-2-14 (Gradual Variations, Method Nb). The equipment shall be powered on and various parameters shall be monitored continuously during the test period.

- (1) Number of cycles required is five (5)
- (2) The degree of severity: temperature TL:0°C, TH: As per operation to specification range
- (3) Cycle duration for each temperature is three (3) hours.
- (4) Ramp: 1 °C/minute.
- (5) Acceptance Criteria: The equipment shall meet the specified requirement and there shall not be any degradation in BER.

II. Power Supply and EMI/EMC tests

The test procedure and acceptance criteria shall be as defined in IEC 60870-2-1.

(a) Immunity Tests

The list of Immunity tests are specified below in Table below.

Recommended Immunity Tests

S. No.	Immunity Test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
1	Voltage Fluctuations	Yes	Yes	N/A	N/A	Table 11 of IEC 60870-2-1: 1995 - Level : 1
2	Voltage dips and Interruptions	Yes	Yes	N/A	N/A	



Recommended Immunity Tests

S. No.	Immunity Test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
3	1.2/50 - 8/20 μ s surges	Yes	Yes	Yes	N/A	Table 12 of IEC 60870-2-1: 1995 - Level : 4
4	Fast transient bursts	Yes	Yes	Yes	Yes	
5	Damped oscillatory waves	Yes	Yes	Yes	Yes	
6	10/700 μ s surges	N/A	N/A	N/A	Yes	
7	Electrostatic discharge	Yes				Table 13 of IEC 60870-2-1: 1995 - Level : 4
8	Power frequency magnetic field	Yes				Table 14 of IEC 60870-2-1: 1995 - Level : 4
9	Damped oscillatory magnetic field	Yes				
10	Radiated electromagnetic field	Yes				Table 15 of IEC 60870-2-1: 1995 - Level : 4



Recommended Immunity Tests

S. No.	Immunity Test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
11	Power Frequency voltage on control and signal lines	N/A	N/A	Yes	Yes	IEC 61000-4-16 : 2002-07 Level : 4
12	DC voltage on control and signal lines	N/A	N/A	Yes	N/A	IEC 61000-4-16 : 2002-07 Level : 4

(b) Emission Tests

The list of Emission tests are specified below in Table.

S. NO.	Emission test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
1	LF disturbance voltages CCITT recommendation P.53	N/A	Yes	N/A	N/A	Table 17 of IEC 60870-2-1: 1995 - Class : B



S. NO.	Emission test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Parameters
2	RF disturbance voltages CISPR 22	Yes	Yes	N/A	N/A	
3	RF disturbance currents CISPR 22	N/A	N/A	N/A	Yes	
4	RF radiated fields CISPR 22	Yes				

(c) **Insulation Withstand Voltages**

As per section 6 of IEC 870-2-1. Recommended class: VW1 of Table 18.

III. **Mechanical Tests**

(a) **Mechanical Vibration Test**

The procedure for this test is described in IEC Publication 60068-2-6. The testing procedure shall be carried out in the sequence 8.1 + 8.2.1 + 8.1 as described in document 60068-2-6.

For the vibration response investigation (clause 8.1 of 60068-2-6), the test shall be carried out over a sweep cycle under the same conditions as for the endurance test (described later), but the vibration amplitude and the sweep rate may be decreased below these conditions so that the determination of the response characteristics can be obtained.

The endurance test conditions are selected according to the vibration withstand requirements.

Transportation tests shall be performed with the equipment packed according to the Contractor's specifications.

(b) **Shock Test**

The procedure of this test is defined in IEC Publication 60068-2-27 (each test) with a semi-sinusoidal shape (clause 3.1.1.2).



The recommended severity shall be $A = 294 \text{ m/s}^2$, $D = 18 \text{ ms}$. Three shocks per axis per direction shall be applied to the equipment packed according to the Contractor's specifications.

Or Free Fall Test

This test could be performed as an alternative to the shock or Bump test. The procedure is defined in IEC publication 60068-2-32. The equipment shall be packed according to the Contractor's specifications. The drop height shall be defined in accordance with IEC 68-2-32. The surface of the packing case which comes into contact with the ground is the surface on which the packing case normally rests; if the packing does not have any features (inscription, special shape, etc.) identifying this surface, the test is carried out successively on all the surfaces of the packing.

Or Bump Test

This test could be performed as an alternative to Shock test or Free Fall test. The procedure is defined in IEC 60068-2-29.

27.4.7 Factory Acceptance Tests

Factory acceptance tests shall be conducted on randomly selected final assemblies of all equipment to be supplied. Factory acceptance testing shall be carried out on SDH Equipments, associated line & tributary cards and all other items for which price has been identified separately in the Bid Price Schedules.

Equipment shall not be shipped to the Employer until required factory tests are completed satisfactorily, all variances are resolved, full test documentation has been delivered to the Employer, and the Employer has issued Material Inspection & Clearance Certificate (MICC). Successful completion of the factory tests and the Employer approval to ship, shall in no way constitute final acceptance of the system or any portion thereof. These tests shall be carried out in the presence of the Employer's authorised representatives unless waiver for witnessing by Employer's representatives is intimated to the contractor.

Factory acceptance tests shall not proceed without the prior delivery to and approval of all test documentation by the Employer.

The factory acceptance test shall demonstrate the technical characteristics of the equipment in relation to this specifications and approved drawings and documents. List of factory acceptance tests for Fibre Optic Transmission system, Termination Equipment Sub-system and NMS are given in specified Tables in this section. This list of factory acceptance tests shall be supplemented by the Contractor's standard FAT testing program. The factory acceptance tests for the other items shall be proposed by the Contractor in accordance with technical specifications and Contractor's (including Sub-Contractor's / supplier's) standard FAT testing program. In general, the FAT for other items shall include at least: Physical verification, demonstration of technical characteristics, various operational modes, functional interfaces, alarms and diagnostics etc.



For Test equipment & clock, FAT shall include supply of proper calibration certificates, demonstration of satisfactory performance, evidence of correct equipment configuration and manufacturer's final inspection certificate/ report.

Factory Acceptance Testing Requirements for Termination Equipment (MUX)

Item	Description:
1.	Physical Inspection for conformance to DRS, BOQ, drawings and appearance of equipment
2.	Performance of supervision, alarm, control and switching systems, diagnostics, loopbacks, Craftsperson interface etc.
3.	Electrical interface tests which include: output and input jitter, bit error rate, pulse shape, cable compensation, and line rate tolerance for the channel banks/low-level multiplexers
4.	Framing, signaling, and operational and maintenance tests consistent with applicable ITU-T requirements
5.	Simulation of failure conditions and failover of each redundant unit
6.	Test of spare card slots and test of spare parts/modules/cards as per applicable tests
7.	Checks of power supply/converter voltage margins and short circuit and overvoltage protection
8.	Random inspections to verify the accuracy of documentation

FAT on Craft Terminal	
1	Physical inspection of Craft Terminal hardware for conformance to approved BoQ, DRS & drawing
2	Testing of Craft Terminal to demonstrate proper operation of all functions



27.4.8 Site Acceptance Tests

The Contractor shall be responsible for the submission of all equipment & test equipment supplied in this contract for site tests and inspection as required by the Employer. All equipment shall be tested on site under the conditions in which it will normally operate.

The tests shall be exhaustive and shall demonstrate that the overall performance of the contract works satisfies every requirement specified. At a minimum Site Acceptance Testing requirement for Telecom equipment. is outlined in following section. This testing shall be supplemented by the Contractor's standard installation testing program, which shall be in accordance with his quality plan(s) for Telecom equipment installation.

During the course of installation, the Employer shall have full access for inspection and verification of the progress of the work and for checking workmanship and accuracy, as may be required. On completion of the work prior to commissioning, all equipment shall be tested to the satisfaction of the Employer to demonstrate that it is entirely suitable for commercial operation.

A. Phases for Site Acceptance Testing

The SAT shall be completed in following phases:

1. Installation Testing

The field installation test shall be performed for all equipment at each location. If any equipment has been damaged or for any reason does not comply with this Specification, the Contractor shall provide and install replacement parts at its own cost and expense.

In the installation test report, the Contractor shall include a list of all hardware or components replaced or changed between the completion of factory tests and the start of field tests and show that documentation and spare parts have been updated.

The minimal installation testing requirements for fiber optic transmission subsystem, Termination equipment sub-system are provided in respective Tables in this section.

2. Link Commissioning Tests

The commissioning tests shall verify that communication can be performed over the fiber optic link under test. Delay measurement, Bit Error measurements & service channel performance monitoring shall be made on the fibre optic links to verify compliance with designed link performance.

For Ethernet interface: At a minimum the following test requirement shall be demonstrated

As per RFC 2544:

- a) Ping test
- b) Throughput test



- c) Latency test
- d) Packet Loss

10% of the total links (Chosen by the Employer, generally to cover links from all configurations used) shall be tested for a duration of 12 Hours. Rest of the links shall be tested for 1 Hour. In case a link does not meet the performance requirements during 1 hour, then the duration of the test shall be increased to 12 hours.

In case any link does not meet the performance requirements during 12 hour, then the cause of failure shall be investigated and the test shall be repeated after rectifying the defects.

This phase of testing shall be conducted by the Contractor and witnessed by the Employer. Field adjustments shall be made to meet established standard, however if the field adjustments fail to correct the defects the equipments may be returned to the Contractor for replacement at his own expense. In case any adjustments are required to be made during the interval of the test then the test shall be repeated.

3. Integrated Testing

Prior to commencement of integrated testing the overall system shall be configured as required to provide all the data and voice channel required to interconnect the various User's interfaces. The integrated testing for a batch shall include end-to-end testing of back-bone network included in that batch. Integrated testing for last batch shall include testing of the entire back-bone. The intent of integrated testing is to demonstrate that the equipment is operational end to end under actual conditions, that all variances identified during factory and field installation and communications testing have been corrected, and that the communication equipment is compatible with other equipment at all locations. The Integrated System Test shall include all fibre optic transmission equipment, termination equipment, the network management subsystem and other components.

At a minimum the following tests shall be included in the integrated testing:

- (1) Equipment configuration shall be checked to establish that it supports the channel routing.
- (2) End to end testing of all individual voice circuits
- (3) End-to-end testing of all individual Data Circuits.
- (4) Demonstration of Protection switching and synchronization of equipment as per synchronization plan.



Fibre Optic Transmission System Installation Testing

Item:	Description:
1.	Physical Inspection for conformance to drawings, rack elevations and appearance of equipment and cabling
2.	Station power supply input and equipment power supply (DC-DC converter) output voltage measurements
3.	Terminal transceiver performance testing (Tx power, Tx spectrum, receive signal strength, connector losses etc.)
4.	Service channel performance
5.	Craftsperson interface, alarm and control functional performance
6.	Rack and local alarms: No alarms shall be present and all alarms shall be demonstrated to be functional
7.	Network management interface and supervision performance
8.	Correct configuration, level setting & adjustments and termination of Input/ output interfaces
9.	Proper establishment of Safety and signalling earthing system and resistance to ground to be checked.
10.	Simulation of failure conditions and failover of protected components.

NMS Installation Testing (if Applicable)

Item:	Description:
1.	Physical inspection for conformance to drawings, rack elevations and appearance of equipment and cabling
2.	Workstation hardware inventory, configuration and characteristics
3.	Demonstration of proper operation of all hardware, including workstations peripherals



27.5 Training for operational staffs

The Contractor shall design and arrange a training programme at his own cost at the manufacturer's premises at least for five (5) days for the Fibre Optic Based Communication system along with control & protection and substation automation system for three concerned NEA personnel so as to make them competent enough to operate and maintain the proposed equipment/system. The overview of such programme shall be proposed by the prospective contractor along with its technical proposal.



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SECTION- 28
SPECIFICATIONS FOR MISCELLANEOUS ITEMS



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SPECIFICATION

All the equipments below shall have but not limited to the following parameters:

28.1 Digital Multimeter

1	Accuracy	0.1 mV to 1000 V \pm 0.05 % + 1
2	AC voltage Range:	Accuracy: 0.1 mV to 1000 V \pm 0.7 % +4
3	DC current Range:	Accuracy: 0.1 μ A to 10 A \pm 0.2 % + 4
4	AC current Range	: Accuracy: 0.1 μ A to 10 A \pm 1.0 % + 2
5	Resistance Range:	Accuracy: 0.1 Ω to 50 M Ω \pm (0.2 % + 1)
6	Conductance Range:	Accuracy: 60.00 nS \pm (1.0 % + 10)
7	Diode test Range:	Accuracy: 2.0 V \pm (2.0 % + 1)
8	Duty cycle Range:	Accuracy: 0.0 % to 99.9 % Within \pm (0.2 % per kHz + 0.1 %) for rise times
TECHNICAL DATA		
1	Ambient temperature:	Different temperature ranges for Tamb are fixed by the type approved batteries. Storage temperature: -40°C ... +60°C without batteries
2	Power supply:	3 x AAA, type-proofed
3	Operating time:	min 400 h
4	Dimensions:	approx. 210 x 100 x 64 mm (with holster)
5	Weight:	approx. 500-750 g
6	Protective rating:	IP67

28.2 Tong Tester

AC Current Measurement: 0-20/50/500 /1000 Amp

- a. AC/DC Voltage Measurement: - 0 to 300 V / 600 V.
- b. Resistance Measurement: - 400 Ohms to 4 K Ohms

Accuracy

- i) For AC current \pm 3% reading with resolution of 0.1 upto 100 A, 1.0 upto 500 / 1000 A.
- ii) For AC /DC voltage \pm 1.5% reading with resolution of 0.1 upto 100 V, 1.0 upto 600 V.
- iii) For Resistance \pm 1% reading with resolution of 0.1 Ohm upto 400 Ohms, 0.1 Ohm upto 4 K Ohms.



For Resistance $\pm 1\%$ reading with resolution of 0.1 Ohm upto 400 Ohms,
0.1 Ohm upto 4 K Ohms.

Accessories:

The equipment shall be complete with test leads of length not less than one meter, output plug, carrying case, operating instructions manual & batteries and leather carrying case. The instrument shall also have following features:

- a. The meter should have 3-1/2 digits 2000 counts LCD display preferably with backlit.
- b. It should have manual range selection switch.
- c. It should have jaw size 40 mm (Min.) for accommodating round cable of dia 40 mm.
- d. It should be able to measure AC Amp., Voltage (AC) and Resistance.
- e. It should have over range indication.
- f. It should have data hold function.
- g. It should display AC/DC voltage and AC current.
- h. It should have overload protection.
- i. It should have water resistance, fire proof heavy duty ABS casing.
- j. It should have auto power OFF function i.e. sleep function.
- k. It should have battery access door for battery replacement without voiding calibration.
- l. It should have continuity check with a beeper and diode test function. Frequency response should be 45 Hz to 55 Hz. The tong tester clamp should accommodate cables having minimum 40 mm dia.

28.3 Transformer Oil Test Kit

1	Mains Supply	110V/220V 50/60Hz, $\pm 10\%$
2	Power Consumption	200VA
3	Mains Supply	110V/220V 50/60Hz, $\pm 10\%$
4	Power Consumption	200VA
5	Output Voltage	0 - 100KV (OTS - 100A)
6	Output Voltage	0 - 100KV (OTS - 100A)
7	Voltage Accuracy	$\pm 1\%$ ± 2 digits
8	Voltage Resolution	0.1KV watts
9	Voltage Rise Rate	0.5kV to 5kV/sec
10	Switch-off Time	<1 ms
11	Test Standards	IEC60156, IS6792, ASTM D877, ASTM D1816, UNE21, BS5730a, BS148, BS5874, VDE0370, NFC1344, OCT6581, SABS555, AS1767, STA8286, IP295
12	Customized Test Standards	5
13	Programmable Parameters	Stand time - 0 to 999 secs Stirring time - 0 to 999 secs Intermediate stand time - 0 to 999 secs Voltage Ramp-up-0.5kV/sec to 5kV/sec Iteration - 24
14	Temperature Measurement	0 - 99 c
15	Temperature Resolution	1C
16	PC Interface	USB
17	Printer	Inbuilt Thermal Printer
18	Internal Memory	100 test results
19	Display	Large LCD Color Display



20	Protection	Zero start and HT cover open interlock Auto trip and reset Open Ground Protection Overload Protection
21	Safety Standards	IEC61010,IEC61326
22	Environmental Condition	0c to +55c, <90% rh, non condensing
23	Size	650 mm X 320 mm X 361 mm
24	Weight	39kg
25	Standard Accessories	Oil test vessel with a mushroom electrodes Magnetic oil stierer Retiever for magnetic stierer Electrode gauge set - 0.1mm / 2.0mm / 2.5mm / 4.0mm Mains Cord User Manual Calibration Certificate
26	Operational Accessories	Voltage Calibrator Oil test vessel with Spherical Electrodes Oil test vessel with Cylindrical Electrodes

28.4 High Voltage Test Kit 80kV

1. Input supply: 0-230 V \pm 10% volts, 1 Phase, 50 \pm 5% Hz, AC supply.
2. Output voltage: Continuously variable 0 to 80 KV AC.
3. Capacity : 100mA in 0-80 KV range
4. Duty Cycle: 5 min On, 10 min Off.
5. Accuracy of TR. : \pm 3 % or better
6. Accuracy of Ammeter, Voltmeter: \pm 1 % or better
7. Percentage Impedance: not more than 8% in any case.
8. Output voltage variation: By means of motor driven arrangement.
 - Over load Tripping adjustment through site selection: At 10mA, 20mA, 50mA and 100mA AC.
 - Over Voltage Indication & Interlock Protection provided.
 - Normal Over Load Tripping set at 50 mA
9. Primary Cable
Primary cable should be three core and minimum 20 Meters long suitable for connection to 230 \pm 10 % Volt, 50 \pm 5% Hz AC supply, 1100 V grade cable to be used.

28.5 Trimble C3 2" Total Station

A	ANGLE MEASUREMENT	
1	Standard deviation [arcsec]	1
2	Division [arcsec]	0.5
B	DISTANCE MEASUREMENT WITH PRISM	
1	Standard deviation: constant part [mm]:	2
2	Standard deviation: variable part [ppm]:	2



3	Maximum range with 1 standard prism [m]:	5000
C	DISTANCE MEASUREMENT WITHOUT PRISM	
1	Standard deviation: constant part [mm]:	3
2	Standard deviation: variable part [ppm]:	2
D	USER INTERFACE	
1	No. faces:	2
2	Resolution [px rows x columns]:	128 x 64
3	Color display:	N
4	Screen type:	Back-lit, graphic LCD
5	Touchscreen:	N
6	No. keys:	25
E	POWER SUPPLY	
1	Battery:	Y
2	Batteries hot-swappable:	Y
F	INTEGRATED CAMERA	
1	Integrated camera available [Y/N]:	N
G	OPERATION	
1	Maximum working temperature [degC]:	50
2	P dust/water protection class [IPxx]:	66
H	INTEGRATED LASER SCANNING	
1	Integrated laser scanning available [Y/N]:	N
I	MISCELLANEOUS	
1	Laser plummet:	Optional
2	Guiding light:	N
J	SUPPORT	
1	Standard warranty [years]:	2
2	Reach of global support network:	Global
K	MORE INFORMATION	
1	Distinguishable features:	Autofocus



28.6 1kV Insulation Tester

A	Insulation	
1	Test voltage:	50 V, 100 V, 250 V, 500 V, 1000 V
2	Insulation accuracy	$\pm 2\% \pm 2$ digits $\pm 0.2\%$ per
3	Display range	Analogue: 1 G Ω full scale
4	Resolution	0.1 k Ω
5	Short circuit/charge current	2 mA +0% -50% to EN 61557-2 (2007)
6	Open circuit voltage insulation	-0% +2% ± 2 V
7	Test current	1 mA at min. pass value of insulation to a maximum of 2 mA max.
8	Leakage (not MIT400/2)	10% ± 3 digits
9	Voltage	3% ± 3 digits $\pm 0.5\%$ of rated voltage
10	Timer control	(not MIT400/2) 60 second countdown timer
B	Continuity:	
1	Continuity measurement	0.01 Ω to 1000 k Ω
2	Continuity accuracy	$\pm 3\% \pm 2$ digits (0 to 100 Ω) $\pm 5\% \pm 2$ digits (100 to 500k Ω) (500k Ω to 1M Ω unspecified) Service Error: BS EN 61557-4 (2007) - $\pm 2.0\%$, 0.1 Ω - 2 Ω $\pm 6.8\%$
3	Open circuit voltage	5 V ± 1 V
4	Test current	200 mA (-0 mA +20 mA) (0.01 Ω to 4 Ω)
5	Polarity	Single polarity (Default) / Dual polarity (configurable on setup).
6	Lead resistance	Null up to 9.00 Ω
C	Voltage:	
1	Voltage range AC:	10 mV to 600 V TRMS sinusoidal (15 Hz to 400 Hz) DC: 0 to 600 V
2	Volt range accuracy	AC: $\pm 2\% \pm 1$ digit DC: $\pm 2\% \pm 2$ digit Service Error: BS EN 61557-1 (2007) - $\pm 2.0\% \pm 2$ d, 0 V – 300 V AC/DC $\pm 5.1\%$
3	Waveform Unspecified range:	0 – 10 mV (15 to 400 Hz) For non-sinusoidal waveforms additional specifications apply Non-sinusoidal waveforms: $\pm 3\% \pm 2$ digits >100 mV to 600 V TRMS



		$\pm 8\% \pm 2$ digits 10 mV to 100 mV TRMS
D	Frequency:	
	Frequency measurement range	15 Hz - 400 Hz
	Frequency measurement accuracy	$\pm 0.5\% \pm 1$ digit (100 Hz to 400 Hz unspecified)
E	Capacitance measurement:	
1	Capacitance measurement	1 nF to 10 μ F
2	Capacitance measurement accuracy	$\pm 5.0\% \pm 2$ digits (0.1 nF – 1 nF unspecified)
F	Storage:	
1	Storage capacity	>1000 test results
2	Data download	Bluetooth® wireless Bluetooth® Class II
3	Range	up to 10 m
4	Power supply	6 x 1.5 V cells type IEC LR6 (AA, MN1500, HP7, AM3 R6HP) Alkaline 6 x 1.2 V NiMH rechargeable cells
5	Battery life	3000 insulation tests with duty cycle of 5 sec ON /55 sec OFF @ 1000 V into 1 M Ω
6	Charger (Optional):	12-15 V dc (accessory interface)
7	Dimensions	Instrument 228 mm x 108mm x 63 mm (9.00 in x 4.25in x 2.32 in)
8	Weight	600 (MIT400/2), (1.32 lb)

28.7 5kV motor operated Insulation Tester

1	a.c. voltage (auto-ranging)	90-264 V rms, 47- 63 Hz 100 VA
2	Battery charge time	2.5 hours deep discharge, 2 hours normal discharge
3	Battery	11.1 V, 5.2Ah Li-ion batteries, meet IEC 62133:2003, MIT1525 has 2 battery packs
4	Battery life	6 hours (typical) continuous testing at 5 kV with a 100 M Ω load
5	Test voltage	250 V, 500 V, 1000 V, 2500 V, 5000 V, User defined test voltage.
6	User defined test voltage	40 V to 1 kV in 10 V steps,
7	Test voltage accuracy	+4%, -0%, ± 10 V nominal test voltage at 1 G Ω load (0°C to 30°C)
8	Resistance range	10 k Ω to 15 T Ω



9	Accuracy	from 1 M Ω to $\pm 5\% \leq 3 \text{ T}\Omega$ $\pm 20\%$ to 35 T Ω
10	Short circuit / charge current	3 mA
11	Insulation test alarm:	100 k Ω to 10 G Ω
12	Capacitor charge	<3 s/ μF at 3 mA to 5 kV
13	Capacitor discharge	<250 ms/ μF to discharge from 5 kV to 50 V
14	Capacitance range	With test voltage set above 500 V: 10 nF to 25 μF
15	Capacitance measurement accuracy	$\pm 10\% \pm 5 \text{ nF}$
16	Current range	0.01 nA to 6 mA
17	Current accuracy	$\pm 5\% \pm 0.2 \text{ nA}$ at all voltages (20 °C)
18	Interference	3 mA from 450 V to 5 kV
19	Voltmeter range	30 V to 660 V a.c. or d.c., 45 Hz – 65 Hz
20	30 V to 660 V a.c. or d.c., 45 Hz –65 Hz	30 V to 660 V a.c. or d.c., 45 Hz – 65 Hz
21	Timer range	Up to 99 minutes 59 seconds, 15 second minimum setting
22	Memory capacity	5.5 hours logging @ 5 second intervals
23	Test modes	IR, IR(t), DAR, PI, SV, DD, Ramp test
24	Interface	USB type B (device)
25	Real time output	1 Hz output readings (V, I, R)
26	Maximum altitude	3000 m
27	Operating temperature range	-20 °C to 50 °C
28	Storage temperature range	-25 °C to 65 °C
29	Humidity	90% RH non-condensing at 40 °C
30	IP rating	IP65 (lid closed), IP40 (lid open)
31	Safety	CAT IV 600 V to 3000 m altitude
2	Dimensions	L 315 mm x W 285 mm x H 181 mm



ANNEX- I

LIST OF PREFERED (SHORTLISTED) MAKE

It is preferred that the following equipment be supplied from the manufacturers listed hereunder:

- (i) **Main Protection Relays, Control & Relay panel, Substation Automation System from:** ABB, AREVA / ALSTOM, SIEMENS, Fuji, Reyrolle, Toshiba, Mitsubishi, GE or equivalent.
- (ii) **Energy Meters from:** ELSTER (ABB), ACTARIS (Schlumberger), EDMI, SIEMENS or equivalent.
- (iii) **SF6 Circuit Breakers from:** ABB, AREVA /ALSTOM, Hitachi, Siemens, Toshiba/Mitsubishi, LG, Fuji, GE or equivalent.
- (iv) **VCB Switchgear from:** ABB, AREVA/ALSTOM, Hitachi, Siemens, Toshiba/Mitsubishi, LG, Fuji, GE, Schneider Electric or equivalent.
- (v) **On-Load Tap Changer:** The on-load tap-changer (OLTC) to be equipped on the power transformers and associated control equipment shall be from MR Germany or ABB Sweden or equivalent
- (vi) **AVR:** The AVR to be equipped on the RTCC shall be from MR Germany or ABB Sweden or equivalent
- (vii) **Temperature Indicators:** shall be from AB Khilstrom, Sweden or equivalent
- (vi) **Gas Insulated Substation:** ABB, AREVA/ALSTOM, SIEMENS, Toshiba / Mitsubishi, GE, HYOSUNG, Hyundai, Hitachi or equivalent.
- (vii) **Communication System:** NOKIA, NOKIA SIEMENS, SIEMENS, ABB, AREVA/ALSTOM or equivalent

The bidders may offer equipment/brands other than those listed above that are better or equivalent with regard to quality and performance substantiated with appropriate documents. The bidder is required to submit all technical information, brochures, and test reports of the proposed equipment for assessing equivalence with the shortlisted vendor during the bid submission.