CEYLON ELECTRICITY BOARD
SRI LANKA

MANNAR NADUKUDA EMBILIPITIYA GRID SUBSTATIONS AUGMENTATION PROJECT

(Funds: Savings from ADB Loan Nos.3585-SRI and 3147-SRI)

GRID SUBSTATIONS

Procurement of Plant

Design, Supply, and Installation

Single-Stage: Two-Envelope Bidding Procedure

BIDDING DOCUMENT FOR

Augmentation of:

Mannar 220/33 kV Grid Substation

Nadukuda 220/33 kV Grid Substation

Embilipitiya 132/33 kV Grid Substation

VOLUME 7 of 8

Part II- REQUIREMENTS

Section 6 - Employer's Requirements: Part D-Supplementary Information, Part E-Bank Guaranties and Certificates, Change Orders

Issued on: 02 Sep 2021

Invitation for Bids No.: CEB/AGM/PRO/2021/IFB/MNEGSAP

OCB No.: CEB/AGM/PRO/2021/OCB/MNEGSAP

Employer: Ceylon Electricity Board

Country: Sri Lanka

Projects Division

Ceylon Electricity Board,

P.O. Box 540, Colombo 02

Sri Lanka

Document – Revision 1

Preface

This Bidding Document for Procurement of Plant – Design, Supply, and Installation, has been prepared by Ceylon Electricity Board and is based on the Standard Bidding Document for Procurement of Plant – Design, Supply, and Installation (SBD Plant) issued by the Asian Development Bank dated June 2018.

ADB's SBD Plant has the structure and the provisions of the Master Procurement Document entitled "Procurement of Plant – Design, Supply, and Installation", prepared by multilateral development banks and other public international financial institutions except where ADB-specific considerations have required a change.

Savings of ADB Loan No. 3585-SRI is used for the Augmentation of Mannar Grid Substation and Nadukuda Grid Substation. Savings of ADB Loan No. 3147-SRI is used for the Augmentation of the Embilipitiya Grid Substation. In order to make the payment for the augmentation of Mannar Grid Substation and Nadukuda Grid Substation by ADB Loan No. 3585-SRI and augmentation of Embilipitiya Grid Substation by ADB Loan No. 3147-SRI, this procurement is separated into two lots as follows.

Lot A - Augmentation of Mannar 220/33kV Grid Substation and Nadukuda 220/33kV Grid Substation
Lot B - Augmentation of Embilipitiya 132/33kV Grid Substation

Separation of this procurement into two lots is only for the above mentioned purpose. It is mandatory for all Bidders to bid for both lots (Lot A and Lot B). Preparation of Bidding Document, evaluation, awarding etc. is carried out accordingly and a single contract that includes both lots will be signed with the successful Bidder.

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Notes on Schedules

The schedules are intended to provide the Employer with essential supplementary information in an organized format. The examples of more commonly used schedules are given herein. Others may be devised and added in accordance with the requirements of the instructions to bidders.

All the schedules are essential for the bid evaluation and some in contract execution; they should all be incorporated in the contract, and appropriate changes introduced with the approval of the employer or its representative.

The schedules are to be completed and submitted as part of the technical proposal in accordance with the instruction to bidders.

There shall be no equipment offered without filling these schedules. These sheets to be copied and filled in separately for each different types of equipment offered.

1 MANUFACTURERS, PLACE OF MANUFACTURE AND TESTING

Item	Manufacturer	Place of Manufacture	Place of Testing & Inspection
HV SWITCHGEAR 245 kV			
Outdoor Switchgear			
Circuit Breakers			
Disconnectors			
Current Transformers			
Capacitor Voltage Transformers			
Surge Arresters			
Neutral Current Transformers			
Post Insulators			
Insulator Strings			
Flexible Conductors			
Busbars (tubular)			
Connectors			
Steel Structures			
MV SWITCHGEAR 36 kV			
Outdoor Switchgear			
Surge Arresters			
Neutral Current Transformers			
Flexible Conductors			
Post Insulators			
Connectors			
Steel Structures			
Indoor GIS Switchgear			
Circuit Breakers			
Disconnectors			
Busbars			

Item	Manufacturer	Place of Manufacture	Place of Testing & Inspection
Current Transformers			
Voltage Transformers			
Earthing Switches			
ANCILLARY EQUIPMENT			
Gas Handling Equipment			
Testing Equipment			
400V SWITCH BOARDS			
Panels			
Circuit Breakers			
CONTROL & PROTECTION, SUBSTATION AUTOMATION SYSTEM AND METERING			
Control and Protection System including Control & Protection IEDs and Panels			
- Control & Protection IEDs			
- Instrument Relays			
- Panels			
Substation Automation System and Gateways including Panels			
Automatic Voltage Regulator System including Automatic Voltage Regulator IEDs and Panel			
Energy Metering System including Energy Meters and Panels			
Communication System and Panel			
Gateway System			
DFR System and Panels			
Bay Marshalling KIOSKS			
Auxiliary Relays			
Terminal Bars			
MIMIC Switches			
MCB's			

Item	Manufacturer	Place of Manufacture	Place of Testing & Inspection
Selector Switches			
DC EQUIPMENT			
Batteries			
Chargers			
Distribution Boards			
110/48 V DC-DC Convertors			
220/48 V DC-DC Convertors			
Inverters			
CONTROL CABLES			
PVC insulated Cables			
Telecommunication Cables			
POWER CABLES & TERMINATION			
245 kV Cables			
36 kV Cables			
12 kV Cables			
1 kV Cables			
Sealing Ends and Joints etc			
245 kV Cable Terminations			
36 kV Cable Terminations			
12 kV Cables			
Cable trays			
EARTHING			
Copper Conductor			
Clamps			
Earthing Rods			

Item	Manufacturer	Place of Manufacture	Place of Testing & Inspection
Welding Material/Compound			
SITE ERECTION			
To be carried out by:			
POWER TRANSFORMERS			
Power Transformer 220/33 kV			
Transformers Complete			
Windings			
220kV Terminal			
33 kV Terminal			
Insulators			
Tap Changers			
Copper			
Core parts			
Tanks			
Radiators			
Fan motors			
Temperature indicators			
Oil valves			
Pressure relief device			
Motor Control equipment			
Alarm Devices			
Gas and Oil actuated relays			
Automatic Voltage regulator panel			
Insulators			
Transformer Oil			

Item	Manufacturer	Place of Manufacture	Place of Testing & Inspection
AUXILIARY TRANSFORMER 33/0.4kV			
Transformer Complete			
HV Bushings			
LV Cable Box			
Insulators			
EARTHING TRANSFORMERS 800 A / 30 sec			
Transformer Complete			
HV Bushings			
LV Cable Box			
Insulators			
Steel Structures			
SCADA Equipment			
Fiber Optic Equipment			
SOLAR POWER SYSTEM			
PV Panels			
Solar Inverter			
Combiner boxes			
Monitoring and data acquisition system			
Diesel Generator			
Cement			

2 TECHNICAL PARTICULARS AND GUARANTEES

A - ELECTRICAL WORKS

Notes:

1. There shall be no equipment offered without filling these schedules. These sheets to be copied and filled in separately for each different type of equipment offered.

2. Refer scope of work & drawings for detail ratings.

2.1 245 kV OUTDOOR SWITCHGEAR (220V DC VOLTAGE)

2.1.1 Circuit Breaker

No	Item	Units	Required	Tendered
			245 kV	245 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC		IEC62271-100	
5.	Manufacturer's type designation, and type ref or model number			
6.	Interrupting Medium		SF_6	
7.	Number of Phases	Nos.		
8.	Frequency	Hz		
9.	Rated Voltage	kV	245	
10.	Impulse withstand voltage on 1.2/50 Wave	kV	1050	
11.	One minute Power frequency withstand voltage			
	Closed	kV	460	
	Open	kV	460	
12.	Rated normal current	A		
13.	Short- time withstand current switchgear – 1 Sec:	rms kA	40	
14.	Rated short-circuit breaking current.			
	Symmetrical	rms kA	40	
	DC component	%	More than 20%	
15.	Short-circuit making current	Peak kA	100	
16.	Rated transient recovery voltage at rated short circuit breaker current	V		
17.	Rated Operating duty cycle		O-0.3Sec- CO-3Min-CO	
18.	First phase to clear factor		1.3	
19.	Rated short circuit Breaking current			
	(a) kV (pk)			
	(b) RRRV			

No	Item	Units	Required	Tendered
			245 kV	245 kV
20.	Rated small inductive breaking current.	A		
21.	Rated line charging breaking current	A	145	
22.	Rated cable charging breaking current.	A	250	
23.	Rated out of phase breaking current	kA		
24.	Rated characteristic for short line fault as per IEC -60056	A		
25.	Maximum allowable switching over voltage	kV		
26.	Minimum time for arc extinction to contact remake when adapted for auto-reclosing (dead time)	ms		
27.	Time from closing of control switch for completion of closing stroke during fault making (make time)	ms		
28.	Type Testing Authority			
29.	Type Test Certificate Report Reference No.			
30.	Opening time			
	- Without current.	ms		
	- at 100% of rated breaking current	ms		
31.	Maximum arcing time of any duty cycle of (IEC 60056-2)	ms		
32.	Duty on which maximum arc duration occurs			
33.	Current at which maximum arc duration occurs	A		
34.	Make time	ms		
35.	Minimum time for arc extinction to contact remake when adopted for auto reclosing	ms		
36.	Time from closing of control switch to completion of closing stroke during fault making.	ms		
37.	Is an external series break incorporated in break?	Yes/No		
38.	Is a device used to limit transient recovery voltage?	Yes/No	No	
39.	Method of closing.			

No	Item	Units	Required	Tendered
			245 kV	245 kV
40.	Method of tripping.			
41.	Rated voltage for spring winding motor for closing	V DC	220	
42.	Closing release coil current	A		
43.	Closing release coil voltage	V DC	220	
44.	Trip coil current	A		
45.	Trip coil voltage	V DC	220	
46.	Is the circuit-breaker trip free?	Yes/No	Yes	
47.	Minimum clearances in air:			
	(a) between phases	mm		
	(b) phases to earth	mm		
	(c) across interrupters	mm		
	(d) live parts to ground level	mm		
48.	Material of tank interrupter chamber			
49.	Material of moving contact operating rod			
50.	Material of contact surfaces			
	(a) Main contact			
	(b) Arcing contact			
51.	Number of breaker per phase	Nos.	01	
52.	Length of each break	mm		
53.	Length of stroke	mm		
54.	Weight of circuit-breaker unit complete	kg		
55.	Maximum shock load imposed on floor of foundations when opening under fault conditions (state whether tension or compression)	kg		
56.	Quantity of gas in complete three-phase circuit breaker	Liters		
57.	Maximum pressure rise in circuit breakers due to the making or breaking of rated current.	Bar		
58.	Routine pressure test on circuit breaker tanks or containers	Bar		

No	Item	Units	Required	Tendered
			245 kV	245 kV
59.	Pressure type test on Circuit Breaker tanks or containers	Bar		
60.	Interrupting Gas Pressure			
	(a) at (20^0C) normal	Bar		
	(b) at (30^0C) normal	Bar		
61.	(a) Limits of gas pressure at 20^0 C			
	Maximum	Bar		
	Minimum	Bar		
	(b) Limits of gas pressure at 30^0 C			
	Maximum	Bar		
	Minimum	Bar		
62.	Period of time equipment has been in commercial operation	Years		
63.	Number of operations before interrupter maintenance required.			
	(a) At rated short circuit current	Nos	10	
	(b) At full load current	Nos	5000	
64.	Mechanical Endurance Class		Class M2	
	Type Tests *Document reference number and Type tested model shall be written in tendered column.*	Included in the Bid (Yes or No)		
65.	Dielectric tests	Yes/No	Yes	
66.	Measurement of the resistance of the main circuit	Yes/No	Yes	
67.	Temperature-rise tests	Yes/No	Yes	
68.	Short-time withstand current and peak withstand current tests	Yes/No	Yes	
69.	Additional tests on auxiliary and control circuits	Yes/No	Yes	
70.	Mechanical operation test at ambient temperature	Yes/No	Yes	
71.	Short-circuit current making and breaking tests	Yes/No	Yes	

2.1.2 Current Transformers

No	Item	Units	Required	Tendered
			245 kV	245 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC		IEC 61869-1&2	
5.	Manufacturer's type designation, and type ref or model number			
6.	Number of phases		Single	
7.	Installed location		Outdoor	
8.	Highest system voltage	kV	245	
9.	Rated frequency	Hz	50	
10.	Rated current ratio.	A		
11.	Rated Primary Current	A		
12.	Rated Secondary Current	A		
13.	Number of cores			
14.	Accuracy			
	(i) For revenue metering		0.2	
	(ii) For Protection			
15.	Rated burden	VA		
16.	Continuous Current Rating Factor		1.2	
17.	Rated short Circuit current 1 sec	rms kA	40	
18.	Rated short time thermal current (as per breaker)	kA Sec		
19.	Rated insulation level			
	(i) AC withstand voltage 1 min.dry			
	Primary	kV	460	
	Secondary			
	(ii) Impulse withstand voltage full wave	kV	1050	
20.	Knee point voltage	V		
21.	DC Resistance			

No	Item	Units	Required	Tendered
			245 kV	245 kV
22.	Dimensions			
	(i) Overall height			
	(ii) Total length			
	(iii) Total weight per phase			
23.	Rated Dynamic peak current.	A		
24.	Creepage distance of the insulators	mm		
		mm/kV	53.7	
	Type Tests *Document reference number and Type tested model shall be written in tendered column.*	Included in the Bid (Yes or No)		
25.	Temperature-rise test	Yes/No	Yes	
26.	Impulse voltage tests on primary terminals	Yes/No	Yes	
27.	Electromagnetic Compatibility tests	Yes/No	Yes	
28.	Electromagnetic Compatibility tests	Yes/No	Yes	
29.	Verification of the degree of protection by enclosures	Yes/No	Yes	
30.	Enclosure tightness test at ambient temperature	Yes/No	Yes	

2.1.3 Insulator Strings

No	Item	Units	Required	Tendered
			245 kV	245 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC			
5.	Manufacturer's type designation, and type ref or model number			
6.	Insulator material Glass or Porcelain			
7.	Number of units per string:			
8.	Outside diameters of units	mm		
9.	Distance of centres of units	mm		
10.	Length of string overall	mm		
11.	Maximum working load	kN		
12.	Minimum failing load per unit	kN		
13.	Mechanical routine load test	kN		
14.	Electro-mechanical failing load	kN		
15.	Mechanical failing load	kN		
16.	Electrostatic capacity of unit	pF		
17.	Weight of complete string	kg		
18.	50 Hz 1 minute withstand voltage of unit, dry	kV	460	
19.	50 Hz 1 minute withstand voltage of unit, wet	kV		
20.	Minimum 50 Hz puncture voltage	kV		
21.	Dry lightning impulse withstand voltage of string 2/50 micro second wave	kV	1050	
22.	Switching impulse withstand voltage, wet	kV		
23.	Minimum total creepage distance per unit			
	(i) Specified Polluted	mm		
	(ii) Guaranteed Polluted	mm		

No	Item	Units	Required	Tendered
			245 kV	245 kV
24.	Protected creepage distance per string	mm		
		mm/kV	53.7	
25.	RTV Silicone coating	Yes/No	Yes	
26.	Minimum thickness of RTV Silicone coating	µm	> 300	

2.1.4 Surge Arresters

No	Item	Units	Required	Tendered
			245 kV	245 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC		IEC 60099	
5.	Manufacturer's type designation, and type ref or model number			
6.	System highest voltage	kV	245	
7.	Protective levels to be less than or equal to:-			
	Transformer	kV	440	
8.	Class of diverter to IEC.60099 :1991 (BS EN 60099-1:1994)			
	-Duty		Heavy	
	-Long duration discharge class		Class 2	
	-Pressure relief class		A	
9.	Rated voltage	rms kV	192	
10.	Rated normal discharge current	kA	10	
11.	50 Hz spark over voltage	Min. rms kV		
12.	100% impulse spark over on 2/50 micro sec. wave	Max. peak kV		
13.	Switching surge spark over.	Max. peak kV		
14.	Discharge residual voltage based on 10/20 wave at			
	5 kA peak	kV		
	10 kA peak	kV		
	20 kA peak	kV		
15.	Current at which resistor elements are stabilized in manufacture	kA		
16.	Current discharge capacity:			
	5/10 micro sec. Wave Peak	kA		
	2,000 micro sec, Peak	kA		

No	Item	Units	Required	Tendered
			245 kV	245 kV
	Rectangular wave Peak	kA		
17.	Minimum reseal voltage	rms kV		
18.	Total height of diverter	mm		
19.	Total weight of diverter	kg		
20.	Type reference of surge counter			
21.	Minimum creepage distance per unit			
	(i) Specified polluted	mm		
	(ii) Guaranteed Polluted	mm		
	NB: Evidence of substantial service experience is to be submitted.			
22.	Material of primary insulation			
23.	RTV Silicone coating	Yes/No	Yes (for Porcelain insulators)	
24.	Minimum thickness of RTV Silicone coating	µm	> 300	

2.1.5 Disconnectors

No	Item	Units	Required	Tendered
			245 kV	245 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC		IEC 62271-102	
5.	Manufacturer's type designation, and type ref or model number			
6.	Rated frequency	Hz	50	
7.	Rated voltage	kV	245	
8.	No. of poles per unit		3	
9.	Dimension and weight			
	(i) Overall height	mm		
	(ii) Total length	mm		
	(iii) Total width	mm		
	(iv) Total weight	kg		
10.	Type of contacts			
11.	Material of contact surface		Silver coated	
12.	Rated normal current	A	See Scope of works & Drawing	
13.	Maximum short time withstand current (1 sec)	rms kA	40	
14.	Air gap between poles of one phase	mm		
15.	Type of operating mechanism			
	- Disconnector		Motor	
16.	Manual Operating facility	Yes/No	Yes	
17.	Motor Voltage	V DC	220	
18.	Total weight of three-phase Isolator complete	kg		
19.	Charging current breaking capacity	A		
20.	Magnetizing current breaking capacity	A		

No	Item	Units	Required	Tendered
			245 kV	245 kV
21.	Power consumption of the motor.	kW		
22.	Operating time			
23.	Lighting impulse withstand voltage			
	(i) to earth	kV	1050	
	(ii) across isolating distance	kV	1050	
24.	Rated one minute Power frequency withstand voltage			
	(i) to earth	kV	460	
	(ii) across isolating distance	kV	460	
	Type Tests *Document reference number and Type tested model shall be written in tendered column.*	Included in the Bid (Yes or No)		
22.	Test to prove satisfactory operation and mechanical endurance test	Yes/No	Yes	
23.	Test to prove the short-circuit making performance of earthing switches	Yes/No	Yes	
24.	Test to prove satisfactory operation at temperature limits	Yes/No	Yes	
25.	Test to prove the proper function of position indicating devices	Yes/No	Yes	
26.	Test to prove the bus-transfer current switching capability of disconnectors	Yes/No	Yes	
27.	Tests to prove the induced current-switching capability of earthing switches	Yes/No	Yes	
28.	Tests to prove the bus-charging current switching ability of disconnectors used in metal enclosed switchgear	Yes/No	Yes	

2.1.6 Busbars and Connections

No	Item	Units	Required	Tendered
			245 kV	245 kV
	BUSBARS			
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC			
5.	Manufacturer's type designation, and type ref or model number			
6.	Material	Al Tubes	Al Tubes	
7.	Overall diameter			
8.	Nominal section	mm		
9.	Cross section and make-up	mm^2		
10.	Maximum rated current	A		
11.	Maximum working tension of main connections	kN/m^2		
12.	Resistance of conductors per 100m at 30^0C	ohms		
13.	Tensile breaking stress of material	kN/m^2		
14.	Maximum permissible span length	m		
15.	Maximum sag under own weight of maximum span	mm		
	CIRCUIT CONNECTIONS			
1.	Manufacturer's Name			
2.	Manufacturer's Address			
3.	Material			
4.	Overall diameter	mm		
5.	Nominal section	mm^2		
6.	Cross section and make-up			
7.	Maximum rated current	A		
8.	Maximum working tension of main connections	kN/m^2		
9.	Resistance of conductors per 100 m at 30^0C	ohms		

No	Item	Units	Required	Tendered
			245 kV	245 kV
10.	Tensile breaking stress of material	kN/m^2		
11.	Maximum permissible span length	m		
12.	Maximum sag under own weight of maximum span	mm		

2.1.7 Neutral Current Transformers

No	Item	Units	Required	Tendered
			245 kV	245 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC			
5.	Manufacturer's type designation, and type ref or model number			
6.	Rated voltage	kV	245	
7.	50 Hz 1 minute withstand voltage, wet	kV	460	
8.	Type of construction (post, ring, etc.)			
9.	Material of primary insulation			
10.	RTV Silicone coating	Yes/No	Yes	
11.	Minimum thickness of RTV Silicone coating	µm	> 300	

2.1.8 Switchgear Insulators

No	Item	Units	Required	Tendered
			245 kV	245 kV
	Including hollow and post insulators for minimum oil or gas circuit breakers, hollow insulators for current transformers, capacitor type voltage transformers and coupling capacitors.			
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC			
5.	Manufacturer's type designation, and type ref or model number			
6.	Rated service voltage	kV	245	
7.	Principal insulating material		Porcelain	
8.	Length of insulator overall	mm		
9.	Shed profile (to be enclosed with Tender)	Drg. No.		
10.	Weight of insulator complete with fittings	kg		
11.	Electrostatic capacity complete insulator	pF		
12.	Material of fittings			
13.	Total creepage distance over porcelain of complete post (based on highest system voltage)	mm/kV	53.7	
14.	Protected creepage distance	mm		
15.	Voltage below which no corona shall be visible	kV		
16.	Dry lightning impulse withstand (1.2/50 microsecond wave)	kV	1050	
17.	Switching impulse withstand voltage	kV		
18.	RTV Silicone coating	Yes/No	Yes	
19.	Minimum thickness of RTV Silicone coating	µm	> 300	

2.1.9 Post and Disconnector Insulators

No	Item	Units	Required	Tendered
			245 kV	245 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC		IEC 60168	
5.	Manufacturer's type designation, and type ref or model number			
6.	Insulator material		Porcelain	
7.	Insulator type			
8.	Maximum working vertical load:			
	Tension	kN		
	Compression	kN		
9.	Minimum failing load (tension)	kN		
10.	Maximum horizontal working load	kN		
11.	Minimum failing load(torsion)	Nm		
12.	Minimum failing load(bending)	kN		
13.	Shed profile (to be enclosed with Tender)	Drg. No		
14.	Greatest diameter	mm		
15.	Number of units in one insulator			
16.	Length overall per complete post	mm		
17.	Weight of complete post	kg		
18.	Electrostatic capacity	pF		
19.	50Hz 1 minute withstand voltage, dry	kV		
20.	50Hz 1 minute withstand voltage, wet	kV	460	

No	Item	Units	Required	Tendered
			245 kV	245 kV
21.	Dry lightning impulse withstand			
22.	Voltage, 2/50 micro sec. wave	kV	1050	
23.	Minimum creepage distance			
	(i) Specified Polluted	mm		
	(ii) Guaranteed Polluted	mm		
24.	Protected creepage distance polluted	mm		
		mm/kV	53.7	
25.	RTV Silicone coating	Yes/No	Yes	
26.	Minimum thickness of RTV Silicone coating	µm	> 300	

2.2 36 kV OUTDOOR SWITCHGEAR

2.2.1 Insulator Strings

No	Item	Units	Required	Tendered
			36 kV	36 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC			
5.	Manufacturer's type designation, and type ref or model number			
6.	Insulator material Glass or Porcelain			
7.	Number of units per string:			
8.	Outside diameters of units	mm		
9.	Distance of centres of units	mm		
10.	Length of string overall	mm		
11.	Maximum working load	kN		
12.	Minimum failing load per unit	kN		
13.	Mechanical routine load test	kN		
14.	Electro-mechanical failing load	kN		
15.	Mechanical failing load	kN		
16.	Electrostatic capacity of unit	pF		
17.	Weight of complete string	kg		
18.	50 Hz 1 minute withstand voltage of unit , dry	kV	70	
19.	50 Hz 1 minute withstand voltage of unit , wet	kV		
20.	Minimum 50 Hz puncture voltage	kV		
21.	Dry lightning impulse withstand voltage of string2/50 micro second wave	kV	170	

No	Item	Units	Required	Tendered
			36 kV	36 kV
22.	Switching impulse withstand voltage, wet	kV		
23.	Minimum total creepage distance per unit			
	(i) Specified Polluted	mm		
	(ii) Guaranteed Polluted	mm		
24.	Protected creepage distance per string	mm		
		mm/kV	53.7	
25.	RTV Silicone coating	Yes/No	NA	
26.	Minimum thickness of RTV Silicone coating	µm	NA	

2.2.2 Post and Disconnector Insulators

No	Item	Units	Required	Tendered
			36 kV	36 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC		IEC 60168	
5.	Manufacturer's type designation, and type ref or model number			
6.	Insulator material		Porcelain	
7.	Insulator type			
8.	Maximum working vertical load:			
	Tension	kN		
	Compression	kN		
9.	Minimum failing load (tension)	kN		
10.	Maximum horizontal working load	kN		
11.	Minimum failing load(torsion)	Nm		
12.	Minimum failing load(bending)	kN		
13.	Shed profile (to be enclosed with Tender)	Drg. No		
14.	Greatest diameter	mm		
15.	Number of units in one insulator			
16.	Length overall per complete post	mm		
17.	Weight of complete post	kg		
18.	Electrostatic capacity	pF		
19.	50Hz 1 minute withstand voltage, dry	kV		
20.	50Hz 1 minute withstand voltage, wet	kV	70	

No	Item	Units	Required	Tendered
			36 kV	36 kV
21.	Dry lightning impulse withstand			
22.	Voltage, 2/50 micro sec. wave	kV	170	
23.	Minimum creepage distance			
	(i) Specified Polluted	mm		
	(ii) Guaranteed Polluted	mm		
24.	Protected creepage distance polluted	mm		
25.	RTV Silicone coating	Yes/No	NA	
26.	Minimum thickness of RTV Silicone coating	µm	NA	

2.2.3 Surge Arrester

No	Item	Units	Required	Tendered
			36 kV	36 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC		IEC 60099	
5.	Manufacturer's type designation, and type ref or model number			
6.	System highest voltage	kV	36	
7.	Protective levels to be less than or equal to:			
	Transformer	kV	136	
8.	Class of diverter to IEC.60099 :1991 (BS EN 60099-1:1994)			
	-Duty		Heavy	
	-Long duration discharge class		Class 2	
	-Pressure relief class		A	
9.	Rated voltage	rms kV	36	
10.	Rated normal discharge current	kA	10	
11.	50 Hz spark over voltage	Min. rms kV		
12.	100% impulse spark over on 2/50 micro sec. wave	Max. peak kV		
13.	Switching surge spark over.	Max. peak kV		
14.	Discharge residual voltage based on 10/20 wave at			
	5 kA peak	kV		
	10 kA peak	kV		
	20 kA peak	kV		
15.	Current at which resistor elements are stabilized in manufacture	kA		
16.	Current discharge capacity:			
	5/10 micro sec. Wave Peak	kA		
	2,000 micro sec, Peak	kA		
	Rectangular wave Peak	kA		

No	Item	Units	Required	Tendered
			36 kV	36 kV
17.	Minimum reseal voltage	rms kV		
18.	Total height of diverter	mm		
19.	Total weight of diverter	kg		
20.	Type reference of surge counter			
21.	Minimum creepage distance per unit			
	(i) Specified polluted	mm		
	(ii) Guaranteed Polluted	mm		
	NB: Evidence of substantial service experience is to be submitted.			
22.	Material of primary insulation			
23.	RTV Silicone coating	Yes/No	NA	
24.	Minimum thickness of RTV Silicone coating	µm	NA	

2.2.4 Neutral Current Transformers

No	Item	Units	Required	Tendered
			36 kV	36 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC			
5.	Manufacturer's type designation, and type ref or model number			
6.	Rated voltage	kV	36	
7.	50 Hz 1 minute withstand voltage, wet	kV	70	
8.	Type of construction (post, ring , etc.)			
9.	Material of primary insulation			
10.	RTV Silicone coating	Yes/No	NA	
11.	Minimum thickness of RTV Silicone coating	µm	NA	

2.3 36KV INDOOR SWITCHGEAR & ASSOCIATED EQUIPMENT

2.3.1 Medium Voltage Gas Insulated Switchgear

No	Item	Units	Required	Tendered
			36 kV	36 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC			
5.	Manufacturer's type designation, and type ref or model number			
6.	Rated voltage	kV	36	
7.	Rated frequency	Hz	50	
8.	Maximum continuous system voltage at minimum gas pressure	kV	36	
9.	Impulse withstand voltage (peak) at minimum gas pressure	kV	170	
10.	Power frequency withstand voltage 1 min. at minimum gas pressure	kV	70	
11.	Power frequency withstand voltage 1 min at atmospheric pressure	kV		
12.	Rated short time withstand current	kA	25	
13.	Rated duration of short time withstand current	s	1	
14.	Rated peak short circuit current	kA		
15.	Heaviest part of any feeder for crane	kg		
16.	Feeder Width	mm		
	Depth	mm		
	Height	mm		
17.	Current SF6 gas replenishing	Yes/No	No	
18.	Material of filter employed for moisture absorption			
19.	Heat losses per feeder at rated Power	kW		

2.3.2 Busbars

No	Item	Units	Required	Tendered
			36 kV	36 kV
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Rated normal current	A		
4.	Rated current at max. ambient temperature	A		
5.	Conductor material			
6.	Standard applicable			
7.	Single conductor cross section	mm²		

2.3.3 Circuit Breaker (Mannar 220/33 kV GSS)

No	Item	Units	Required	Tendered
			36 kV	36 kV
	(These sheets to be copied and filled in for each different type of CBs)			
1.	Manufacturer's Name			
2.	Manufacturer's Address			
3.	Manufacturer's Type Designation and Model No.			
4.	Applicable Standard			
5.	Type tested	Yes/No	Yes	
6.	Type test report, Ref. No.			
7.	Rated normal current at 20deg. C			
	- line feeder circuit breaker	A	1250	
	- transformer feeder circuit breaker	A	2500	
	- bus coupler circuit breaker	A	2500	
8.	Rated current at max. ambient temperature	A		
	- line feeder circuit breaker	A		
	- transformer feeder circuit breaker	A		
	- bus coupler circuit breaker	A		
9.	Rated short circuit breaking current (symmetrical, r.m.s.)	kA		
10.	Rated short circuit breaking current (asymmetrical, r.m.s.)	kA		
11.	Rated short circuit making current (peak)	kA		
12.	Rated cable charging breaking current	A		
13.	Rated line charging breaking current	A		
14.	Rated small inductive breaking current	A		
15.	Voltage drop across terminals of one pole at rated current	mV		
16.	Amplitude factor			
17.	First pole-to-clear factor		1.5	

No	Item	Units	Required	Tendered
			36 kV	36 kV
18.	Rated operating sequence:		O-t-CO-t'-CO	
	- with t	sec.	0.3	
	- with t'	min.	3	
19.	Min. time t" between two successful three phase auto reclosures at full rated breaking current (sequence O-t-C-t"-O-t-C)	min.		
20.	Closing time	ms		
	- tolerances	ms		
21.	Dead time (max.)	ms		
	- tolerances	ms		
22.	Break time (max.) at full rated breaking current	ms		
	- tolerances	ms		
23.	Make time (max.)	ms		
	- tolerances	ms		
24.	Arcing time (max.) at full short circuit duty	ms		
	- tolerances	ms		
25.	Life duration of main contacts (no load mechanical operations)	operations		
26.	Number of switching operations at rated breaking capacity before contact maintenance becomes necessary	No.	min. 100	
27.	Rated pressure of SF6 for arc quenching	bar		
28.	Auxiliary contacts:			
	- number (NO/NC)			
	- voltage rating	V DC	220	
	- current rating	A DC		
29.	SF6 pressure at which lockout operates	bar		
30.	To be filled in only in case of hydraulic operating mechanism:			
	- Setting of pressure relief device	bar		

No	Item	Units	Required	Tendered
			36 kV	36 kV
	- Rated pressure of hydraulic oil	bar		
	- Lowest oil pressure at which lockout	bar		
31.	Making coil			
	- Rated voltage	V DC	220	
	- min. operating voltage	V	176	
	- Rated power each	W		
32.	Trip coil			
	- Rated voltage	V DC	220	
	- min. operating voltage	V	110	
	- Rated power each	W		
33.	Motor voltage	V DC	220	
34.	Motor power	W		
35.	Total loss of heaters for 3 poles	W		
36.	Max. temperature rise of contacts at rated normal Current	K		
37.	Arc quenching medium		SF_6/VACUUM	
38.	Material of main contacts			
39.	Number of breaks in series (per pole)	No.		
	- for closing			
	- for opening			
40.	Single pole operation (only in Line Feeder Breakers)	Yes/No	No	
41.	Making coil:			
	- number	pcs		
42.	Trip coil:			
	- number	pcs	2	
43.	Gas quantity of complete breaker (3 Phase)	kg		
44.	Material of filter employed for the absorption of the products of combustion			

No	Item	Units	Required	Tendered
			36 kV	36 kV
45.	Method of controlling voltage distribution between breaks (capacitor, resistor etc.)			
46.	Weight of complete 3 pole breaker	kg		
47.	Weight of heaviest part for shipment	kg		

2.3.4 Circuit Breaker (Embilipitiya 132/33 kV GSS)

No	Item	Units	Required	Tendered
			36 kV	36 kV
	(These sheets to be copied and filled in for each different type of CBs)			
1.	Manufacturer's Name			
2.	Manufacturer's Address			
3.	Manufacturer's Type Designation and Model No.			
4.	Applicable Standard			
5.	Type tested	Yes/No	Yes	
6.	Type test report, Ref. No.			
7.	Rated normal current at 20deg. C			
	- line feeder circuit breaker	A	1250	
	- transformer feeder circuit breaker	A	1250	
	- bus coupler circuit breaker	A	2500	
8.	Rated current at max. ambient temperature	A		
	- line feeder circuit breaker	A		
	- transformer feeder circuit breaker	A		
	- bus coupler circuit breaker	A		
9.	Rated short circuit breaking current (symmetrical, r.m.s.)	kA		
10.	Rated short circuit breaking current (asymmetrical, r.m.s.)	kA		
11.	Rated short circuit making current (peak)	kA		
12.	Rated cable charging breaking current	A		
13.	Rated line charging breaking current	A		
14.	Rated small inductive breaking current	A		
15.	Voltage drop across terminals of one pole at rated current	mV		
16.	Amplitude factor			
17.	First pole-to-clear factor		1.5	

No	Item	Units	Required	Tendered
			36 kV	36 kV
18.	Rated operating sequence:		O-t-CO-t'-CO	
	- with t	sec.	0.3	
	- with t'	min.	3	
19.	Min. time t" between two successful three phase auto reclosures at full rated breaking current (sequence O-t-C-t"-O-t-C)	min.		
20.	Closing time	ms		
	- tolerances	ms		
21.	Dead time (max.)	ms		
	- tolerances	ms		
22.	Break time (max.) at full rated breaking current	ms		
	- tolerances	ms		
23.	Make time (max.)	ms		
	- tolerances	ms		
24.	Arcing time (max.) at full short circuit duty	ms		
	- tolerances	ms		
25.	Life duration of main contacts (no load mechanical operations)	operations		
26.	Number of switching operations at rated breaking capacity before contact maintenance becomes necessary	No.	min. 100	
27.	Rated pressure of SF6 for arc quenching	bar		
28.	Auxiliary contacts:			
	- number (NO/NC)			
	- voltage rating	V DC	110	
	- current rating	A DC		
29.	SF6 pressure at which lockout operates	bar		
30.	To be filled in only in case of hydraulic operating mechanism:			
	- Setting of pressure relief device	bar		

No	Item	Units	Required	Tendered
			36 kV	36 kV
	- Rated pressure of hydraulic oil	bar		
	- Lowest oil pressure at which lockout	bar		
31.	Making coil			
	- Rated voltage	V DC	110	
	- min. operating voltage	V	88	
	- Rated power each	W		
32.	Trip coil			
	- Rated voltage	V DC	110	
	- min. operating voltage	V	55	
	- Rated power each	W		
33.	Motor voltage	V DC	110	
34.	Motor power	W		
35.	Total loss of heaters for 3 poles	W		
36.	Max. temperature rise of contacts at rated normal Current	K		
37.	Arc quenching medium		SF_6/VACUUM	
38.	Material of main contacts			
39.	Number of breaks in series (per pole)	No.		
	- for closing			
	- for opening			
40.	Single pole operation (only in Line Feeder Breakers)	Yes/No	No	
41.	Making coil:			
	- number	pcs		
42.	Trip coil:			
	- number	pcs	2	
43.	Gas quantity of complete breaker (3 Phase)	kg		
44.	Material of filter employed for the absorption of the products of combustion			

No	Item	Units	Required	Tendered
			36 kV	36 kV
45.	Method of controlling voltage distribution between breaks (capacitor, resistor etc.)			
46.	Weight of complete 3 pole breaker	kg		
47.	Weight of heaviest part for shipment	kg		

2.3.5 Disconnector Switch (Mannar 220/33 kV GSS)

No	Item	Units	Required	Tendered
			36 kV	36 kV
1.	Model No.			
2.	Type tested	Yes/No	Yes	
3.	Type test report, Ref. No.			
4.	Standards to which disconnector conforms		IEC 62271-200	
5.	Power frequency withstand voltage across isolating distance	kV	80	
6.	Lightning impulse withstand voltage across isolating distance	kV	195	
7.	Rated normal current at 20 ^{0}C			
	- feeder disconnecting switch	A	1250	
	- bus coupler disconnecting switch	A	2500	
	- BSC feeder disconnecting switch	A	1250	
	- transformer feeder disconnecting switch	A	1250	
8.	Rated current at max. ambient temperature:			
	- line feeder disconnecting switch	A		
	- bus coupler disconnecting switch	A		
	- transformer feeder disconnecting switch	A		
9.	Voltage drop across terminals of one pole at rated current	mV		
10.	Rated breaking current (capacitive)	A		
11.	Rated momentary current (peak)	kA		
12.	Life duration of main contacts	operations		
13.	Material of main contacts			
14.	Auxiliary contacts:			
	- number (NO/NC)	pcs/pcs		
	- voltage rating	V DC	220	
	- current rating	A DC		
15.	Operating mechanism:			

No	Item	Units	Required	Tendered
			36 kV	36 kV
	- for closing		electric motor	
	- for opening		electric motor	
16.	Manual operating facility	Yes/No	Yes	
17.	Motor voltage	V DC	220	
18.	Motor power	W		
19.	Hand operating facilities	Yes/No		
20.	Weight			
	- 3 phase unit with driving mechanism	kg		
21	Mechanism heater loss	W		

2.3.6 Disconnector Switch (Embilipitiya 132/33 kV GSS)

No	Item	Units	Required	Tendered
			36 kV	36 kV
1.	Model No.			
2.	Type tested	Yes/No	Yes	
3.	Type test report, Ref. No.			
4.	Standards to which disconnector conforms		IEC 62271-200	
5.	Power frequency withstand voltage across isolating distance	kV	80	
6.	Lightning impulse withstand voltage across isolating distance	kV	195	
7.	Rated normal current at 20 ^{0}C			
	- feeder disconnecting switch	A	1250	
	- bus coupler disconnecting switch	A	2500	
	- BSC feeder disconnecting switch	A	1250	
	- transformer feeder disconnecting switch	A	1250	
8.	Rated current at max. ambient temperature:			
	- line feeder disconnecting switch	A		
	- bus coupler disconnecting switch	A		
	- transformer feeder disconnecting switch	A		
9.	Voltage drop across terminals of one pole at rated current	mV		
10.	Rated breaking current (capacitive)	A		
11.	Rated momentary current (peak)	kA		
12.	Life duration of main contacts	operations		
13.	Material of main contacts			
14.	Auxiliary contacts:			
	- number (NO/NC)	pcs/pcs		
	- voltage rating	V DC	110	
	- current rating	A DC		
15.	Operating mechanism:			

No	Item	Units	Required	Tendered
			36 kV	36 kV
	- for closing		electric motor	
	- for opening		electric motor	
16.	Manual operating facility	Yes/No	Yes	
17.	Motor voltage	V DC	110	
18.	Motor power	W		
19.	Hand operating facilities	Yes/No		
20.	Weight			
	- 3 phase unit with driving mechanism	kg		
21	Mechanism heater loss	W		

2.3.7 Maintenance Earthing Switch

No	Item	Units	Required	Tendered
			36 kV	36 kV
1.	Type tested	Yes/No	Yes	
2.	Type test report, Ref. No.			
3.	Standards to which earthing switch conforms			
4.	Life duration of main contacts	operations		
5.	Material of main contacts			
6.	Auxiliary contacts:			
	- number (NO/NC)	pcs/pcs		
	- voltage	V DC	Mannar:220 Embilipitiya:110	
7.	Operating mechanism:			
	- for opening		Electric motor	
	- for closing		Electric motor	
8.	Motor voltage	V DC	Mannar:220 Embilipitiya:110	
9.	Motor power (for Mannar)	W		
11.	Motor power (for Embilipitiya)	W		
10.	Hand operating facilities	Yes/No	Yes	

2.3.8 High Speed Earthing Switch

No	Item	Units	Required	Tendered
			36 kV	36 kV
1.	Type tested	Yes/No	Yes	
2.	Type test report, Ref. No.			
3.	Standards to which earthing switch conforms			
4.	Making current	kA r.m.s	25	
5.	Number of closing operations with maximum short circuit current before the contact maintenance becomes necessary	No	2	
6.	Short circuit withstand duration	s	1	
7.	Life duration of main contacts	operations		
8.	Material of main contacts			
9.	Auxiliary contacts:			
	- number (NO/NC)	pcs/pcs		
	- voltage	V DC	Mannar:220 Embilipitiya:110	
10.	Operating mechanism:			
	- for closing			
	- for opening			
11.	Max. Operating time			
	- for closing	ms		
	- for opening	ms		
12.	Motor voltage	V DC	Mannar:220 Embilipitiya:110	
13.	Motor power (for Mannar)	W		
14.	Motor power (for Embilipitiya)	W		
15.	Hand operating facilities	Yes/No	Yes	

2.3.9 Current Transformer

No	Item	Units	Required	Tendered
			36 kV	36 kV
	(These sheets to be copied and filled in for each different type of CTs)			
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Type			
4.	Standards to which CT conforms	IEC	IEC 61869-1&2	
5.	Rated secondary current	A	1	
6.	Rated primary current and number of cores	A	See Scope of Works and drawings	
7.	Rated momentary current (peak)	kA		
8.	Rated short-time current	kA		
9.	Measuring cores:			
	- Accuracy class		0.2	
	- Burden			
	- Resistance of secondary winding at 75 ^{0}C	Ohms		
	- Instrument security factor			
10.	Protection cores:			
	- Accuracy class protection cores min. (higher class to be used wherever necessitated due to protection requirements)		5P	
	- Resistance of secondary winding protection cores at 75 0C	Ohms		
	- Resistance of secondary winding busbar protection cores at 75 0C	Ohms		
11.	Number of cores	Nos.	See Scope of Works and drawings	
12.	Knee point e.m.f. of protection cores	V		
13.	Knee point e.m.f. of busbar protection cores	V		

No	Item	Units	Required	Tendered
			36 kV	36 kV
14.	Insulation material for windings			
15.	Limits on exciting current	A		
16.	Partial discharge			

2.3.10 Voltage Transformer

No	Item	Units	Required	Tendered
			36 kV	36 kV
	(These sheets to be copied and filled in for each different type of VTs)			
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Type			
4.	Standards	IEC	IEC 61869-1&3	
5.	Method of transformation (inductive or capacitive)		inductive	
6.	Nominal primary voltage	kV	33/√3	
7.	Number of secondaries and accuracy class		See Scope of Works & Drawings	
8.	Thermal capacity of ground-fault detection winding	A/h		
9.	Rated burden (total on all secondaries)	VA		
10.	Partial discharge		acc.IEC 60044-4	
11.	Height	mm		
12.	Weight of single pole unit	kg		

2.3.11 Local Control Unit

No	Item	Units	Required	Tendered
			36 kV	36 kV
1.	Type			
2.	Manufacturer			
3.	Country of manufacture			
4.	Standards			
5.	Material			
6.	Thickness	mm		
7.	Surface finish			
8.	Dimensions: -			
	length	mm		
	width	mm		
	height	mm		
9.	Total net mass	kg		

2.4 LVAC EQUIPMENT

No	Item	Units	Required	Tendered
			400/230 V	400/230 V
(a)	**DISTRIBUTION BOARD**			
1.	Manufacturer's Name			
2.	Manufacturer's Address			
3.	Manufacturer's type designation and type ref number or Model number			
4.	Rating	A	1000	
5.	Fault Rating	kA	16	
6.	Voltage	V	400/230	
(b)	**MCCB**			
1.	Manufacturer's Name			
2.	Manufacturer's Address			
3.	Manufacturer's type designation and type ref number or Model number			
4.	Type			
5.	Rating	A		
6.	Fault Rating	kA	16	
(c)	**ACB**			
1.	Manufacturer's Name			
2.	Manufacturer's Address			
3.	Manufacturer's type designation and type ref number or Model number			
4.	Type			
5.	Rating	A		
6.	Fault Rating	kA	16	

2.5 BATTERIES AND CHARGERS

2.5.1 220V DC/ 110V DC

No	Item	Units	Required	Tendered
			110 V	110 V
(a)	**Battery**			
1.	Manufacturer's Name			
2.	Country of Manufacture			
3.	Place of Testing			
4.	Applicable Standard - IEC		60623	
5.	Type		NiCd	
6.	Manufacturer's type designation, and type ref or model number			
7.	Voltage	V DC	110	
8.	Capacity at 6 hour rate	Ah		
9.	Number of cells			
10.	Voltage per cell	V		
11.	Battery voltage at end of the duty cycle	V		
12.	Normal charging rate	A		
13.	Maximum charging rate	A		
14.	Ampere-hour efficiency at ten hour rate	%		
15.	Ampere-hour efficiency at one hour rate	%		
16.	Dimensions of cells	mm		
17.	Dimensions of battery complete	mm		
18.	Weight of cell complete with electrolyte	kg		
19.	Total weight of battery complete	kg		
20.	Internal resistance per cell when fully charged	ohms		
21.	Material of battery case			
(b)	**Battery Charger**			
1.	Manufacturer's name			
2.	Manufacturer's address			
3.	Place of Testing			

No	Item	Units	Required	Tendered
			110 V	110 V
4.	Manufacturer's type designation and type ref number			
5.	Applied standard			
6.	Number of phases	Three	3	
7.	Type of charger control	Micro processor		
8.	AC Input Nominal Voltage	V	400	
9.	AC Input Voltage range	%		
10.	Operating frequency	Hz		
11.	AC input to charger at full load	kVA		
12.	AC input current	A		
13.	DC Nominal Voltage	V	110	
14.	DC output of the charger	kW		
15.	Constant voltage			
	(i) Floating charge	V		
	(ii) Equalizing charge	V		
16.	Maximum output voltage			
	(i) at automatic control	V		
	(ii) at Boost charge	V		
17.	Regulation	%		
18.	Range of DC voltage control			
19.	Output voltage ripple	%	4	
20.	Protection class		IP 51	
21.	Operating ambient temperature	deg.	40^0C	
22.	Dimension			
	(i) Height	mm		
	(ii) Width	mm		
	(iii) Depth	mm		
23.	Normal and Boost charge are Independent Units	Yes/No		
24.	Test report reference No:			
(c)	**D.C. Switchboards**			

No	Item	Units	Required	Tendered
			110 V	110 V
1.	Manufacturer's Name			
2.	Manufacturer's Address			
3.	Place of Testing			
4.	Type of construction			
5.	Manufacturer's type designation and type ref number			
6.	Busbars:			
	(i) Maximum current rating	A		
	(ii) Dimensions	mm		
7.	Boost charge contactors:			
	(i) Manufacturer			
	(ii) Maximum current rating	A		
	(iii) Coil rating	W		
	(iv) Method of interlocking			
8.	Alarm relays:			
	(i) Manufacturer			
	(ii) Type and reference			
	(iii) Power consumption:			
	a) Quiescent	A		
	b) Operated	mA		
9.	Number and rating of distribution circuits			
10.	Overall dimensions	mm		
11.	Total weight	kg		

2.6 DC-DC CONVERTER

No	Item	Units	Required	Tendered
1	Make			
2	Model			
3	Name & Address of Manufacturer			
4	Output voltage of individual convertors	V	48 V +/- 5%	
5	Output current rating of individual convertors			
6	No. of convertors		≥ 2	
7	Is the load current shared equally among all convertors?		Yes	
8	Manufacturer recommended input breaker current rating for DC-DC convertor(s)			
9	Overall efficiency of the convertor(s) %		>88%	
10	Final output voltage of the power supply system	V	48 V +/- 5%	
11	Is output and input of the power supply system galvanically isolated?		Yes	
12	Maximum output voltage ripple	mV	100mV p-p (20MHz Bandwidth)	
13	Output overvoltage detection threshold	V	52	
14	Output overvoltage cut-off threshold	V	56	
15	Output undervoltage detection threshold	V	42	
16	Output undervoltage cut-off threshold	V	35	
17	Nominal input voltage (110V DC or 220V DC) (This shall be same as station DC supply voltage)	V	110V or 220V DC as per Scope of Works	
18	Input overvoltage detection threshold	V	118V	
19	Input overvoltage cut-off threshold	V	125V	
20	Input undervoltage detection threshold	V	105	

No	Item	Units	Required	Tendered
21	Input undervoltage cut-off threshold (if any)	V	90	
22	Current rating of individual DC- DC convertors (without derating due to ambient temperature)			
23	Total current rating of the power supply system (without derating due to ambient temperature)	A	≥25	
24	Total current rating of the power supply system at a failure of one DC-DC convertor (without derating due to ambient temperature)			
25	48V DC supply output voltmeter		Yes	
26	48V DC supply output ammeter		Yes	
27	Operating temperature range		0°C to 55°C	
28	Storage temperature range		-20°C to 85°C	
29	Operating humidity range		5% to 95%	
30	Storage humidity range		5% to 95%	
31	Operation and maintenance manual in English language		Yes	
32	A complete set of manufacturer recommended spares		Yes	
33	Availability of spares for next five years (please provide details)		5 years or more	
34	Warranty		2 years or more	

2.7 245 kV PROTECTION EQUIPMENT

2.7.1 220/33kV Transformer 220kV Protection IED

No	Item	Units	Required	Tendered
1.	Manufacturer's Information			
	- Name & Address			
	- Country of Manufacture			
	- Relay type			
2.	Country of Origin			
3.	Model no.			
4.	Dimensions			
	- Width	mm		
	- Height	mm		
	- Depth	mm		
5.	Current Inputs			
	- Current Transformer			
	○ Secondary current (In)	A	1	
	○ No. of Inputs		8	
	- Thermal rating of current circuits			
	○ Continuous		4 x In	
	○ For 10s		30 x In	
	○ For 1s		100 x In	
	- Burden	VA	≤0.1	
	- Rated Frequency	Hz	50	
	- Operating range	Hz	47 - 53	
5.	Voltage Inputs			
	- Voltage Transformer secondary			
	○ Voltage (Phase-Phase) (Un)	V	110	
	○ Operating Range	V	0 - 300	
	○ No. of Inputs		5	
	- Thermal rating of voltage			
	○ circuit (10s)	V	450	

No	Item	Units	Required	Tendered
	- Burden	VA	0.2VA at 110V	
	- Rated Frequency	Hz	50	
	- Operating range	Hz	47 - 53	
6.	Station DC voltage			
	- Station DC voltage Vdc=110V or 220V		Vdc +10% to -15%	
	- DC auxiliary Operating Voltage Range			
	○ for 110V dc system	V	88 – 132	
	○ for 220V dc system	V	176 - 264	
	- Maximum Relay Burden	VA	50	
7.	Binary Outputs			
	- No. of Binary Output contacts		≥ 23	
	- Voltage Vdc = 220V or 110V		Vdc ± 15%	
	- Breaking Capacity with L/R=40ms			
	○ For nominal dc voltage 110V Systems		0.3A at 125V DC	
	○ For nominal dc voltage 220V Systems		0.2A at 250V DC	
	- Carry Continuous	A	6	
	- Make and Carry for 0.2s	A	30	
8.	Binary Inputs			
	- No. of Binary Inputs		≥ 42	
	- Nominal Voltage Rating for 110V DC supply	V	110V DC	
	○ Pickup Threshold for 110V DC supply	V	88V DC	
	○ Drop off Threshold for 110V DC supply	V	66V DC	
	- Nominal Voltage Rating for 220V DC supply	V	220V DC	
	○ Pickup Threshold for 220V DC supply	V	176V DC	
	○ Drop off Threshold for 220V DC supply	V	132V DC	
9.	LED indications		≥ 15	

No	Item	Units	Required	Tendered
10.	Spare parts guarantee	Years	10	
11.	Warranty period and Warranty certificate		At least 10 years from the date of Commissioning	
12.	Design Features		As Specified in Chapter 5 of Technical Specifications-Vol 5 of 8.	
13.	Standard for communication with Remote equipment		Yes	
14.	Substation Automation		IEC 61850	
15.	Standards			
	- Temperature tests Cold		IEC 60068-2-1 (2007)	
	- Dry Heat		IEC 60068-2-2 (2007)	
	- Operation		0ºC to +70ºC	
	- Storage		0ºC to +85ºC	
	- Humidity		IEC 68-2-3(1984)	
	- Insulation		IEC 60255-27 (2013)	
	○ Dielectric Test		2kV AC 50Hz, 1min	
	○ Insulation resistance tests		500V DC	
	○ Impulse Voltage Test		5kV, 1.2/50 µs, 0.5J	
	- 1MHz burst disturbance tests		IEC 255-22-1(1988), ANSI/IEEE C37, 90.1-1989	
	- Electrostatic discharge tests		IEC 60255-26 (2013)	
	○ 2, 4, 6,8kV contact discharge		Yes	
	○ 2, 4, 8,15kV air discharge		Yes	
	- Fast transient tests (Burst)		IEC 60255-26 (2013)	

No	Item	Units	Required	Tendered
	○ 2kV/4kV 5kHz		Yes	
	- Power frequency magnetic		IEC 61000-4-9 (2001) 1000 A/m 50/60Hz permanent field	
	○ Field immunity test		Level 5	
	- Radio frequency		IEC 60255-26 (2013)	
	○ Conducted RFI Immunity		10Vrms	
	○ Radiated RFI Immunity		10V/m (Unmodulated)	
	- Emission			
	○ Cl.A EN 50081-2(1994)		Yes	
	○ (Industrial environment) EN 55011(1992)		Yes	
	○ CISPR 11(1990)		Yes	
	○ EN 55022(1995)		Yes	
	○ CISPR 22(1995)		Yes	
	- Seismic Test		IEC 60255-27(2013) / IEC 60255-21-3	
	○ Class 2		Yes	
16.	Functions			
	- Over excitation protection - 24		Yes	
	- Synchrocheck - 25			
	○ For HV Circuit Breaker		Yes	
	○ Availability of separate Synchrocheck for each circuit breaker in 1.5 circuit breaker stations			
	- Negative-sequence system overcurrent protection, Unbalanced-load protection (thermal) - 46			
	- Thermal overload protection - 49		Yes	

No	Item	Units	Required	Tendered
	- HV Over Current Protection - 50/51 HV		Yes	
	- HV Earth Fault Protection - 50N/51N HV		Yes	
	- HV Directional Over Current & Earth Fault Protection - 67/67N HV		Yes	
	- HV Stand by Earth fault Protection - 51G HV		Yes	
	- HV Over/Under Voltage Protection - 27/59		Yes	
	- MV Over Current Protection - 50/51 MV		Yes	
	- MV Earth Fault Protection - 50N/51N MV		Yes	
	- LV Stand by Earth fault Protection - 51G LV		Yes	
	- Transformer differential Protection - 87T		Yes	
	- HV Transformer Restricted Ground-Fault Protection- 87N T		Yes	
	- LV Transformer Restricted Ground-Fault Protection- 87N T		Yes	
	- Availability of two sets of CT inputs for 1.5 Circuit Breaker Stations			
	- BCU function for HV side		Yes	
	- VTFF		Yes	
	- Ability to measure			
	○ Active Power		Yes	
	○ Reactive Power		Yes	
	○ Apparent Power		Yes	
	○ Power Factor		Yes	
	○ Recording of Minimum /Maximum value		Yes	
	○ Active Energy (Forward/Reverse)		Yes	
	○ Reactive Energy (Forward/Reverse)		Yes	
	- Basic Power Quality Measurements.			

No	Item	Units	Required	Tendered
	○ Voltage unbalance; voltage changes: overvoltage, dip, interruption; TDD(Total Demand Distortion), THD (Total Harmonic Distortion), and harmonics			
	- GPS Time Synchronization		Yes	
	○ Support for SNTP protocol		Yes	
	○ Support for IEEE 1588 protocol		Yes	
	- Rugged Design with Conformal Coating		Yes	
17.	Minimum of fifteen (15) years successful experience in the manufacturing of equipment in rated voltage and capacity, comparable to the equipment offered under the contract		Yes	
18.	Minimum of ten (10) years of experience in manufacturing for orders from outside the country of the manufacturer		Yes	
19.	Offered model in successful operation in substations for at least three years		Yes	
20.	IED Data Sets - Data sets as per Annexures in Chapter 5 of Technical Specifications-Vol 5 of 8.		Annexure 43	
21.	IEC 61850 Conformance certificate			
	- Tested according to IEC61850 issued by an Independent laboratory empowered by UCA		Yes	

2.7.2 220/33kV Transformer 33kV Protection IED

No	Item	Units	Required	Tendered
1.	Manufacturer's Information			
	- Name & Address			
	- Country of Manufacture			
	- Relay type			
2.	Country of Origin			
3.	Model no.			
4.	Dimensions			
	- Width	mm		
	- Height	mm		
	- Depth	mm		
5.	Current Inputs			
	- Current Transformer			
	○ Secondary current (In)	A	1	
	○ No. of Inputs		4	
	- Thermal rating of current circuits			
	○ Continuous		4 x In	
	○ For 10s		30 x In	
	○ For 1s		100 x In	
	- Burden	VA	≤0.1	
	- Rated Frequency	Hz	50	
	- Operating range	Hz	47 - 53	
5.	Voltage Inputs			
	- Voltage Transformer secondary			
	○ Voltage (Phase-Phase) (Un)	V	110	
	○ Operating Range	V	0 - 300	
	○ No. of Inputs		5	
	- Thermal rating of voltage			
	○ circuit (10s)	V	450	

No	Item	Units	Required	Tendered
	- Burden	VA	0.1VA at 110V	
	- Rated Frequency	Hz	50	
	- Operating range	Hz	47 - 53	
6.	Station DC voltage			
	- Station DC voltage Vdc=110V or 220V		Vdc +10% to -15%	
	- DC auxiliary Operating Voltage Range			
	○ for 110V dc system	V	88 – 132	
	○ for 220V dc system	V	176 - 264	
	- Maximum Relay Burden	VA	50	
7.	Binary Outputs			
	- No. of Binary Output contacts		≥ 12	
	- Voltage Vdc = 220V or 110V		Vdc ± 15%	
	- Breaking Capacity with L/R=40ms			
	○ For nominal dc voltage 110V Systems		0.3A at 125V DC	
	○ For nominal dc voltage 220V Systems		0.2A at 250V DC	
	- Carry Continuous	A	6	
	- Make and Carry for 0.2s	A	30	
8.	Binary Inputs			
	- No. of Binary Inputs		≥ 46	
	- Nominal Voltage Rating for 110V DC supply	V	110V DC	
	○ Pickup Threshold for 110V DC supply	V	88V DC	
	○ Drop off Threshold for 110V DC supply	V	66V DC	
	- Nominal Voltage Rating for 220V DC supply	V	220V DC	
	○ Pickup Threshold for 220V DC supply	V	176V DC	
	○ Drop off Threshold for 220V DC supply	V	132V DC	
9.	LED indications		≥ 15	

No	Item	Units	Required	Tendered
10.	Spare parts guarantee	Years	10	
11.	Warranty period and Warranty certificate		At least 10 years from the date of Commissioning	
12.	Design Features		As Specified in Chapter 5 of Technical Specifications-Vol 5 of 8.	
13.	Standard for communication with Remote equipment		Yes	
14.	Substation Automation		IEC 61850	
15.	Standards			
	- Temperature tests Cold		IEC 60068-2-1 (2007)	
	- Dry Heat		IEC 60068-2-2 (2007)	
	- Operation		0ºC to +70ºC	
	- Storage		0ºC to +85ºC	
	- Humidity		IEC 68-2-3(1984)	
	- Insulation		IEC 60255-27 (2013)	
	○ Dielectric Test		2kV AC 50Hz, 1min	
	○ Insulation resistance tests		500V DC	
	○ Impulse Voltage Test		5kV, 1.2/50 µs, 0.5J	
	- 1MHz burst disturbance tests		IEC 255-22-1(1988), ANSI/IEEE C37, 90.1-1989	
	- Electrostatic discharge tests		IEC 60255-26 (2013)	
	○ 2, 4, 6,8kV contact discharge		Yes	
	○ 2, 4, 8,15kV air discharge		Yes	
	- Fast transient tests (Burst)		IEC 60255-26 (2013)	

No	Item	Units	Required	Tendered
	○ 2kV/4kV 5kHz		Yes	
	- Power frequency magnetic		IEC 61000-4-9 (2001) 1000 A/m 50/60Hz permanent field	
	○ Field immunity test		Level 5	
	- Radio frequency		IEC 60255-26 (2013)	
	○ Conducted RFI Immunity		10Vrms	
	○ Radiated RFI Immunity		10V/m (Unmodulated)	
	- Emission			
	○ Cl.A EN 50081-2(1994)		Yes	
	○ (Industrial environment) EN 55011(1992)		Yes	
	○ CISPR 11(1990)		Yes	
	○ EN 55022(1995)		Yes	
	○ CISPR 22(1995)		Yes	
	- Seismic Test		IEC 60255-27(2013) / IEC 60255-21-3	
	○ Class 2		Yes	
16.	Functions			
	- Synchrocheck - 25			
	○ For MV Circuit Breaker		Yes	
	○ Availability of separate Synchrocheck for each circuit breaker in 1.5 circuit breaker stations			
	- MV Over Current Protection - 50/51 MV		Yes	
	- MV Earth Fault Protection - 50N/51N MV		Yes	
	- MV Directional Over Current & Earth Fault Protection - 67/67N MV		Yes	

No	Item	Units	Required	Tendered
	- MV Over/Under Voltage Protection - 27/59		Yes	
	- Availability of two sets of CT inputs for 1.5 Circuit Breaker Stations			
	- LV Breaker Failure Protection - 50BF LV			
	- BCU function for MV side		Yes	
	- VTFF		Yes	
	- Ability to measure			
	○ Active Power		Yes	
	○ Reactive Power		Yes	
	○ Apparent Power		Yes	
	○ Power Factor		Yes	
	○ Recording of Minimum /Maximum value		Yes	
	○ Active Energy (Forward/Reverse)		Yes	
	○ Reactive Energy (Forward/Reverse)		Yes	
	- Basic Power Quality Measurements.			
	○ Voltage unbalance; voltage changes: overvoltage, dip, interruption; TDD(Total Demand Distortion), THD (Total Harmonic Distortion), and harmonics			
	- GPS Time Synchronization		Yes	
	○ Support for SNTP protocol		Yes	
	○ Support for IEEE 1588 protocol		Yes	
	- Rugged Design with Conformal Coating		Yes	
17.	Minimum of fifteen (15) years successful experience in the manufacturing of equipment in rated voltage and capacity, comparable to the equipment offered under the contract		Yes	

No	Item	Units	Required	Tendered
18.	Minimum of ten (10) years of experience in manufacturing for orders from outside the country of the manufacturer		Yes	
19.	Offered model in successful operation in substations for at least three years		Yes	
20.	IED Data Sets - Data sets as per Annexures in Chapter 5 of Technical Specifications-Vol 5 of 8.		Annexure 47	
21.	IEC 61850 Conformance certificate			
	- Tested according to IEC61850 issued by an Independent laboratory empowered by UCA		Yes	

2.7.3 220kV, 33kV Bus Coupler/ Bus Section Protection IED

No	Item	Units	Required	Tendered
	(These sheets to be copied and filled in for each different type of IEDs)			
1.	Manufacturer's Information			
	- Name & Address			
	- Country of Manufacture			
	- Relay type			
2.	Country of Origin			
3.	Model no.			
4.	Dimensions			
	- Width	mm		
	- Height	mm		
	- Depth	mm		
5.	Current Inputs			
	- Current Transformer			
	○ Secondary current (In)	A	1	
	○ No. of Inputs		8	
	- Thermal rating of current circuits			
	○ Continuous		4 x In	
	○ For 10s		30 x In	
	○ For 1s		100 x In	
	- Burden	VA	≤0.1	
	- Rated Frequency	Hz	50	
	- Operating range	Hz	47 - 53	
5.	Voltage Inputs			
	- Voltage Transformer secondary			
	○ Voltage (Phase-Phase) (Un)	V	110	
	○ Operating Range	V	0 - 300	
	○ No. of Inputs		5	

No	Item	Units	Required	Tendered
	- Thermal rating of voltage			
	○ circuit (10s)	V	450	
	- Burden	VA	0.1VA at 110V	
	- Rated Frequency	Hz	50	
	- Operating range	Hz	47 - 53	
6.	Station DC voltage			
	- Station DC voltage Vdc=110V or 220V		Vdc +10% to -15%	
	- DC auxiliary Operating Voltage Range			
	○ for 110V dc system	V	88 – 132	
	○ for 220V dc system	V	176 - 264	
	- Maximum Relay Burden	VA	50	
7.	Binary Outputs			
	- No. of Binary Output contacts		≥ 18	
	- Voltage Vdc = 220V or 110V		Vdc ± 15%	
	- Breaking Capacity with L/R=40ms			
	○ For nominal dc voltage 110V Systems		0.3A at 125V DC	
	○ For nominal dc voltage 220V Systems		0.2A at 250V DC	
	- Carry Continuous	A	6	
	- Make and Carry for 0.2s	A	30	
7.	Binary Inputs			
	- No. of Binary Inputs		≥ 42	
	- Nominal Voltage Rating for 110V DC supply	V	110V DC	
	○ Pickup Threshold for 110V DC supply	V	88V DC	
	○ Drop off Threshold for 110V DC supply	V	66V DC	
	- Nominal Voltage Rating for 220V DC supply	V	220V DC	
	○ Pickup Threshold for 220V DC supply	V	176V DC	

No	Item	Units	Required	Tendered
	○ Drop off Threshold for 220V DC supply	V	132V DC	
8.	LED indications		≥ 15	
9.	Spare parts guarantee	Years	10	
10.	Warranty period and Warranty certificate		At least 10 years from the date of Commissioning	
11.	Design Features		As Specified in chapter 5 of volume 5 of 8	
12.	Standard for communication with Remote equipment		Yes	
13.	Substation Automation		IEC 61850	
14.	Standards			
	- Temperature tests Cold		IEC 60068-2-1 (2007)	
	- Dry Heat		IEC 60068-2-2 (2007)	
	- Operation		0ºC to +70ºC	
	- Storage		0ºC to +85ºC	
	- Humidity		IEC 68-2-3(1984)	
	- Insulation		IEC 60255-27 (2013)	
	○ Dielectric Test		2kV AC 50Hz, 1min	
	○ Insulation resistance tests		500V DC	
	○ Impulse Voltage Test		5kV, 1.2/50 µs, 0.5J	
	- 1MHz burst disturbance tests		IEC 255-22-1(1988), ANSI/IEEE C37, 90.1-1989	
	- Electrostatic discharge tests		IEC 60255-26 (2013)	
	○ 2, 4, 6,8kV contact discharge		Yes	
	○ 2, 4, 8,15kV air discharge		Yes	

No	Item	Units	Required	Tendered
	- Fast transient tests (Burst)		IEC 60255-26 (2013)	
	○ 2kV/4kV 5kHz		Yes	
	- Power frequency magnetic		IEC 61000-4-9 (2001) 1000 A/m 50/60Hz permanent field	
	○ Field immunity test		Level 5	
	- Radio frequency		IEC 60255-26 (2013)	
	○ Conducted RFI Immunity		10Vrms	
	○ Radiated RFI Immunity		10V/m (Unmodulated)	
	- Emission			
	○ Cl.A EN 50081-2(1994)		Yes	
	○ (Industrial environment) EN 55011(1992)		Yes	
	○ CISPR 11(1990)		Yes	
	○ EN 55022(1995)		Yes	
	○ CISPR 22(1995)		Yes	
	- Seismic Test		IEC 60255-27(2013) / IEC 60255-21-3	
	○ Class 2		Yes	
15.	Functions			
	- Synchrocheck - 25		Yes	
	- Over Current Protection - 50/51		Yes	
	- Earth Fault Protection - 50N/51N		Yes	
	- Directional Over Current & Earth Fault Protection - 67/67N		Yes	
	- Over/Under Voltage Protection - 27/59		Yes	
	- Breaker Failure Protection - 50BF		Yes	
	- BCU function		Yes	
	- VTFF		Yes	

No	Item	Units	Required	Tendered
	- Ability to measure			
	○ Active Power		Yes	
	○ Reactive Power		Yes	
	○ Apparent Power		Yes	
	○ Power Factor		Yes	
	○ Recording of Minimum /Maximum value		Yes	
	○ Active Energy (Forward/Reverse)		Yes	
	○ Reactive Energy (Forward/Reverse)		Yes	
	- Basic Power Quality Measurements.			
	○ Voltage unbalance; voltage changes: overvoltage, dip, interruption; TDD(Total Demand Distortion), THD (Total Harmonic Distortion), and harmonics			
	- GPS Time Synchronization		Yes	
	○ Support for SNTP protocol		Yes	
	○ Support for IEEE 1588 protocol		Yes	
	- Rugged Design with Conformal Coating		Yes	
16.	Minimum of fifteen (15) years successful experience in the manufacturing of equipment in rated voltage and capacity, comparable to the equipment offered under the contract		Yes	
17.	Minimum of ten (10) years of experience in manufacturing for orders from outside the country of the manufacturer		Yes	
18.	Offered model in successful operation in substations for at least three years		Yes	
19.	IED Data Sets - Data sets as per Annexures in Chapter 5 of Technical Specifications-Vol 5 of 8.		Annexures 44 & 48	
20.	IEC 61850 Conformance certificate			

No	Item	Units	Required	Tendered
	- Tested according to IEC61850 issued by an Independent laboratory empowered by UCA		Yes	

2.7.4 220kV Bus bar Protection Central IED

No	Item	Units	Required	Tendered
1.	Manufacturer's Information			
	- Name & Address			
	- Country of Manufacture			
	- Relay type			
2.	Country of Origin			
3.	Model no.			
4.	Dimensions			
	- Width	mm		
	- Height	mm		
	- Depth	mm		
5.	Current Inputs			
	- Current Transformer			
	○ Secondary current (In)	A		
	○ No. of Inputs		0	
	- Thermal rating of current circuits			
	○ Continuous			
	○ For 10s			
	○ For 1s			
	- Burden	VA		
	- Rated Frequency	Hz		
	- Operating range	Hz		
5.	Voltage Inputs			
	- Voltage Transformer secondary			
	○ Voltage (Phase-Phase) (Un)	V		
	○ Operating Range	V		
	○ No. of Inputs		0	
	- Thermal rating of voltage			
	○ circuit (10s)	V		

No	Item	Units	Required	Tendered
	- Burden	VA		
	- Rated Frequency	Hz		
	- Operating range	Hz		
6.	Station DC voltage			
	- Station DC voltage Vdc=110V or 220V		Vdc +10% to -15%	
	- DC auxiliary Operating Voltage Range			
	○ for 110V dc system	V	88 – 132	
	○ for 220V dc system	V	176 - 264	
	- Maximum Relay Burden	VA	50	
7.	Binary Outputs			
	- No. of Binary Output contacts		≥ 12	
	- Voltage Vdc = 220V or 110V		Vdc ± 15%	
	- Breaking Capacity with L/R=40ms			
	○ For nominal dc voltage 110V Systems		0.3A at 125V DC	
	○ For nominal dc voltage 220V Systems		0.2A at 250V DC	
	- Carry Continuous	A	6	
	- Make and Carry for 0.2s	A	30	
8.	Binary Inputs			
	- No. of Binary Inputs		≥ 3	
	- Nominal Voltage Rating for 110V DC supply	V	110V DC	
	○ Pickup Threshold for 110V DC supply	V	88V DC	
	○ Drop off Threshold for 110V DC supply	V	66V DC	
	- Nominal Voltage Rating for 220V DC supply	V	220V DC	
	○ Pickup Threshold for 220V DC supply	V	176V DC	
	○ Drop off Threshold for 220V DC supply	V	132V DC	
9.	LED indications		≥ 15	

No	Item	Units	Required	Tendered
10.	Spare parts guarantee	Years	10	
11.	Warranty period and Warranty certificate		At least 10 years from the date of Commissioning	
12.	Design Features		As Specified in Chapter 5 of Technical Specifications-Vol 5 of 8.	
13.	Standard for communication with Remote equipment		Yes	
14.	Substation Automation		IEC 61850	
15.	Standards			
	- Temperature tests Cold		IEC 60068-2-1 (2007)	
	- Dry Heat		IEC 60068-2-2 (2007)	
	- Operation		0ºC to +70ºC	
	- Storage		0ºC to +85ºC	
	- Humidity		IEC 68-2-3(1984)	
	- Insulation		IEC 60255-27 (2013)	
	○ Dielectric Test		2kV AC 50Hz, 1min	
	○ Insulation resistance tests		500V DC	
	○ Impulse Voltage Test		5kV, 1.2/50 µs, 0.5J	
	- 1MHz burst disturbance tests		IEC 255-22-1(1988), ANSI/IEEE C37, 90.1-1989	
	- Electrostatic discharge tests		IEC 60255-26 (2013)	
	○ 2, 4, 6,8kV contact discharge		Yes	
	○ 2, 4, 8,15kV air discharge		Yes	
	- Fast transient tests (Burst)		IEC 60255-26 (2013)	

No	Item	Units	Required	Tendered
	○ 2kV/4kV 5kHz		Yes	
	- Power frequency magnetic		IEC 61000-4-9 (2001) 1000 A/m 50/60Hz permanent field	
	○ Field immunity test		Level 5	
	- Radio frequency		IEC 60255-26 (2013)	
	○ Conducted RFI Immunity		10Vrms	
	○ Radiated RFI Immunity		10V/m (Unmodulated)	
	- Emission			
	○ Cl.A EN 50081-2(1994)		Yes	
	○ (Industrial environment) EN 55011(1992)		Yes	
	○ CISPR 11(1990)		Yes	
	○ EN 55022(1995)		Yes	
	○ CISPR 22(1995)		Yes	
	- Seismic Test		IEC 60255-27(2013) / IEC 60255-21-3	
	○ Class 2		Yes	
16.	Functions			
	- Busbar differential protection - 87B		Yes	
	- 1/3-pole or 3-pole circuit-breaker failure protection - 50BF		Yes	
	- End-fault protection - 50EFP		Yes	
	- Over Current Protection - 50/51		Yes	
	- Earth Fault Protection - 50N/51N		Yes	
	- Disconnector-independent check zone as additional tripping criterion		Yes	
	- HMI (LCD Display)		Yes	

No	Item	Units	Required	Tendered
	- Event Log			
	o Capacity of event log			
	- Fault Recorder: It shall be possible to record all analogue inputs, binary inputs and binary outputs.		Yes	
	o Sampling frequency		Yes	
	o Recording duration			
	o no. of records possible with available storage		Yes	
	- User-friendliness		Yes	
	o Configuration by the user during the entire service life		Yes	
17.	Minimum of fifteen (15) years successful experience in the manufacturing of equipment in rated voltage and capacity, comparable to the equipment offered under the contract		Yes	
18.	Minimum of ten (10) years of experience in manufacturing for orders from outside the country of the manufacturer		Yes	
19.	Offered model in successful operation in substations for at least three years		Yes	
20.	IED Data Sets - Data sets as per Annexures in Chapter 5 of Technical Specifications-Vol 5 of 8.		Annexure 45	
21.	IEC 61850 Conformance certificate			
	- Tested according to IEC61850 issued by an Independent laboratory empowered by UCA		Yes	

2.7.5 220kV Bus bar Protection Bay IED

No	Item	Units	Required	Tendered
1.	Manufacturer's Information			
	- Name & Address			
	- Country of Manufacture			
	- Relay type			
2.	Country of Origin			
3.	Model no.			
4.	Dimensions			
	- Width	mm		
	- Height	mm		
	- Depth	mm		
5.	Current Inputs			
	- Current Transformer			
	○ Secondary current (In)	A	1	
	○ No. of Inputs		4	
	- Thermal rating of current circuits			
	○ Continuous		4 x In	
	○ For 10s		30 x In	
	○ For 1s		100 x In	
	- Burden	VA	≤0.1	
	- Rated Frequency	Hz	50	
	- Operating range	Hz	47 - 53	
5.	Voltage Inputs			
	- Voltage Transformer secondary			
	○ Voltage (Phase-Phase) (Un)	V		
	○ Operating Range	V		
	○ No. of Inputs		0	
	- Thermal rating of voltage			
	○ circuit (10s)	V		

No	Item	Units	Required	Tendered
	- Burden	VA		
	- Rated Frequency	Hz		
	- Operating range	Hz		
6.	Station DC voltage			
	- Station DC voltage Vdc=110V or 220V		Vdc +10% to -15%	
	- DC auxiliary Operating Voltage Range			
	○ for 110V dc system	V	88 – 132	
	○ for 220V dc system	V	176 - 264	
	- Maximum Relay Burden	VA	50	
7.	Binary Outputs			
	- No. of Binary Output contacts		≥ 6	
	- Voltage Vdc = 220V or 110V		Vdc ± 15%	
	- Breaking Capacity with L/R=40ms			
	○ For nominal dc voltage 110V Systems		0.3A at 125V DC	
	○ For nominal dc voltage 220V Systems		0.2A at 250V DC	
	- Carry Continuous	A	6	
	- Make and Carry for 0.2s	A	30	
8.	Binary Inputs			
	- No. of Binary Inputs		≥ 13	
	- Nominal Voltage Rating for 110V DC supply	V	110V DC	
	○ Pickup Threshold for 110V DC supply	V	88V DC	
	○ Drop off Threshold for 110V DC supply	V	66V DC	
	- Nominal Voltage Rating for 220V DC supply	V	220V DC	
	○ Pickup Threshold for 220V DC supply	V	176V DC	
	○ Drop off Threshold for 220V DC supply	V	132V DC	
9.	LED indications		≥ 15	

No	Item	Units	Required	Tendered
10.	Spare parts guarantee	Years	10	
11.	Warranty period and Warranty certificate		At least 10 years from the date of Commissioning	
12.	Design Features		As Specified in Chapter 5 of Technical Specifications-Vol 5 of 8.	
13.	Standard for communication with Remote equipment		Yes	
14.	Substation Automation		IEC 61850	
15.	Standards			
	- Temperature tests Cold		IEC 60068-2-1 (2007)	
	- Dry Heat		IEC 60068-2-2 (2007)	
	- Operation		0ºC to +70ºC	
	- Storage		0ºC to +85ºC	
	- Humidity		IEC 68-2-3(1984)	
	- Insulation		IEC 60255-27 (2013)	
	○ Dielectric Test		2kV AC 50Hz, 1min	
	○ Insulation resistance tests		500V DC	
	○ Impulse Voltage Test		5kV, 1.2/50 µs, 0.5J	
	- 1MHz burst disturbance tests		IEC 255-22-1(1988), ANSI/IEEE C37, 90.1-1989	
	- Electrostatic discharge tests		IEC 60255-26 (2013)	
	○ 2, 4, 6,8kV contact discharge		Yes	
	○ 2, 4, 8,15kV air discharge		Yes	
	- Fast transient tests (Burst)		IEC 60255-26 (2013)	

No	Item	Units	Required	Tendered
	○ 2kV/4kV 5kHz		Yes	
	- Power frequency magnetic		IEC 61000-4-9 (2001) 1000 A/m 50/60Hz permanent field	
	○ Field immunity test		Level 5	
	- Radio frequency		IEC 60255-26 (2013)	
	○ Conducted RFI Immunity		10Vrms	
	○ Radiated RFI Immunity		10V/m (Unmodulated)	
	- Emission			
	○ Cl.A EN 50081-2(1994)		Yes	
	○ (Industrial environment) EN 55011(1992)		Yes	
	○ CISPR 11(1990)		Yes	
	○ EN 55022(1995)		Yes	
	○ CISPR 22(1995)		Yes	
	- Seismic Test		IEC 60255-27(2013) / IEC 60255-21-3	
	○ Class 2		Yes	
16.	Functions			
	- Busbar differential protection - 87B		Yes	
	- 1/3-pole or 3-pole circuit-breaker failure protection - 50BF		Yes	
	- End-fault protection - 50EFP		Yes	
	- Over Current Protection - 50/51		Yes	
	- Earth Fault Protection - 50N/51N		Yes	
	- Disconnector-independent check zone as additional tripping criterion		Yes	
	- HMI (LCD Display)		Yes	

No	Item	Units	Required	Tendered
	- Event Log			
	o Capacity of event log			
	- Fault Recorder: It shall be possible to record all analogue inputs, binary inputs and binary outputs.		Yes	
	o Sampling frequency		Yes	
	o Recording duration			
	o no. of records possible with available storage		Yes	
	- User-friendliness		Yes	
	o Configuration by the user during the entire service life		Yes	
17.	Minimum of fifteen (15) years successful experience in the manufacturing of equipment in rated voltage and capacity, comparable to the equipment offered under the contract		Yes	
18.	Minimum of ten (10) years of experience in manufacturing for orders from outside the country of the manufacturer		Yes	
19.	Offered model in successful operation in substations for at least three years		Yes	
20.	IED Data Sets - Data sets as per Annexures in Chapter 5 of Technical Specifications-Vol 5 of 8.		Annexure 45	
21.	IEC 61850 Conformance certificate			
	- Tested according to IEC61850 issued by an Independent laboratory empowered by UCA		Yes	

2.7.6 33kV Feeder Protection IED

No	Item	Units	Required	Tendered
	(These sheets to be copied and filled in for each different type of IEDs)			
1.	Manufacturer's Information			
	- Name & Address			
	- Country of Manufacture			
	- Relay type			
2.	Country of Origin			
3.	Model no.			
4.	Dimensions			
	- Width	mm		
	- Height	mm		
	- Depth	mm		
5.	Current Inputs			
	- Current Transformer			
	○ Secondary current (In)	A	1	
	○ No. of Inputs		5	
	- Thermal rating of current circuits			
	○ Continuous		4 x In	
	○ For 10s		30 x In	
	○ For 1s		100 x In	
	- Burden	VA	≤0.1	
	- Rated Frequency	Hz	50	
	- Operating range	Hz	47 - 53	
5.	Voltage Inputs			
	- Voltage Transformer secondary			
	○ Voltage (Phase-Phase) (Un)	V	110	
	○ Operating Range	V	0 – 300	
	○ No. of Inputs		5	

No	Item	Units	Required	Tendered
	- Thermal rating of voltage			
	○ circuit (10s)	V	450	
	- Burden	VA	≤0.1 at 110V	
	- Rated Frequency	Hz	50	
	- Operating range	Hz	47 - 53	
6.	Station DC voltage			
	- Station DC voltage Vdc=110V or 220V		Vdc +10% to -15%	
	- DC auxiliary Operating Voltage Range			
	○ for 110V dc system	V	88 – 132	
	○ for 220V dc system	V	176 - 264	
	- Maximum Relay Burden	VA	50	
7.	Binary Outputs			
	- No. of Binary Output contacts		≥ 18	
	- Voltage Vdc = 220V or 110V		Vdc ± 15%	
	- Breaking Capacity with L/R=40ms			
	○ For nominal dc voltage 110V Systems		0.3A at 125V DC	
	○ For nominal dc voltage 220V Systems		0.2A at 250V DC	
	- Carry Continuous	A	6	
	- Make and Carry for 0.2s	A	30	
8.	Binary Inputs			
	- No. of Binary Inputs		≥ 42	
	- Nominal Voltage Rating for 110V DC supply	V	110V DC	
	○ Pickup Threshold for 110V DC supply	V	88V DC	
	○ Drop off Threshold for 110V DC supply	V	66V DC	
	- Nominal Voltage Rating for 220V DC supply	V	220V DC	
	○ Pickup Threshold for 220V DC supply	V	176V DC	

No	Item	Units	Required	Tendered
	○ Drop off Threshold for 220V DC supply	V	132V DC	
9.	LED indications		≥ 15	
10.	Spare parts guarantee	Years	10	
11.	Warranty period and Warranty certificate		At least 10 years from the date of Commissioning	
12.	Design Features		As Specified in Chapter 5 of Technical Specifications-Vol 5 of 8.	
13.	Standard for communication with Remote equipment		Yes	
14.	Substation Automation		IEC 61850	
15.	Standards			
	- Temperature tests Cold		IEC 60068-2-1 (2007)	
	- Dry Heat		IEC 60068-2-2 (2007)	
	- Operation		0ºC to +70ºC	
	- Storage		0ºC to +85ºC	
	- Humidity		IEC 68-2-3(1984)	
	- Insulation		IEC 60255-27 (2013)	
	○ Dielectric Test		2kV AC 50Hz, 1min	
	○ Insulation resistance tests		500V DC	
	○ Impulse Voltage Test		5kV, 1.2/50 µs, 0.5J	
	- 1MHz burst disturbance tests		IEC 255-22-1(1988), ANSI/IEEE C37, 90.1-1989	
	- Electrostatic discharge tests		IEC 60255-26 (2013)	
	○ 2, 4, 6,8kV contact discharge		Yes	

No	Item	Units	Required	Tendered
	○ 2, 4, 8,15kV air discharge		Yes	
	- Fast transient tests (Burst)		IEC 60255-26 (2013)	
	○ 2kV/4kV 5kHz		Yes	
	- Power frequency magnetic		IEC 61000-4-9 (2001) 1000 A/m 50/60Hz permanent field	
	○ Field immunity test		Level 5	
	- Radio frequency		IEC 60255-26 (2013)	
	○ Conducted RFI Immunity		10Vrms	
	○ Radiated RFI Immunity		10V/m (Unmodulated)	
	- Emission			
	○ Cl.A EN 50081-2(1994)		Yes	
	○ (Industrial environment) EN 55011(1992)		Yes	
	○ CISPR 11(1990)		Yes	
	○ EN 55022(1995)		Yes	
	○ CISPR 22(1995)		Yes	
	- Seismic Test		IEC 60255-27(2013) / IEC 60255-21-3	
	○ Class 2		Yes	
16.	Functions			
	- Synchrocheck - 25		Yes	
	- Over Current Protection - 50/51		Yes	
	- Earth Fault Protection - 50N/51N		Yes	
	- Directional Over Current & Earth Fault Protection - 67/67N		Yes	
	- Over/Under Voltage Protection - 27/59		Yes	
	- Breaker Failure Protection - 50BF		Yes	

No	Item	Units	Required	Tendered
	- Auto Reclose - 79		Yes	
	- Frequency protection - 81, 81O, 81U, 81R		Yes	
	- BCU		Yes	
	- VTFF		Yes	
	- Ability to measure			
	o Active Power		Yes	
	o Reactive Power		Yes	
	o Apparent Power		Yes	
	o Power Factor		Yes	
	o Recording of Minimum /Maximum value		Yes	
	o Active Energy (Forward/Reverse)		Yes	
	o Reactive Energy (Forward/Reverse)		Yes	
	- Basic Power Quality Measurements.			
	o Voltage unbalance; voltage changes: overvoltage, dip, interruption; TDD(Total Demand Distortion), THD (Total Harmonic Distortion), and harmonics		Yes	
	- GPS Time Synchronization		Yes	
	o Support for SNTP protocol		Yes	
	o Support for IEEE 1588 protocol		Yes	
	- Rugged Design with Conformal Coating		Yes	
17.	Minimum of fifteen (15) years successful experience in the manufacturing of equipment in rated voltage and capacity, comparable to the equipment offered under the contract		Yes	
18.	Minimum of ten (10) years of experience in manufacturing for orders from outside the country of the manufacturer		Yes	

No	Item	Units	Required	Tendered
19.	Offered model in successful operation in substations for at least three years		Yes	
20.	IED Data Sets - Data sets as per Annexures in Chapter 5 of Technical Specifications-Vol 5 of 8.		Annexure 45	
21.	IEC 61850 Conformance certificate			
	- Tested according to IEC61850 issued by an Independent laboratory empowered by UCA		Yes	

2.7.7 Substation Automation System

No	Item	Units	Required	Tendered
1.	General Information			
	- SAS Manufacturer Name & Address			
	- Owner of the SAS Software			
	- SAS Software			
	- SAS Model number			
	- Number of Licensed data points for SAS configuration software		More than 10,000	
	- Number of Licensed data points for SAS runtime software		More than 10,000	
	- SAS architecture of Substation		To be provided in color by the SAS manufacturer	
	- Country of Manufacture			
	- Place of testing		At Factory of OEM	
	- Warranty	Years	5	
2.	Compliance with standard for Substation Automation system			
	- Communication protocol at all levels		IEC 61850 Edition 2 Fully complying to the standard	
	- Interoperability and IEC 61850 conformance certificate		Independent laboratory empowered by UCA International Users Group	
	- Temperature range (min/max) Computer	Deg.	5 - 60	
	- Relative humidity	%	20 to 90% non-condensing	
3.	Detailed Requirements			
	- Number of years of proven field experience of offered system	Years	8	
	(Note: proof of experience should be furnished. The components used			

No	Item	Units	Required	Tendered
	in the offered system and those with field experience should be the same)			
	- No of years of proven field experience of offered system outside country of manufacture	Years	5	
	- Design life of substation Automation System	Years	20	
	- Number of Years to discounted the offered product & spare parts	Years	15	
	- High quality Single Line Diagram included SCD file complete with all ICD files & station topology		Required	
	- SAS equipment excluding GPS server should be in redundant		02 HMIs, 02 Gateways, 02 SAS Ethernet Switches	
	- Cyber Security		Required	
	- Remote Web HMI		Required	
	- OPC server / Client		Required	
	- SNMP facility		Required	
	- Manufacturers quality assurance system		ISO 9001/9002	
	- Dimensions of SAS cubicle			
	○ Width	mm		
	○ Depth	mm		
	○ Height	mm		
	○ Floor load	N/m²	600	
	- Proper ventilation method should be provided to dissipate the heat generator inside SAS cubicle		Specify	
	- Manufacturer of SAS Cubicle		Same as OEM	
4.	Workstation Computer		19" Rack Mounted Industrial PC	
	(i) Main Services			

No	Item	Units	Required	Tendered
	- Manufacturer Name & Address			
	- Country of Origin			
	- Model			
	- Warranty	Years	5	
	- Display		Dual 27" LED Displays HDMI Type	
	- Display cable between workstation and monitor		Fiber optic HDMI cable	
	- Processer		7th Generation Intel® Xeon® and Core™ Processor or latest	
	- Random Access Memory (RAM)	GB	16	
	- Storage	TB	1 TB SSD Type with RAID Redundancy	
	- Power supply		Redundant (Dual) DC from 2 Battery Banks	
	- Operating System		Latest Microsoft Windows Server	
	- SAS Software and Version			
	- Web Server facility in HMI of SAS software		Required	
	- Number of years of proven field experience of offered software	Years	10	
	- Cyber Security and Anti Virus Software		Required	
	- Other software		Latest Microsoft Office	
	- MTBF (Mean time between Failures)	Hours		
	- MTTR (Mean time to repair)	Hours		

No	Item	Units	Required	Tendered
	- Redundant hot and standby configuration		Yes	
	- Hot standby take over time	Seconds		
	- Auto starting of application in both servers and both monitors			
	- IED provided for Alarms & indications			
	- All standard picture as per spec included in HMI			
	- Process Status Display & Command Procedures			
	- Event processing as per spec			
	- Alarm processing as per spec			
	- Reports as per spec			
	- Customizable location to save Reports at the end of each month			
	- Trend Display as per spec			
	- User Authority levels as per spec			
	- System supervision & monitoring as per specs			
	- Standard		IEC 61850	
	- Working Temperature Range	Deg. C	5 - 60	
	- Working Voltage Range	V DC	110 - 220	
	- Relative humidity	%	5 - 95	
	- Power Consumption	W		
	- Type of Mounting		19" Rack	
	- Size (W x D x H)	mm		
	(ii) Interface & Function			
	- Number of Electrical signal Ethernet Ports (RJ45)		>= 4	
	- Connectivity		Up to 128 Devices	
	- Access by the Engineering PC		Yes	
	- No of Data Points with the License			

No	Item	Units	Required	Tendered
	- License for Configuration, Maintenance and Operation		Required	
5.	Ethernet Switch			
	- Manufacturer			
	- Country of Origin			
	- Type		Industrial Grade	
	- Power supply		Redundant (Dual) DC	
	- Model			
	- Warranty	Years	5	
	- Ethernet Switch Communication		RSTP Ring Network with IEC 61850	
	- Ethernet Ring Physical Medium		Glass Fiber	
	- Bay Level Physical Medium		Glass Fiber	
	- Spare ports		at least 50% spare ports available over total ports at time of commissioning	
6.	GPS Time Server			
	- Manufacturer			
	- Country of Origin			
	- Model			
	- Warranty	Years	5	
	- Protection again direct/indirect lightning		Surge Protected	
	- Redundant communication link should be provided to SAS Ethernet Switch 01 & 02			
7.	Gateway to National System Control Center			
	(i) Main Services			
	- Manufacturer Name & Address			
	- Country of Origin			

No	Item	Units	Required	Tendered
	- Model			
	- Gateway Software and Version			
	- Warranty	Years	5	
	- Type		Industrial grade hardware with no moving parts (PC based gateway is not accepted)	
	- Number of years of proven filed experience of offered unit	Years	10	
	- Insulation tests			
	- Fast disturbance tests			
	- Industrial environment			
	- Design life of offered equipment	Years	20	
	- Communication channels		Three IEC 60870-5-104 one IEC 60870-5-101	
	- Power Supply		Redundant (Dual) DC	
	- MTBF (Mean time between Failures)	Hours		
	- MTTR (Mean time to repair)	Hours		
	- Standard		IEC 60870 & 61850	
	- Working Temperature Range	Deg. C	5 - 60	
	- Working Voltage Range	V DC	110 - 220	
	- Relative humidity	%	5 - 95	
	- Power Consumption	W		
	- Type of Mounting		19" Rack	
	- Size (W x D x H)	mm		
	(ii) Interface & Function			
	- Number of Electrical signal Ethernet Ports (RJ45)		≥2	
	- Number of IEC60870-5-101 Serial Ports		≥2	

No	Item	Units	Required	Tendered
	- Number of IEC60870-5-104 Ethernet Ports		≥ 4	
	- Connectivity		Up to 128 Devices	
	- Access by the Engineering PC		Yes	
	- No of Data Points with the License			
	- License for Configuration, Maintenance and Operation		Required	
8.	Audible Alarm System			
	- Make of the Alarm Device			
	- Make of the Hootor			
9.	System Performance			
	- Time to start the application after a shutdown	Minutes		
	- Exchange of display (First reaction)	Seconds	< 2	
	- Presentation of a binary change in the process display	Seconds	< 1	
	- Presentation of an analogue change in the process display	Seconds	< 1	
	- From order to process output	Seconds	< 1	
	- From order to updated of display	Seconds	< 1	
10.	Engineering Workstation Software			
	- SAS Configuration and Engineering Tool software with the license		Required	
	- SAS Configuration and Engineering Tool software Name and Version			
	- IED Configuration software with the license		Required	
	- IED Configuration software Name and Version			
	- Single Line Diagram included SCD file		Required	
	- ICD files (IEC device capability files)		Required	
	- Protection Project		Required	

No	Item	Units	Required	Tendered
11.	SAS Signal List			
	- SAS Signal list of 220kV/132kV Lines		Required	
	- SAS Signal list of 220kV side of 220kV/132kV/LV Transformer		NA	
	- SAS Signal list of AVR		Required	
	- SAS Signal list of 132 kV side of 220kV/132kV/LV Transformer		NA	
	- SAS Signal list of HV side of HV/LV Transformer		Required	
	- SAS Signal list of 220kV/132kV Bus Coupler		Required	
	- SAS Signal list of Bas Bar Protection		Required	
	- SAS Signal list of LV Transformer Bay		Required	
	- SAS Signal list of LV Feeder		Required	
	- SAS Signal list of LV Bus Coupler		Required	
12.	IEC61850 Conformance certificate tested according to IEC61850-10 issued by an Independent Laboratory empowered by UCA		Required	

2.7.8 Digital Disturbance Recorder (DDR) System

No	Item	Units	Required	Tendered
(a)	**General**			
1.	Manufacturer's Name & Address			
2.	Manufacturer's type designation & model number			
3.	Power Supply	VDC		
	-Power Supply for Printer	VAC	230	
(b)	**Analogue Inputs**			
1.	Number of channel		Min 192	
2.	Nominal Current	Amp	1A/5A/4-20 mA	
3.	Nominal Voltage	Vac / Vdc		
4.	Frequency Response			
5.	Cut-off frequency			
a	Bandwidth,	dB		
b	Attenuation at	dB		
c	Auto adjusted Anti - aliasing filters for chosen sampling rate	Yes/No	Yes	
d	Simultaneously Programmable Sample rate		Min 2 for FAST and SLOW recording	
	-Locally Changeable	Yes/No	Yes	
	-Remotely Changeable	Yes/No	Yes	
e	Possible Sample rates systems		3 different sampling rates:	
		Samples /sec	slow: 10 - 500 Hz	
		Samples /sec	fast: 0.5 - 10 kHz	
6.	DC coupled inputs	yes / no	yes	
7	Resolution	bits	16	
8	Accuracy	%	Min 0.5	
9.	Burden			
	1. Current circuit at IN	VA		

No	Item	Units	Required	Tendered
	2. Voltage circuit	VA		
10.	Over load			
	1. Current	%In	100% In continuously, 700% In for 1 second	
	2. Voltage	%Vn	2Vn and max. 350 Vn	
(c)	**Digital Input**			
1	Number of channels - Expandability (without any time skew)		Min 576	
2	Selectable Input level	Vdc	N/O or N/C , 24 V-250 V DC	
3	Type		Potential or potential free contact	
4	Resolution	ms		
(d)	**Memory**			
1	Size		128MB or higher	
2	Type		Solid state	
3	Pre-fault time (fast scanning rate)	sec	0.1 – 2 user programmable	
4	Post fault (fast scanning rate)	sec	0.1 – 20 programmable	
5	Pre- and Post-fault time (slow scanning rate)	sec	min. 180 user programmable	
6	In-built hard disk (auto-maintained	GB	min. 4 GB	
7	Features		Preferably programmable and virtually recordable	
(e)	**Sensor** /Triggering Circuits			
	All sensors/ triggers are preferably programmable and virtually recordable			
1	Logical combination sensor	Yes / No	yes	
2	Three phase over or under voltage / current	Yes / No	yes	

No	Item	Units	Required	Tendered
3	Mono phase over or under voltage / current	Yes / No	yes	
4	du / dt , dp/ dt, dg/dt,(sigl/3phase)df/dt,etc	Yes / No	yes	
5	RMS (voltage/current)	Yes / No	yes	
6	Zero sequence	Yes / No	yes	
7	Negative, positive sequence	Yes / No	yes	
8	Frequency	Yes / No	yes	
9	DC signal step	Yes / No	yes	
10	Pending /swing	Yes / No	yes	
11	Digital level and edge	Yes / No	yes	
12	Sensor trigger	Yes / No	yes	
13	Event trigger	Yes / No	yes	
14	Manual trigger	Yes / No	yes	
15	Remote trigger	Yes / No	yes	
(f)	**Clock System**			
1	Internal clock	Yes / No	yes	
2	Accuracy			
3	External Synchronization	Yes / No	yes	
4	Time resolution between 2 synchronized pulses			
5	GPS Synchronisation	Yes/No	yes	
(g)	**Output Alarm Relay Contact**			
1	Max. operating voltage DC / AC	Vac / Vdc	250Vac or above 60 V dc or above	
2	Make and carry for 0.5 sec	A	Min 8A	
3	Carry continuously	A	Min 5A	
4	Break (DC) - resistive	W		
(h)	**Interface for Data Communication**			
1	Full definition compression	yes / No	yes	
2	Maximum transmission rate	bits / sec		

No	Item	Units	Required	Tendered
3	TCP/IP(10/100 Mbps) Ethernet port(Rj45)	yes / No	yes	
4	Standard serial port (EIA _ 232_D)	yes / No	yes	
5	Printer port	yes / No	yes	
6	Dedicated serial port for modem	yes / No	yes	
7	TCP/IP port for Master Station	yes / No	yes	
(i)	**Printer Data**			
1	Printer amplitude (scaling peak to peak)			
2	Time Scale (mm / s)			
3	Printer resolution	mm		
4	Auto printing	yes / No	Yes	
(j)	Fault priority transmission	yes / No	Yes	
(k)	Fault location (Distance calculation)	yes / No	Yes	
(l)	Test certificates from Internationally recognised Laboratories	Yes / No	Yes	
(m)	**Communication and Remote Analyzing Unit**			
1.	Processor Pentium	(MHz) Yes/No	At least 2 GHz Pentium	
2.	Co- processor Pentium	yes / No	Yes	
3.	Main memory capacity	(MB) Yes/No	At least 2GB	
4.	Colour graphics board S-VGA	yes / No	Yes	
5.	Screen S-VGA	yes / No	Yes	
6.	Hard disk unit	yes / No	At least 80GB	
7.	Printer	yes / No	Yes	
8.	Modem	yes / No	Yes	

2.8 FIBER OPTIC & SCADA EQUIPMENT

2.8.1 Optical Fiber Equipment

No	Item	Units	Required	Tendered
	SDH-Multiplexer			
(a)	**Main Services**			
1.	Manufacturer's name & address			
2.	Manufacturer's type designation & model number			
3.	Remote Management via existing NMS		yes	
4.	Working temperature range	Deg C	30-40	
5.	Working voltage	V DC	-48V DC	
6.	PDH Cross connection capacity		≥ 2x128Mbps	
7.	SDH cross connection		VC-12, VC-3,VC-4	
8.	Relative Humidity			
9.	Power Consumption	W		
10.	Output aggregate bit rate		STM-1/STM-4	
11.	User Interface		Ethernet	
12.	Power supply inputs		2 Nos. -48VDC inputs	
13.	Central Processing Units		2 nos. (Main and Standby)	
14.	Size of panel (W x D x H)	mm		
(b)	**SDH Aggregate module**	pcs		
1.	Bit Rate		STM-1/STM-4	
2.	Number of SDH ports		> 4	
3.	Traffic protection		SNCP/MSP	
4	Number of Ethernet ports		>4	
(c)	**Tributary modules**			
(i)	PDH E1 Module	pcs		
1.	No of electrical ports		> 4	

No	Item	Units	Required	Tendered
2.	Bit rate		2048 kbps±50 PPM	
3.	Traffic protection		SNCP on 64kbps and P12 layer for transparent E1 channels	
(ii)	V.24/V.28 Data Access Module	pcs		
1.	Bit rate	kbps	0.6 to 38.4 asynchronous and 48,56, 64 synchronous	
2.	No of ports		> 4	
3.	Point to multipoint and point to point data conferencing facility		yes	
(iii)	Ethernet switching and routing module for IEC 104 SCADA	pcs		
1.	No of physical ports		> 4	
2.	Bit rates		10/100 Base T	
3.	Features		L2 switching, L3 routing	
4.	L2 switching		Min 8 independent switching instances	
5.	L3 routing		OSPF routing, Static routing, VRRP, Inter VLAN routing	
6.	Traffic protection		STP, RSTP	
(iv)	Ethernet module for other IT applications	pcs		
1	No of ports 10/100/1000 BaseT physical ports		>8	
2	No of GbE/10 GbE , SFP based physical ports		>4	
3	Features		L2 Switching, VLAN	
4	L2 switching		Min 8 independent switching instances	

No	Item	Units	Required	Tendered
5	Traffic Protection		STP, RSTP	
(iv)	FXO Module	pcs		
1.	No of ports		>12	
2.	Input level (from Exchange)	dBr	-5…….+4 Programmable	
3.	Output level (to Exchange)	dBr	-7.5…..-1, programmable	
4.	Nominal Impedance	ohm	600	
5.	Channel bandwidth	Hz	300-3400	
6.	Signalling		Pulse, DTMF	
(v)	**FXS Module (2 wire)**	pcs		
1.	No of ports		≥10	
2.	Input level(from subscriber)	dBr	-5….+4 , programmable	
3.	Output level (from subscriber)	dBr	-7.5….-1, programmable	
4.	Nominal Impedance	ohm	600	
5.	Channel Bandwidth	Hz	300-3400	
(vi)	**4 wire E & M Voice Interface**			
	No of Ports		≥4	
	Input Level	dBr		
	Output level	dBr		
	Power Consumption	W		
	Signalling			
	Bandwidth	KHz		
	Tele protection			
(vii)	**Line protection module**	pcs		

No	Item	Units	Required	Tendered
1.	No of ports		≥4	
2.	Connector		Terminal block for direct wiring	
3.	Protection Voltage	VDC	24 – 250, programmable	
4.	Traffic protection		1+1 protection (with typically 3.5 ms switch over time)	
5.	Propagation Delay time	ms		
6.	No of auxiliary ports		≥8	
7.	**Features**			
	Protection link addressing		yes	
	Remote supervision and management		yes	
	Command drop and insert		yes	
	Event recorder		yes	
	Auxiliary relay outputs		yes	
(viii)	**Differential Protection Module**	pcs		
1.	Protection port Bitrate	kbps	≥ 64	
2.	1+1 path traffic protection		yes	
3.	No of Ports		≥ 4	

2.9 GROUNDING MATERIALS

No	Item	Units	Required	Tendered
(a)	**Shield Wire System**			
1.	Manufacturer's name and address			
2.	Material			
3.	Overall diameter	mm		
4.	Nominal section	mm^2		
5.	Cross section and make-up			
6.	Maximum rated current (3 Sec.)	A		
7.	Maximum working tension of main connections	kg/m^2		
8.	Resistance of conductor per 100 m at 30 ^0C	ohm		
9.	Tensile breaking stress of material	N/mm^2		
10.	Maximum permissible span length	m		
11.	Maximum sag under own weight of maximum span	mm		
(b)	**Earthing Grid**			
1.	Manufacturer's name and address			
2.	Material			
3.	Overall diameter	mm		
4.	Nominal section	mm^2		
5.	Maximum rated current (3 Sec)	A		
6.	Resistance of conductor per 100 m at 30 ^0C	ohm		
(c)	**Grounding Electrodes**			
1.	Manufacturer's name and address			
2.	Material			
3.	Dimensions			
4.	Number of electrode per group			
5.	Number of earthing points per substation			

No	Item	Units	Required	Tendered
6.	Calculated resistance of combined earth grid and points			

2.10 CABLES

2.10.1 1000 V Cables

No	Item	Units	Required	Tendered
(a)	1000V Cables			
1.	Identification nos.			
2.	Manufacturers name & address			
3.	Number of cores			
4.	Cross sectional area	mm^2		
5.	Core stranding			
	(i) Number			
	(ii) Diameter	mm		
6.	Insulation thickness	mm		
7.	Materials of insulation			
8.	Type of filler			
9.	Type of tape			
10.	Bedding thickness	mm		
11.	Bedding outer diameter	mm		
12.	Type of sheath	mm		
13.	Sheath thickness	mm		
14.	Completed cable:			
	(i) Diameter	mm		
	(ii) Weight per meter	kg		
	(iii) Max. drum length	m		
15.	Minimum installed bending radius	mm		
16.	Maximum conductor temperature	^0C		
17.	Maximum DC resistance of conductor per km of cable at 20 ^0C	ohm		

2.10.2 Multicore Control Cables

No	Item	Units	Required	Tendered
(b)	Multicore Control Cables			
	Items Nos: (List types)			
1.	Identification nos.			
2.	Manufacturers name & address			
3.	Number of cores			
4.	Cross section area	mm^2		
5.	Core stranding			
	(i) Number			
	(ii) Diameter	mm		
6.	Insulation thickness	mm		
7.	Materials of insulation			
8.	Type of filter			
9.	Type of tape			
10.	Bedding thickness	mm		
11.	Bedding outer diameter	mm		
12.	Type of sheath	mm		
13.	Sheath thickness	mm		
14.	Completed cable:			
	(i) Diameter	mm		
	(ii) Weight per meter	kg		
	(iii) Max. drum length	m		
15.	Minimum installed bending radius	mm		
16.	Maximum conductor temperature	^0C		
17.	Maximum DC resistance of conductor per km of cable at 20 ^0C	ohm		

2.10.3 XLPE Power Cables

2.10.3.1 220 kV Single Core XLPE Cable

No	Item	Units	Required	Tendered
1	General			
	-Name of manufacturer			
	-Location of manufacturing site			
	-Manufacturing & testing standard		IEC 62067	
	-Manufacturer's Quality Certification		ISO 9001 or equivalent	
	-Name of Certifying authority			
	-Validity of Certificate (year)			
	-Required Power Transmission Capacity of the Cable between power transformer and indoor switchgear	MVA	63	
	-Required Power Transmission Capacity of the Cable between outdoor equipment and indoor switchgear	MVA	N/A	
	General description of 220kV cable			
	a. Number of cores		Single core	
	b. Maximum rated Voltage (Um)	kV	245	
	c. Conductor cross section	mm^2	400	
	d. Insulation Type		XLPE	
	e. Type of over sheath		HDPE	
	-Year of first commercial operation of cable type			
2	Insulation Rating			
	-Maximum Rated voltage, phase to phase (Um)	kV	245	
	-Nominal operating voltage, phase to phase (U)	kV	220	
	-Nominal operating voltage, phase to earth (U_0)	kV	127	
	-Rated frequency	Hz	50	
	-Rated impulse withstand voltage (Upeak)	kV	1050	
	-Rated Short time Power frequency withstand voltage	kV /30min	318	

No	Item	Units	Required	Tendered
3	Conductor			
	-Material		Copper	
	-Nominal cross-section	mm^2	400	
	-Shape and type of Conductor			
	-Number of segments			
	-Water blocking method		Swelling powder or tapes	
	-Semi-conducting binder tape		Yes	
4	Conductor screen (inner shielding layer)			
	- Type of Material		Semi-con., XLPE, fully bonded to the insulation	
	-Visible irregularities on outer surface	µm	≤76	
	-Maximum void at the interface between conductor screen and insulation	µm	≤51	
	-Production method		Extrusion	
	-Volume Resistivity	Ohm-m	≤1000	
	Wall thickness			
	Average value	mm		
	Minimum value	mm	0.76	
5	Insulation			
	-Material		XLPE	
	-Maximum void in the insulation	µm	≤51	
	-Number of voids larger than 0.025mm per cubic centimeter		≤1.8	
	-Maximum contaminant in the insulation	mm	0.127	
	-Number of contaminants between 0.051 to 0.127mm per cubic centimeter in the insulation		≤0.6	
	-Maximum amber in the insulation	mm	0.254	

No	Item	Units	Required	Tendered
	Maximum stress at nominal voltage as per		ICEA S-108-720-2012	
	a. At conductor screen	kV/mm	≤8	
	b. At insulation screen	kV/mm	≤4	
	Maximum stress at impulse voltage as per		ICEA S-108-720-2012	
	a. At conductor screen	kV/mm		
	b. At insulation screen	kV/mm		
	-Nominal thickness	mm		
	-Minimum thickness	mm		
	-Maximum partial discharge	pC	no detectable exceeding the sensitivity	
	-Maximum losses/tan delta		$\leq 10\times10^{-4}$	
	-Minimum tensile strength	N/mm^2	12.5	
6	Insulation screen (outer shielding layer)			
	-Type of Material		Semi-con, XLPE, fully bonded to the insulation	
	-Visible irregularities at the interface between insulation and insulation screen	µm	≤127	
	-Maximum void at the interface between insulation and insulation screen	µm	≤38	
	-Resistivity	Ohm-m	≤500	
	Wall thickness – minimum & maximum value	mm	≤1.02~≤2.54	
7	XLPE manufacturing Method			
	-Extrusion line type		VCV	
	-Single pass triple extrusion		Yes	
	-Curing method		Dry	
	-Cooling method		Dry/Water	
8	Water barrier			

No	Item	Units	Required	Tendered
	-Type & material		Semi-con swellable tape	
	-Nominal thickness	mm		
9	Metallic Sheath			
	Type and material		Lead Alloy	
	Construction method		extrusion	
	Nominal thickness	mm		
	Cross section area of sheath	mm^2		
	Maximum earth fault current	kA	40	
10	Bedding			
	-Type and material		Semi-con swellable tape	
	-Nominal thickness			
11	Metallic screen			
	-Type & Material		Copper wire & / or tape	
	-Wire diameter & numbers	mm & nos.		
	-Total cross sectional area of screen	mm^2		
	-Nominal thickness of copper tape, if any	mm		
	-Earth fault current (1 sec) combination with Metallic Sheath (Lead alloy)	kA	40	
12	Binder			
	-Material		Semi-con swellable tape(s)	
	-Number of tapes and thickness			
13	Outer sheath (protective layer)			
	-Material		HDPE	
	-Nominal wall thickness	mm	6.0	
	Color		black	

No	Item	Units	Required	Tendered
	-Tensile strength without aging	N/mm^2	12.5	
	-Termite resistance		Yes	
14	Type of conductive outer layer		Graphite layer	
15	Nominal Overall cable diameter			
16	Weight of completed cable			
	-Copper	kg/m		
	-Lead Alloy	kg/m		
	-Gross weight	kg/m		
17	Transmission capacity of 220kV $400mm^2$ 1C XLPE cable (minimum)	MVA	63	
18	Reactive power requirements			
	-Maximum charging current	A/km		
19	Short circuit currents			
	-Max three phase short circuit current for 3 sec	kA	40	
	-Max earth fault current for 1sec	kA	40	
	-Max conductor temperature for three phase/earth fault 40kA, 3 sec.	^0C	250	
20	Electrical Parameters			
	-Copper purity		99.99%	
	-Maximum DC resistance of conductor at 20^0C	Ohm/km	0.0113	
	-AC resistance of conductor at 20^0C	Ohm/km		
	-AC resistance of conductor at 90^0C	Ohm/km		
	-DC resistance of metal sheath at 20^0C	Ohm/km		
	-DC resistance of copper wire screen at 20^0C	Ohm/km		
	-Max field strength at conductor screen at U_0=127 kV	kV/mm		
	-Charging current per phase at operating voltage	A/km		
	-Charging power per circuit at operating voltage	kVar/km		
	-Dielectric loss factor at 20/90 ^0C	p.u.		

No	Item	Units	Required	Tendered
	-Service capacitance	µF/km		
	-Inductance for flat formation (400 mm between phases)			
	Phase L1	mH/km		
	Phase L2	mH/km		
	Phase L3	mH/km		
	-Reactance for flat formation (400 mm between phases)			
	Phase L1	Ohm/km		
	Phase L2	Ohm/km		
	Phase L3	Ohm/km		
	-Surge impedance of cable	Ohm		
	-Max positive sequence & negative sequence impedance			
	(1) with sheath current	Ohm/km		
	(2) without sheath current	Ohm/km		
	-Max zero sequence impedance (return currents in sheath)	Ohm/km		
21	Current ratings			
	Calculation of maximum permissible continuous current carrying capacity per circuit with cross-bonding. Required capacity 63MVA			
	A1 option: direct buried at 1200mm depth, flat formation, 400mm spacing, thermal soil resistivity (X)	A		
	A2 option: laid in air at temperature 40^{0}C, flat formation, 400 mm spacing	A		
	A3 option: laid in 250mmØ HDPE pipes, laid in air at temperature 40^{0}C	A		
	A4 option: laid in 250mmØ HDPE pipes, flat formation, 400mm spacing, buried at 1.2m depth, thermal soil resistivity (X)	A		
	A5 option: laid in 250mmØ HDPE pipes, Trefoil formation, buried at 1.2m depth, thermal soil resistivity (X)	A		
	(X) – Thermal Soil Resistivity shall be mentioned in Option A1,A4 & A5			

No	Item	Units	Required	Tendered
	Current Carrying Capacity at Emergency Conditions			
	Calculate the Emergency Current level that can be carried for max. 4 hours without exceeding the maximum operating temperature 105^{0}C, assuming that the cable system is operating at required rated current.		For A4 option	
	a. For 1 hour	A		
	b. For 2 hours	A		
	c. For 3 hours	A		
	d. For 4 hours	A		
	-System load factor			
22	Cable losses			
	-Max continuous current, cross-bonding, nominal voltage, 40 ^{0}C,			
	(1) Conductor	kW/km		
	(2) Dielectric	kW/km		
	(3) Metal sheath	kW/km		
	(4) Copper wire screen	kW/km		
	(5) Total losses at rated capacity (total of 1,2,3 and 4)	kW/km		
23	Mechanical data and dimension of cable			
	-Outer diameter	mm		
	-Net weight	kg/km		
	-Max delivery length (according to site conditions)	m		
	-Min. permissible bending radius (according to site conditions)	m		
	-Max. permitted pulling tension	kN		

No	Item	Units	Required	Tendered
	-Transport dimensions of cable drum shall comply with Sri Lanka transport regulations of weight and height		Yes	
24	Requirement of Type test report			
	-Name of independent testing authority			
	-Accreditation for test laboratory			
	-Date of type test certificate			
	-Standard for type test		IEC 60840	
	a.) Electrical Tests			
	I. Bending test		Yes	
	II. Partial discharge tests		Yes	
	III. Tan δ measurement		Yes	
	IV. Heating cycle voltage test followed by partial discharge		Yes	
	V. Lightning impulse voltage test followed by a power frequency voltage test		Yes	
	VI. Resistivity of semi-conducting screens		Yes	
	VII. Examination with completion of above tests		Yes	
	VIII. The resistivity of the cable semi conducting screens		Yes	
	b).None electrical type Tests			
	I. Check of cable construction		Yes	
	II. Tests for determining the mechanical properties of insulation before and after ageing		Yes	
	III. Tests for determining the mechanical properties of oversheaths before and after ageing		Yes	
	IV. Ageing tests on pieces of complete cable to check compatibility of materials		Yes	
	V. Measurement of density of HDPE insulation		Yes	

No	Item	Units	Required	Tendered
	VI. Test under fire conditions		Yes	
	VII. Water penetration test		Yes	
	VIII. Shrinkage test for PE, HDPE and XLPE insulations		Yes	
	c) Additional tests for CCV Extrusion (As per ICEA S-108-720-2018 standard)			
	I. Amber, Agglomerate, Gel, Contaminant, Protrusion, irregularity and Void Test		Yes	
	II. Wafer Boil Test for conductor and Insulation shield.		Yes	

2.10.3.2 36 kV Single Core XLPE Power Cables

No	Item	Units	Required	Tendered
	(These sheets to be copied and filled in for each size of 36kV cables offered for each Grid Substation)			
1	Name of the Manufacturer			
2	Country of Origin			
3	Rated Voltage category	kV	33	
4	System Highest Voltage (phase to phase) (U_m to IEC 60502)	kV	36	
5	Number of cores		One	
6	Basic Insulation level(Minimum)	kV	194kV	
7	Maximum Nominal Operating temperature	^{0}C	90 ^{0}C	
8	Applicable Standards		BS 6622-2007/IEC 60502-2-2014 as applicable	
9	Conductor			
	-Design fault current and duration for a conductor	kA/sec	25kA/1sec	
	- Cross sectional area	mm^2		
	- Diameter			
	-Number of strands			
	-Diameter of strands			
	- Material		Annealed Copper	
	- Shape		Round	
	- Overall Dimensions	mm		
	-Type			
	i. Solid/Stranded		Stranded	
	ii. Compact/Non Compact		Compact	
	- Welding or soldering temp.	^{0}C		
10	Longitudinal water swellable tape			
	-Form of water blocking material			
	-Thickness	mm		
11	Conductor Screen			

No	Item	Units	Required	Tendered
	- Material			
	- Thickness Approx:	mm	As per applicable standard	
	- Method of application		Extruded	
12	Insulation			
	- Material		XLPE	
	-Extrusion process		Triple	
	i. Minimum Average Thickness	mm	As per applicable standard	
	ii. Minimum at a point	mm	As per applicable standard	
13	Insulation screen			
	- Type		Non metallic semi conducting	
	i. Semi conducting layer		Extruded	
	ii. Metallic		No	
	iii. Strippability		Cold	
	-Material		Extruded semi conducting compound	
	-Maximum electrical Stress		As per applicable standard	
	- Thickness, approx.	mm		
	- Diameter over screen	mm		
14	Longitudinal water swellable tape			
	-Form of water blocking material			
	-Thickness	mm		
15	Metallic Layer			
	- Material		Copper	
	- No. Of Wires or Tapes	mm		
	- Size Of Wire or Tapes	mm		
	- Cross Section	mm^2		
	-Fault current carrying capacity of metallic screen	kA	25kA/1 sec	

No	Item	Units	Required	Tendered
16	Longitudinal water swellable tape			
	Form of water blocking material			
	Thickness	mm		
17	Metal Sheath		Not applicable	
	- Material		Not applicable	
	- Nominal Thickness	mm	Not applicable	
	- External Diameter	mm^2	Not applicable	
	Lead Alloy Sheath Composition		Not applicable	
	- Tin	%	Not applicable	
	- Cadmium	%	Not applicable	
	- Antimony	%	Not applicable	
	- Lead	%	Not applicable	
18	Innersheath			
	-Type/Material			
	-Thickness	mm		
19	Metallic armour			
	-Material		Aluminium Alloy	
	-Diameter of wire		As per applicable standard	
	-Maximum Working Hoop		kPa	
	-Stress			
	-Purity	%		
	- Plumbing Temperature	^0C		
20	Longitudinal water blocking material			
	-Form of water blocking material			
	-Thickness	mm		
21	Oversheath			
	- Type/Material		PVC-ST2 or Type 9	
	- Thickness	mm		

No	Item		Units	Required	Tendered
	i. Nominal		mm	As per applicable standard	
	ii. Minimum at a point		mm	As per applicable standard	
	-Whether Graphite layer provided			Yes	
	-Whether DC test on oversheath carried out				
	- Type of Termite Repellent				
22	Completed Cable				
	- Overall Diameter, approx.		mm		
	- Approximate weight of cable		kg/m		
	- Drum Length		m		
23	Cable Drums				
	-Material of the drum			steel	
	- Overall Diameter		m		
	- Width		m		
	- Weight Loaded		kg		
24	Conditions Upon which current carrying capacity calculated				
	- Axial spacing between phase cable		mm		
	- Axial spacing between circuits		mm		
	- Soil thermal resistively		m.K/w		
	- Ground Temperature		^{0}C		
	- Air Temperature		^{0}C		
	- Burial depth		m		
	- Type Of earth bonding: Single Point		Yes/No		
25	Current Ratings				
	-Laid Direct	Trefoil	A		
		Flat			
	-Laid in Ducts	Trefoil	A		
		Flat			
	-Laid in air	Trefoil	A		
		Flat			

No	Item	Units	Required	Tendered
	-whether the maximum symmetrical short circuit current rating curves for 0.2 to 0.3 sec. duration Furnished		Yes	
26	Maximum dielectric stress at the Sector screen (assumed smooth)	kV/mm		
27	Minimum radius of bend around which can be laid.			
	- Laid direct.	m		
	- In ducts.	m		
	- In Air.	m		
28	Nominal internal diameter of pipes or ducts through which cable may be pulled.	mm		
29	Maximum D.C Resistance of conductor per meter of cable 20^0C		As per applicable standard	
	- of Conductor	μΩ/m		
	- of metallic layers	μΩ/m		
30	Maximum A.C. Resistance of conductor per meter of cable at maximum conductor temperature.	μΩ/m		
31	Insulation Resistance Of Cable Per Core			
	- 20^0C	MΩ		
	- at max. rated temp.	MΩ		
32	Maximum conductor reactance at 50Hz	μΩ/m		
33	Maximum conductor capacitance at 50Hz	pF/m		
34	Coefficient of thermal variations of the electrical parameters			
35	Maximum Charging Current per core per meter of Cable at nominal voltage U_0	A		
36	Maximum Conductor Temperature at and duration			
	-Full load condition/Duration	^{0}C		

No	Item	Units	Required	Tendered
	-Short circuit condition/Duration	^{0}C		
	-Overload condition/Duration	^{0}C		
	-Allowable maximum overloading in determining the above	%		
37	Conductor Short Circuit Current carrying capacity for one second, cable loaded as above prior to short circuit and final conductor temperature of 250^{0}C	kA	25kA/1 sec	
38	Metallic layer earth faulty current Carrying Capacity for one second, cable loaded as above Prior to earth fault and final screen temperature	kA	25kA/1 Sec	
39	Maximum dielectric loss of cable per meter of three-phase circuit when laid direct in the ground at nominal voltage U_o, nominal frequency and operating at maximum conductor Temperature	W/m		
40	Maximum dielectric loss angle of charging VA of Cable when laid direct in the ground at nominal voltage, Uo, normal frequency at	tan d		
	-A conductor temperature of 20^{0}C			
	-Maximum Conductor Temperature	tan d		
41	Maximum dielectric loss angle of charging VA of cable at normal frequency conductor temperature of 20^{0}C at			
	-50% rated voltage U_o	tan d		
	-125% rated voltage U_o	tan d		
	-200% rated voltage U_o	tan d		
42	Metallic layer loss (including amour if applicable) Of cable per meter of three-phase circuit at nominal voltage U_o and normal	W		

No	Item	Units	Required	Tendered
	frequency at the circuit rating stated above			
43	Horizontal distance between cable supporting racks			
44	Creepage distance of sealing end porcelain			
	Specified	mm		
	Guaranteed	mm		
45	Partial discharge at $2U_0$	%	<=5	
46	Whether a certified copy of ISO 9001:2015 or latest furnished with the offer			
47	Whether all the Type test certificates specified in BS 6622:2007 or IEC 60502:2014 submitted		Yes/No	
	-Whether Copy of Accreditation certificate of type test laboratory submitted		Yes/No	
48	Incase cables are type tested for IEC standards, whether supplier/manufacturer is agreeing to perform tests according to BS 6622 during pre-shipment(for the tests which are less stringent than BS 6622:2007 and not covered)		To be agreed	

2.11 TRANSFORMERS

2.11.1 63 MVA, 220/33 kV Power Transformer (Mannar and Nadukuda)

No	Item	Units	Required	Tendered
(A)	**Rating and Performance**			
1.	Manufacturer's name and address			
2.	Continuous maximum rating (ONAN/ONAF)	MVA	48/63	
3.	Number of phases		3	
4.	Rated Frequency	Hz	50	
5.	Number of Windings		2	
6.	Applicable standards		IEC 60076:2011	
7.	System maximum voltages			
	- HV	kV	245	
	- MV	kV	36	
8.	Winding Insulation			
	- HV		Graded	
	- MV		Uniform	
9.	Highest voltage for equipment			
	- HV	kV	245	
	- MV	kV	36	
10.	Winding insulation levels			
	- HV		LI: 1050, AC: 460	
	- MV		LI: 170, AC: 70	
11.	Transformer nominal ratio		220 kV/ 33 kV	
12.	Phase connections			
	- HV winding		Star	
	- MV winding		Delta	
	- Vector group		YNd1	

No	Item	Units	Required	Tendered
13.	Short circuit withstand fault level at terminals of			
	- 245 kV Busbars	kA	40	
	- 36 kV Busbars - Short circuit current duration	kA sec	25 3	
14.	Type of cooling		ONAN/ONAF	
15.	External cooling medium		Air	
16.	Service conditions			
	• Altitude not exceeding	m	1000	
	• Air temperature not exceeding	^{0}C	40	
	• Average air temperature in any one year not exceeding - In any one day - Average in one year	 ^{0}C ^{0}C	 32 30	
17.	On load tap changer			
	(a) Type		M.R. Germany	
	(b) Category of voltage control		CFVV	
	(c) HV or LV winding		HV	
	(d) Range (+ & -) (e) Interrupter		+7 to -10 Vacuum Type	
	(f) Step size	%	1.5	
	(g) Power frequency withstand test voltage between first and last contacts of the selector switch between any two adjacent contacts of the selector between diverter and switch contacts	kV		
	(h) Type test certificate reference			
	(i) Tap position indication	2nos BCD		
18.	Size of tapping step with position nos.		18 taps 1.5% step voltage	
19.	Approximate ONAN rating	MVA	33	
20.	Winding temperature rise at CMR	^{0}C	55	
21.	Top oil temperature rise			

No	Item	Units	Required	Tendered
	(a) CMR	^{0}C	50	
	(b) ONAN rating	^{0}C		
22.	Maximum hot spot temperature at CMR	^{0}C	98	
23.	Maximum winding hot spot temperature of transformer at			
	(a) Normal Cyclic Loading (IEC 60076-7)	^{0}C	120	
	(b) Long time emergency loadings (IEC 60076-7)	^{0}C	140	
	(c) Short time emergency loading (IEC 60076-7)	^{0}C	160	
24.	Flux density in iron at nominal voltage and frequency and at nominal ratio – (no load)			
	(a) Core	Tesla		
	(b) Yokes	Tesla		
25.	Magnetizing current (approx) at nominal ratio and			
	- At 0.9 x nominal voltage	%		
	- At 1.0 x nominal voltage	%		
	- At 1.1 x normal voltage	%		
	- At 1.2 x normal voltage	%		
26.	Guaranteed losses at 75 ^{0}C			
	- No load losses at rated voltage, frequency and at nominal tap position	kW	Maximum 27.5	
	- Load losses at maximum tap position at ONAN base	kW		
	- Load losses at nominal tap position at ONAN base	kW		
	- Load loss at minimum tap position at ONAN base	kW		
	- Load losses at maximum tap position at ONAF base	kW		
	- Load losses at nominal tap position at ONAF base	kW	Maximum 160	
	- Load loss at minimum tap position at ONAF base	kW		
	- Auxiliary losses at CMR corrected to 75^{0}C	kW	Maximum 3	
	- Total losses at nominal tap position at ONAN base	kW		
	- Total losses at nominal tap position at ONAF base	kW		

No	Item	Units	Required	Tendered
27.	Efficiency referred to 75 ^{0}C and nominal ratio			
	(a) 100 % CMR at unity power factor	%		
	(b) 75 % CMR at unity power factor	%		
	(c) 50 % CMR at unity power factor	%		
	(d) 25 % CMR at unity power factor	%		
	(e) 100 % CMR at 0.8 power factor	%		
	(f) 75 % CMR at 0.8 power factor	%		
	(g) 50 % CMR at 0.8 power factor	%		
	(h) 25 % CMR at 0.8 power factor	%		
28.	Voltage regulation referred to 75 ^{0}C and nominal ratio			
	(a) 100 % CMR at unity power factor	%		
	(b) 75 % CMR at unity power factor	%		
	(c) 50 % CMR at unity power factor	%		
	(d) 25 % CMR at unity power factor	%		
	(e) 100 % CMR at 0.8 power factor	%		
	(f) 75 % CMR at 0.8 power factor	%		
	(g) 50 % CMR at 0.8 power factor	%		
	(h) 25 % CMR at 0.8 power factor	%		
29.	Impedance voltage at 75 ^{0}C			
	(a) For nominal tap position between HV and MV windings at ONAN rating	%		
	(b) For nominal tap position between HV and MV windings at ONAF rating	%	11.00	
	(c) For maximum tap position between HV and MV windings at ONAN rating	%		
	(d) For maximum tap position between HV and MV windings at ONAF rating	%		
	(e) For minimum tap position between HV and MV windings at ONAN rating	%		

No	Item		Units	Required	Tendered
	(f) For minimum tap position between HV and MV windings at ONAF rating		%		
30.	Equivalent zero sequence impedance between HV and LV windings				
31.	Maximum current density in windings at CMR				
	(a) HV winding		A/mm^2		
	(b) MV winding		A/mm^2		
32	Transformer warranty period		Years	2	
(B)	**Control Circuits**				
1.	Type of controls for on load tap changer and cooler controls			Automatic	
2.	Whether automatic control required			Yes	
	Reference voltage (VT output line to line)		V	220 AC (50 Hz)	
3.	Whether load compensation required on the AVR			Yes	
4.	Whether separate remote control panel required			Yes	
5.	Estimated distance between remote control point and transformer		m	<110	
6.	DC Supply (Control voltage)				
	- Nominal		V DC	220	
	- Maximum float voltage		V DC		
7.	AC supply voltage for tap changer operating motor 3 phase			400 V AC 50 Hz	
8.	Whether provision for supervisory control required, including AVR setting			Yes	
9.	Whether marshalling kiosk required			Yes/No	
10.	Transformer terminals for line and neutral				
	(a) HV line	For Mannar GSS		Outdoor Bushings (with RTV Silicone Coating)	
		For Nadukuda GSS		Cable Chamber including pressure relief devices, oil level indicators, drain and filter	

No	Item	Units	Required	Tendered
			valves as per the drawings	
	(b) MV line		Multi-Terminal Plug-in Type	
	(c) Neutral		Outdoor Bushings	
	(Attach all technical data of all types of bushings & ducts)			
11.	Accommodation for current transformers bushings at			
	(a) HV line			
	(b) MV line			
	(c) Neutral			
12.	Accommodation of tank for outdoor weatherproof HV neutral current transformers			
13.	Pollution category of bushings Creepage distance based on system highest voltage	mm/kV	53.7	
(C)	**Cooling**			
1.	Minimum number of radiators per transformer			
2.	Maximum rating of each radiator as percentage of total loss at CMR	%		
3.	Cooling capacity 100% with one fan out of order		Yes	
(D)	**General**			
1.	Type of oil preservation system		Conservator with silica gel breather	
2.	Whether wheels, skid or flat base required		Wheels	
3.	Whether anti-vibration pads required		No	
4.	Transformer Sound Pressure Level	dB(A)	78	
(E)	**Details of Construction**			
1.	Types of winding			
	(a) HV			
	(b) MV			
2.	Material of Insulation			
	(a) HV			

No	Item	Units	Required	Tendered
	(b) MV			
3.	Insulation of tapping connections			
4.	Insulation of			
	(a) Yoke bolts			
	(b) Side plates			
5.	Winding connection brazed or crimped (specify winding and joint material)			
6.	Is facility for adjustment of axial pressure on windings	Yes/ No		
7	Thickness of transformer tank			
	(a) Sides	mm		
	(b) Bottom	mm		
	(c) Cover	mm		
8.	Material used for gaskets for oil tight joints			
9.	Cover Flange			
	- Level	Low/high		
	- Joint	Welded		
10.	Maximum vacuum pressure safely withstand by tank	Pa		
(F)	**Radiators and Fans**			
1.	Thickness of radiator plates and/ or cooling tubes			
2.	Equipment for ONAN cooling state (a) or (b) (a) Radiator on main tank (b) Separate cooler bank			
3.	Number of cooling air blowers per transformer			
4.	Speed of air blowers and air flow	rpm/m^3 per min		
5.	Rating of each air blower motor	kW		
6.	Starting current of each air blower motor	A		
(G)	**Oil volumes, weights and dimensions**			
1.	Total oil required including cooler system	Liters		
2.	Volume of oil to fill transformer above the top yoke	Liters		

No	Item	Units	Required	Tendered
3.	Capacity of conservator	Liters		
4.	Volume of oil in conservator between highest and lowest visible points	Liters		
5.	Weight of core and winding assembly	Tons		
6.	Weight of each oil cooler bank complete with oil if mounted separately from transformer	Tons		
7.	Total weight of complete transformer, including attached coolers, voltage regulating equipment, all fittings and oil	Tons		
8.	Weight of transformer arranged for transport	Tons		
9.	Overall dimensions including bushings			
	- Height	mm		
	- Depth	mm		
	- Width	mm		
10.	Shipping dimensions			
	- Height	mm		
	- Depth	mm		
	- Width	mm		
11.	Minimum space required for transformer bay			
	- Depth	mm		
	- Width	mm		
(H)	**Transformer oil**			
1.	Manufacturer			
2.	Type		Uninhibited	
3.	Class		1	
4.	Standard		IEC60296	
(I)	**Transformer parts subject to Short circuit test**			
1.	Demonstration of ability to withstand short circuit as per IEC 60076-5: 2006	(Yes / No)	Yes	
(J)	**Transformer bushing**			

No	Item	Units	Required	Tendered
1.	220 kV Bushings			
	- Manufacturer			
	- Insulator material (Solid/oil-paper)			
	- Manufacturer's type reference and rated voltage			
	- Rated current	A		
	- Manufacturer of porcelain			
	- Length of insulator (Overall)	mm		
	- Weight of insulator	kg		
	- Electrostatic capacity of complete bushings.	pF		
	- Dry lightning impulse voltage (1.2/50 wave) test voltage	kV		
	- 50 Hz dry voltage withstand test voltage without arching horns	kV		
	- 50 Hz wet voltage withstand test voltage without arching horns	kV		
	- Total creepage distance of shed (USCD minimum 53.7mm/kV based on maximum system voltage)	mm		
	- Capacitive voltage tap available for testing purposes		Yes	
2.	33 kV Bushings			
	- Manufacturer			
	- Insulator material (Solid/oil-paper)			
	- Manufacturer's type reference and rated voltage			
	- Rated current	A		
	- Manufacturer of porcelain			
	- Length of insulator (Overall)	mm		
	- Weight of insulator	kg		
	- Electrostatic capacity of complete bushings.	pF		
	- Dry lightning impulse voltage (1.2/50 wave) test voltage	kV		
	- 50 Hz dry voltage withstand test voltage without arching horns	kV		
	- 50 Hz wet voltage withstand test voltage without arching horns	kV		

No	Item	Units	Required	Tendered
	- Total creepage distance of shed (USCD minimum 53.7mm/kV based on maximum system voltage)	mm		
	- Capacitive voltage tap available for testing purposes		Yes/No	
3.	220kV Neutral Bushings			
	- Manufacturer			
	- Insulator material (Solid/oil-paper)			
	- Manufacturer's type reference and rated voltage			
	- Rated current	A		
	- Manufacturer of porcelain			
	- Length of insulator (Overall)	mm		
	- Weight of insulator	kg		
	- Electrostatic capacity of complete bushings.	pF		
	- Dry lightning impulse voltage (1.2/50 wave) test voltage	kV		
	- 50 Hz dry voltage withstand test voltage without arching horns	kV		
	- 50 Hz wet voltage withstand test voltage without arching horns	kV		
	- Total creepage distance of shed (USCD minimum 53.7mm/kV based on maximum system voltage)	mm		
	- Capacitive voltage tap available for testing purposes		Yes/No	
(K)	**Transformer tank Fittings**			
1	Draining and filter valves (a) Type (b) Material for 75 mm and below (c) Material for above 75 mm		Yes Gate/ Ball Gunmetal	
2	Valves for tank oil sampling (a) Type (b) Material		Yes Gunmetal	
3	Radiator isolation valves (a) Type (b) Material for 75 mm and below (c) Material for above 75 mm		Yes Gunmetal	
4	Pulling eyes for complete transformer		yes	

No	Item	Units	Required	Tendered
5	Supports for hydraulic jacks		yes	
6	Lifting lugs		yes	
7	Tank earth terminals		yes	
8	Core earth terminal box		yes	
9	Inspection manholes		yes	
10	Ladder		yes	
11	Skids or wheels adjustable in two directions		yes	
(L)	**Transformer accessories**			
1	Oil preservation system with or without rubber bag		Yes	
2	Dehydrating breather		Yes	
3	Oil level indicator of magnetic type		Yes	
4	Contact thermometer for the oil temperature		Yes	
5	Winding temperature indicator		Yes	
6	Direct winding temperature measurement using fibre optic sensors		Yes	
7	Pressure relief device		Yes	
8	Rapid pressure relay		Yes	
9	Buchholz relay		Yes	
10	Buchholz relay gas sampling		Yes	
11	On-line gas monitor		No	
12	On-line monitoring system		No	
13	Fire protection system		Required	
(M)	**Quality Assurance**			
1	Manufacturer quality assurance acc. to ISO 9001 and 14001		Yes	
2	Manufacturer Quality Manual is submitted with offer		Yes	
3	Manufacturer a sample of Quality Inspection and Test Plan is submitted with offer		Yes	
(N)	**Other Information**			
1.	Negative pressure tank can withstand			

No	Item	Units	Required	Tendered
2.	Type & Special test Certificate for similar category transformer	To be annexed	Yes	
3.	Customer reference list for similar category Transformers	To be annexed	Yes	
4.	Tests carried out at the manufacture's work as per IEC 60076-1:2011	To be annexed	Yes	
(O)	**Routine tests at manufacturers works (IEC 60076-1:2011)**			
1	Measurement of winding resistance (11.2).		Yes	
2	Measurement of voltage ratio and check of phase displacement (11.3).		Yes	
3	Measurement of short-circuit impedance and load loss (11.4).		Yes	
4	Measurement of no-load loss and current (11.5).		Yes	
5	Dielectric routine tests (IEC60076-3).		Yes	
6	Tests on on-load tap-changers (11.7).		Yes	
7	Leak testing with pressure for liquid- immersed transformers (tightness test) (11.8).		Yes	
8	Check of the ratio and polarity of built-in current transformers.		Yes	
9	Check of core and frame insulation for liquid immersed transformers with core or frame insulation (11.12).		Yes	
10	Insulation of Auxiliary wiring (IEC 60076 , part 3)		Yes	
11	Partial discharge measurement (IEC 60076 , part 3		Yes	
12	Determination of capacitances windings- to-earth and between windings		Yes	
13	Measurement of d.c. insulation resistance between each winding to earth and between windings.		Yes	
14	Measurement of dissipation factor (tan δ) of the insulation system capacitances.		Yes	
15	Measurement of no-load loss and current at 90 % and 110 % of rated voltage(11.5).		Yes	
(P)	**Type tests**			

No	Item	Units	Required	Tendered
1	Temperature-rise type test (IEC60076-2).		Yes	
2	Dielectric type tests (IEC60076-3).		Yes	
3	Determination of sound level (IEC60076-10) for each method of cooling		Yes	
4	Measurement of the power taken by the fan and liquid pump motors.		Yes	
5	Measurement of no-load loss and current at 90% and 110% of rated voltage		Yes	
(Q)	**Special tests**			
1	Dielectric special tests (IEC60076-3).		Yes	
2	Winding hot-spot temperature-rise measurements.		Yes	
3	Determination of capacitances windings- to-earth, and between windings.		Yes	
4	Measurement of dissipation factor (tan δ) of the insulation system capacitances.		Yes	
5	Determination of transient voltage transfer characteristics (Annex B of IEC60076-3:2000).		Yes	
6	Measurement of zero-sequence impedance(s) on three-phase transformers (11.6).		Yes	
7	Short-circuit withstand test (IEC60076-5) (If theoretical evaluation is unsuccessful)		Yes (At an independent test lab such as KEMA or CESI)	
8	Measurement of DC insulation resistance each winding to earth and between windings.		Yes	
9	Vacuum deflection test on liquid immersed transformers (11.9).		Yes	
10	Pressure deflection test on liquid immersed transformers (11.10).		Yes	
11	Vacuum tightness test on site on liquid immersed transformers (11.11).		Yes	
12	Measurement of frequency response (Frequency Response Analysis or FRA). The test procedure shall be agreed between manufacturer and purchaser.		Yes	

No	Item	Units	Required	Tendered
13	Check of external coating (ISO 2178 and ISO 2409 or as specified).		Yes	
14	Measurement of dissolved gasses in dielectric liquid.		Yes	
15	Mechanical test or assessment of tank for suitability for transport (to customer specification).		Yes	
16	Determination of weight with transformer arranged for transport. For transformers up to 1,6 MVA by measurement. For larger transformers by measurement or calculation as agreed between manufacturer and purchaser.		Yes	
17	Measurement of the harmonics of the no- load current		Yes	
18	Insulation test of oil and Measurement of dielectric strength of oil		Yes	
(R)	**Site tests**			
1	insulation resistance measurement of core and frame insulation, winding insulation to earth and between windings		Yes	
2	frequency response analysis		Yes	
3	interrogation of shock recorders fitted for transport		Yes	
4	Voltage ratio		Yes	
5	Vector group		Yes	
6	Dielectric tests on transformer oil		Yes	
7	Temperature rise test with rated load for 6 hrs		Yes	
8	Thermograph imaging from all possible views		Yes	
9	Measurement of Moisture in oil & DGA after temperature rise test		Yes	
10	Any other oil tests (Please specify)		Yes/No	
11	Winding resistance on each tap		Yes	
12	Insulation resistance measurement		Yes	
13	Check of protective earthing connections		Yes	
14	Current transformer polarity check		Yes	

No	Item	Units	Required	Tendered
15	Control equipment circuit check		Yes	
16	Operation test of supervisory equipment		Yes	
17	Operation test of cooling equipment		Yes	
18	Operation test of on load tap changer		Yes	
19	Visual Inspections and adjustments as per clause 10.24 of technical specifications		Yes	
20	fingerprint tests (Um>72 kV)		Yes	
(S)	**Type test reports submitted with the bid**			
1	Temperature-rise type test (IEC60076-2).		Yes	
2	Dielectric type tests (IEC60076-3).		Yes	
3	Determination of sound level (IEC60076-10) for each method of cooling		Yes	
4	Measurement of the power taken by the fan and liquid pump motors.		Yes	
5	Measurement of no-load loss and current at 90% and 110% of rated voltage		Yes	
(T)	**Special test reports submitted with the bid**			
1	Short circuit withstand test on similar transformer as per IEC 60076-5 at an internationally recognized test laboratory such as KEMA or CESI		Yes	

2.11.2 Earthing Transformers

No	Item	Units	Required	Tendered
	33kV EARTHING TRANSFORMERS 800A/30sec			
(a)	**General**			
1.	Manufacturer's Name & Address			
2.	Location of installation			
3.	Standards			
4.	Single or three-phase unit		Three- phase unit	
5.	Core or shell type			
6.	Type of tank			
7.	Tank fully vacuum proof		Yes	
8.	Number of windings			
9.	Specification of oil			
10.	Connection of MV phases			
11.	Connection of MV neutral			
12.	System voltages			
	- primary	kV		
(b)	**Ratings**			
1.	Rated symmetrical short circuit current of 33 kV system	kA		
2.	Rating of interconnected star winding on 3sec. basis	A		
3.	Earth-fault current duty (10 s)	A		
4.	Continuous rated current in Neutral	A		
5.	Rated voltages	kV		
6.	Vector group symbol	kV		
7.	Rated frequency	Hz		
(c)	**Service Conditions**			
1.	- Maximum ambient temperature	^{0}C		
2.	- Maximum service altitude	m		

No	Item	Units	Required	Tendered
3.	Temperature rise limit- oil / windings	K		
4.	Zero sequence impedance per phase (L.V. winding unloaded)	Ohms	70-80	
5.	Magnetic flux density at rated voltage and frequency	Tesla		
6.	No-load losses	kW		
(d)	**Insulation level and Tests**			
1.	Highest voltage for equipment			
	- windings / Bushings	kV		
2.	Minimum specific creepage distance of bushings based on highest system voltage	mm/kV	53.7	
3.	Routine tests according to IEC 60076 on each unit			
4.	Full-wave lightning Type test & impulse test on each unit			
	- test Voltage	kV		
(e)	**Operating Details**			
1.	Cooling method			
2.	Noise level at measuring distance of 0.3 m	dB(A)		
(f)	**Construction Details**			
1.	Bottom base type			
2.	Terminations:			
	- MV		Plug-in type	
	- Neutral			
(g)	**Masses, Measures and Drawings**			
1.	Overall dimensions including bushings			
	- height	mm		
	- depth	mm		
	Shipping dimensions			
	- height	mm		

No	Item	Units	Required	Tendered
	- depth	mm		
	- width	mm		
2.	Total mass of transformer complete as in service	kg		
3.	Transportation mass	kg		
4.	Un-tanking mass	kg		
5.	Mass of insulating liquid	kg		
6.	Minimum space requirements for transformer bay			
	- width	m		
	- depth	m		

2.11.3 Auxiliary Transformers 33/0.4 kV

No	Item	Units	Required	Tendered
	AUXILIARY TRANSFORMERS 160 kVA, 33/0.4 kV			
(a)	**General**			
1.	Manufacturer's Name & Address			
2.	Location of installation			
4.	Single or three-phase unit		Three-phase unit	
5.	Core or shell type			
6.	Type of tank			
7.	Tank fully vacuum proof			
8.	Number of windings			
9.	Specification of oil			
10.	System voltages			
	- primary	kV		
	- secondary	kV		
(b)	**Ratings**			
1.	Rated power	kVA	160	
2.	Rated symmetrical short circuit current	kA		
3.	Rated voltages (no load)			
	- primary	kV		
	- secondary	kV		
4.	Vector group symbol		Dyn11	
5.	Rated frequency	Hz		
(c)	**Service Conditions**			
	- Maximum ambient temperature	^0C		
	- Maximum service altitude	m		
1.	Temperature rise limit '- top oil / windings	K		
2.	Impedance voltage at rated power	%	on HV base 4.5	
	between H.V. and L.V. windings			

No	Item	Units	Required	Tendered
3.	Zero sequence impedance per phase (L.V. winding unloaded)	Ohms		
4.	Magnetic flux density at rated voltage and frequency	Tesla		
5.	No-load losses	kW		
6.	Load losses at full rated power of L.V. winding	kW		
(d)	**Insulation level and Tests**			
1.	Highest voltage for equipment			
	- primary winding	kV	36	
	- secondary winding	kV	0.44	
2.	Routine tests according to IEC 60076 series on each unit			
3.	Full-wave lightning impulse test			
	Type test on each unit			
	- test Voltage / primary	kV	170	
(e)	**Operating Details**			
1.	Cooling method		ONAN	
2.	Noise level at measuring distance of 0.3 m	dB(A)		
(f)	**Construction Details**			
1.	Bottom base type			
2.	Terminations:			
	- MV		Cable Box	
	- LV		Cable Box	
	- Neutral		Cable Box	
(g)	**Masses, Measures and Drawings**			
1.	Overall dimensions including bushings			
	- height	mm		
	- depth	mm		
	- width	mm		
	Shipping dimensions			

No	Item	Units	Required	Tendered
	- height	mm		
	- depth	mm		
	- width	mm		
2.	Total mass of transformer complete as in service	kg		
3.	Transportation mass	kg		
4.	Un-tanking mass	kg		
5.	Mass of insulating liquid	kg		
6.	Minimum space requirements for transformer bay			
	- width	m		
	- depth	m		

2.11.4 Diesel Generator

No	Item	Units	Required	Tendered
	DIESEL GENERATOR			
1.	Manufacturer's Name & Address			
2.	Type			
3.	Rating	kVA	See Scope of Works	

2.12 ENERGY METERS

No	Item	Units	Required	Tendered
A	**General**			
A.1	Name of the Manufacturer			
A.2	Address of the Manufacturer			
A.3	Country of Manufacture			
A.4	Make			
	Model No.			
	Manufacturers Catalogue Ref. No.			
A.5	Type		3P4W	
A.6	Applicable Standards		As per clause 2.0	
B	**Principle Parameters**			
B.1	Reference voltage and operating range	V	110	
B.2	Standard Rated Current	A	1	
B.3	Rated Maximum Current (Imax)		1.2 times of the rated current	
B.4	Starting Current of Meter		at 0.001 of basic current	
B.5	Auxiliary Supply	V	60-240 V AC/DC	
C	**Basic Features**			
C.1	Limit of errors 1. Active Energy Reactive Energy		 Class 0.2S Class 2	
C.2	Capability of measurement in full p.f range		Accuracy in full p.f range	
C.3	TOD measurement		Yes	
	Minimum TOD intervals		6	
C.4	Demand integration period	min	15	
C.5	Maximum demand reset both Locally and Remotely		Yes	
C.6	Password Authorization Levels		Min 2 levels	
C.7	No. of Blinking LEDs		Min 2	
A.3	Blinking LED analogues to			

No	Item	Units	Required	Tendered
	1. Active Energy consumption 2. Reactive Energy consumption		Yes Yes	
C.8	Battery lifetime of calendar clock battery		Min 10 years	
C.9	Display Sequence		As per in Clause 3.2.8 of this specification	
C.10	Meter Sampling rate		30s or less	
C.11	Memory retention period (months)		12 months	
C.12	Programming parameters		As per Clause 3.2.9 of this specification	
C.13	Logging Load profile		as per Clause 3.2.9 of this specification	
C.14	Event log		as per Clause 3.2.9 of this specification	
C.15	Display memory type		non-volatile	
D	**Remote/ Local Communication**			
D.1	Types of communication ports available		Optical Port	
B.5	Auxiliary Supply		RS 232	
C	**Basic Features**		Ethernet	
D.2	Remote meter access via a GSM and 2G/3G/4G modem		Yes	
D.3	Software and manuals		As per Clause 3.3.4 of this specification	
D.4	Meter communication 1. software name 2. version			
D.5	Facilities provided by remote operation			
	(a) To programme each meter		Yes	
	(b) To take the relevant meter reading individually		Yes	
	(c) To download stored data from meter		Yes	

No	Item	Units	Required	Tendered
D.6	Type of Modem		Dual band GSM modem (900/1800 MHz) or 2G/3G/4G modem	
D.7	Mounting of Modem		Built In	
D.8	Power Supply to the modem		Through Meter	
D.9	Minimum speed of the modem (kbps)			
D.10	Type of the Network Switch		Unmanageable	
D.11	Number of IP Ports and the speed		Minimum 24 No.s 10/100 Mbps	
D.12	Download data to be stored in MS Access/SQL		Yes	
D.13	Tamper proof SIM card holder		Yes	
D.14	DLMS based communication enable		Yes	
D.15	APIs are provided		Yes	
E	**Mechanical Requirement**			
E.1	Protective class		Class 2 (Double Insulation)	
E.1	Type of meter cover and terminal cover		As per clause 3.4.1 and 3.4.3 of this specification	
E.2	Bore Size of the terminals and number of screws provided		As per clause 3.4.2 of this specification	
E.3	Degree of protection (IP Category)		IP 51 (minimum)	
E.4	No. of digits in the LCD display		Minimum 10 including three decimals	
E.5	Size of numbers in the LCD display		Minimum 4mm high and 4 mm width	
E.6	Seal-ability of meters to prevent from: • Access to adjustment or calibration devices on meter Access to terminals of incoming current or potential wiring		Yes Yes	

No	Item	Units	Required	Tendered
F	**Climate Condition**			
F.1	Operating Temperature range		As per table 5 of IEC 62052-11 for indoor meters	
F.2	Conform to operate accurately under Maximum Relative Humidity of 90%		Yes	
G	**Electrical Requirement**			
G.1	Active and apparent power consumption in the voltage and current circuits of the meter at a reference voltage, frequency, temperature		not more than that stipulated in table 1 of IEC 62053-22	
G.2	Permissible error due to voltage variation		conform to the table 7 of IEC 62052-11	
G.3	Meter operation during Voltage dips and short interruptions		conform to Clause 7.1.2 of IEC 62052-11	
G.4	Meter operation during short time over current		as per the clause 7.2 of IEC 62053-22.	
G.5	Variation of error due to self – heating		not exceed the value given in IEC 62053-22	
G.6	Reference Temperature and Temperature coefficient			
G.7	Insulation Level			
	(a) Power Frequency Withstand voltage for 1 min		4 kV	
	(b) Impulse Voltage at 1.2/50 µsec		6 kV	
H	**Electromagnetic compatibility**			
H.1	meter operation conform to the clause 3.7 of this specification		Yes	
I	**Accuracy Requirements**			
I.1	Limits of error due to variation in current and influence quantities		do not exceed the limit given in IEC 62053-22 for class 0.2S	

No	Item	Units	Required	Tendered
I.2	Meter starting and running with no-load		conform to the clause 3.8 (a) of this specification	
I.3	Meter constant		conform to the clause 3.8 (b) of this specification	
J	**Marking of Meters**			
J.1	Making of Meters		as per clause 3.9 of this specification is possible	
K	**Quality Assurance**			
K.1	Quality Assurance conforming ISO 9001		Yes	
K.2	ISO/IEC 17025 accreditation for the Laboratory		Yes	
L	**Additional Requirements**			
L.1	Guaranteed Life Span of the meters and communication module		10 years	
L.2	Warranty for meters and accessories		5 years minimum	
M	Testing, Installation and Commissioning			
M.1	Test certificate			
	Test of insulating properties			
M.1.1	Impulse test voltage		Required	
M.1.2	A.C. Voltage Test		Required	
	Test of Accuracy requirements			
M.1.3	Test of meter constant		Required	
M.1.4	Test of starting condition		Required	
M.1.5	Test of no-load condition		Required	
M.1.6	Test of influence quantities		Required	
	Test of electrical requirements			
M.1.7	Test of power consumption		Required	
M.1.8	Test of influence of supply voltage		Required	

No	Item	Units	Required	Tendered
M.1.9	Test of influence of short-time current		Required	
M.1.10	Test of influence of self-heating		Required	
M.1.11	Test of influence of heating		Required	
M.1.12	Test of immunity to earth fault		Required	
	Test of electromagnetic compatibility			
M.1.13	Radio interference suppression		Required	
M.1.14	Fast transient burst test		Required	
M.1.15	Damped oscillatory waves immunity test		Required	
M.1.16	Test of immunity to electromagnetic RF fields		Required	
M.1.17	Test of immunity to conducted disturbances, induced by radio-frequency fields		Required	
M.1.18	Test of immunity to electrostatic discharges.		Required	
M.1.19	Surge immunity test		Required	
	Tests of the effect of the climatic environments			
M.1.20	Dry heat test		Required	
M.1.21	Cold test		Required	
M.1.22	Damp heat cyclic test		Required	
M.1.23	Solar radiation test		Required	
	Mechanical Tests			
M.1.24	Vibration Test		Required	
M.1.25	Shock test		Required	
M.1.26	Spring Hammer Test		Required	
M.1.27	Tests of protection against penetration of dust and water		Required	
M.1.28	Test of resistance to heat and fire		Required	
M.2	Acceptance / Sample tests		as per clause 5.2 of this specification	
N	**Technical Literature and Drawings**			

No	Item	Units	Required	Tendered
N.1	Submission of complete set of technical literature on installation, calibration and operation and maintenance of the meter		Required	
N.2	Submission of User Manuals for communication software		Required	

2.13 SOLAR PHOTO VOLTAIC SYSTEM

2.13.1 Solar PV Module

No	Item	Units	Required	Tendered
1.	Manufactures Name			
2.	Country of Origin			
3.	Country of Manufacture			
4.	Make			
5.	Model No.			
6.	Dimension			
7.	Total Area Required			
8	Weight			
9.	Output Cables			
10	No. of Modules Required			
11.	Place of Testing			
12.	Applicable Standard (latest)		IEC 61215 or Equivalent / IEC 61730 or Equivalent	
13.	Quality Management		ISO 9001: 2008 or Equivalent	
14.	System Capacity			
15.	Total System Rated Power			
16.	Minimum Rating of a Solar Module	Wp	> 450	
17.	Electrical Conversion Efficiency of SPV Module	%	>19	
18.	Grade of the Solar Panels		GRADE A	
19.	Tier class of the Solar Panel Manufacturer		Tier 1	
20.	Product Warranty (materials and workmanship)	years	Minimum 10	
21.	Power Output Warranty	years	25 (linear performance: 80% or more power output at the end of 25 years)	

No	Item	Units	Required	Tendered
22.	Module Architecture		60 cell (10x6) prefers)	
23.	Panel Voltage (Nominal)	V		
24.	Module Power Tolerance			
25.	Maximum Power Voltage of a Module (Vmpp)			
26.	Maximum Power Current of a Module (Immp)			
27.	Open Circuit Voltage (Voc)			
28.	Short Circuit Current (Isc)			
29.	Maximum String Voltage of SPV Array			
30.	High voltage safety measures for fire, electrical hazards and automatic shutdown at a fault			
31.	Operational Temperature Range	0_C	-40 - 85	
32.	Nominal Operating Cell Temperature (NOCT)	0_C	45 (±2)	
33.	Module Efficiency	%		
34.	Cell Type		Mono/Poly	
35.	Junction Box		Sealable and Resistance	
36.	Junction Box Protection		IP65	
37.	Frame		Aluminium or resist to corrosion	
38.	Front Glass	mm	3.2 tempered high transmission glass.	
39.	Linear Performance	Depreciation Rate %		
40.	Expected Life time	years	25 minimum	
41.	Number of bypass diodes			

2.13.2 Inverter and Other Parts

No	Item	Units	Required	Tendered
1.	Manufactures Name			
2.	Country of Origin			
3.	Country of Manufacture			
4.	Model No.			
5.	Inverter Technology		Transformer less	
6.	Place of Testing			
7.	Applicable Standard (latest)		IEC 62109-1 IEC 61683, IEC 61727: ed2.0, IEC 62116, IEEE 1547	
8.	Total Inverter Capacity			
9.	Minimum Efficiency at maximum solar generation	%	97	
10.	Inverter Rated Power Output	W		
11.	Maximum AC Power Output	W		
12.	Maximum DC Input Power	W		
13.	Housing		IP65	
14.	Inverter Installation		Indoor/Outdoor	
15.	Product Warranty	years	Minimum 10	
16.	Inverter Performance Monitoring			
17.	Remote monitoring system, module level monitoring ability			
18.	Upgradability of the system			
19.	System performance under shaded conditions (comparison)			
20.	System performance under module mismatch conditions (comparison)			
21.	Ability to have different string lengths in a same inverter			
22.	Availability of individual MPP trackers for different strings			
23.	Reverse-Polarity Protection			
24.	Ground-Fault Isolation Detection			

No	Item	Units	Required	Tendered
25.	Dimensions			
26.	Operating Temperature Range	^0C	-20 to +60	
27.	Inverter Type			
28.	No. of Inverter Required			
29.	Cooling Method			
30.	Protection Rating		IP-65	
31.	DC Protection			
32.	AC Protection			
33.	Lightning surge Protection			
34.	Relative Humidity	%	0 - 100	
35.	MPPT Voltage Range	V DC Minimum to Maximum		
36.	Maximum Input Voltage (DC)	V		
37.	Minimum Input Voltage / Start-up, I = input voltage (DC)	V		
38.	Maximum Continues Output Current	A		
39.	Rated Grid Voltage	V	230	
40.	Rated Grid Frequency	Hz	50	
41.	Maximum AC Output Apparent Power	W		
42.	Power Factor			
43.	Short Circuit Proof			
44.	Internal Consumption at Night			
45.	Ground Fault Monitoring			

2.13.3 Supporting Structures and Cabling

No	Item	Units	Required		Tendered	
			DC	AC	DC	AC
1.	Manufacturer's Name					
2.	Country of Manufacture					
3.	Place of Testing					
4.	Applicable Standard		IEE 17th Edition Wiring Regulations			
5.	Application Range					
6.	Design					
7.	Product Feature					
8.	Corrosion protection of Al railing and other components					
9.	Ability to withstand dead, live and wind loads					
10.	Solar PV System Cabling					
11.	DC cables					
12.	Minimum Bending Radius	mm				
13.	Nominal Voltage	V				
14.	Temperature Range	°C				
15.	Voltage Drop	%				
16.	Mounting Structure					
i.	Railing		GI Coated steel or Aluminium			
ii.	Nuts & Bolts, clips, etc		Stainless steel			
iii.	Other fixing components		Stainless steel			

2.13.4 Other Facilities

No	Item	Units	Required	Tendered
1.	After sales services	Years	Minimum 10/25	
2.	After sales staff capacity			
3.	Minimum duration to attend to a after sales issue	hours	48	
4.	Past local project experience			
5.	Company Existence in Sri Lanka	Years (Min)	3	
6.	Manufacture Authorization for Products. (Attach the Supplier Authorization certifications separately)		The supplier should be authorized as the direct local dealer and installer of the product	
7.	Number of local projects with capacities greater than 50 kW	Min	5	
8.	Number of local projects with capacities greater than 100 kW			
9.	Reference projects local (Attach separately)			
10.	Quality certificates (ISO, UL, etc)			
11.	Qualification and experience of local staff			
12.	System Installation Standards			

2.14 PORTABLE DIGITAL FAULT RECORDER

Note: The supplier shall specify the chapter, title, page and the paragraph in the product manual/documentation or literature which points to each terms or requirements of the specification given below. (The relevant paragraphs shall also be highlighted in the documentation of the manufacturer supplied with the offer)

No	Item	Units	Required	Tendered
	BASIC PRODUCT INFORMATION			
a	Manufacturer			
b	Manufacturer's Address			
c	Country of Origin			
d	Model / Type			
3.0	**TECHNICAL SPECIFICATIONS**			
3.1	**General Requirements**			
a	Provide spares for next 10 years	yes		
3.2	**Input Channels**			
a	Provide 10 current input channels with clipped on type current transformer for 0-150A range measurements, maintain overall accuracy of the current measuring system within ±1%	yes		
b	Provide 06 voltage input channels for 0-250V AC/DC measurements, maintain overall accuracy of the voltage measuring system within ±0.2%	yes		
c	Provide 16 Digital inputs which can be configured as potential free inputs or with potential inputs in the range of 48-250V DC.	yes		
3.3	**Data Acquisition**			
a	Two configurable sampling rates are available (one in the range of 10Hz – 500Hz and other in the range of 500Hz – 10 kHz)	yes		

No	Item	Units	Required	Tendered
b	Possibility of triggering by analog level sensors of either directly connected analog signals or by calculated analog signals	yes		
c	Availability of manual triggering	yes		
d	Triggering possibility with digital input edge detection	yes		
e	Configurability of CT ratios in the range of 1 to 5000, Configurability of VT ratios in the range of 1 to 4000	yes		
3.4	**Data Storage**			
a	Minimum RAM capacity of 512MB with provisions for future upgrading	yes		
b	Minimum Hard Disk capacity of 120 GB with provisions for future upgrading	yes		
3.5	**Communication Interfaces**			
a	Availability of a Serial Interface	yes		
b	Availability of an Ethernet Interface	yes		
3.6	**System Clock**			
a	Provide calendar clock with millisecond accuracy	yes		
b	Provide interface to connect a GPS clock signal (IRIG-B Port)	yes		
3.7	**Power Supply**			
a	Availability of a rated power supply in the range of 48-250V DC	yes		
3.8	**Self-diagnostic & Watchdog Features**			
a	Availability of self-diagnostic features & providing of suitable LED indications	yes		
b	Provide a complete self-diagnostic report through the user software	yes		
3.9	**Software Requirements**			
a	Provide engineering tools (software for configuration, parameterization & calibration,	yes		

No	Item	Units	Required	Tendered
	software for disturbance analysis) with required licensees & compatibility of the software with Microsoft Windows 10 64bit & 32bit versions, Microsoft Windows 8.1 64bit & 32bit versions, Microsoft Windows 07 64bit & 32bit versions & with Microsoft Windows XP 64bit & 32bit versions.			
3.10	**Deliverables**			
a	Number of hardware units	Maximum 02		
b	Provide box/boxes having lockable wheels for each hardware unit & its accessories	yes		
c	Provide power codes of minimum 2m length	yes		
d	Provide earthing cables (16 mm^2 or more in size) of minimum 2m length	yes		
e	Provide 10 clipped on type current transformers having voltage outputs	yes		
f	Provide 4 mm^2 & 10 m banana cables (20 for current inputs, 12 for voltage inputs, 32 for digital inputs)	yes		
g	Provide communication cables & accessories (2m serial cable, serial to USB converter, Ethernet cables of 2m & 20m in length)	yes		
h	Package DDR accessories in the box/boxes provided for main hardware units or provide separate compact sized box for accessories	yes		
i	Provide a 20m fiber optic cable with a rugged outer cover & suitable communication interfaces if two hardware units included in the DDR system	yes		
j	Provide connecting leads to connect banana cables to panel			

No	Item	Units	Required	Tendered
	terminal bars (12 for voltage inputs & 32 for digital inputs)			
3.11	**Applicable Standards & Environmental Conditions**			
a	Operation Temperature Storage Temperature	0 … 50°C 0 … 70°C		
b	Relative humidity - non condensing	5 … 95%		
c	Conforming to standards Electromagnetic Compatibility (EMC) directive 89/336/EEC Emission IEC 61326; IEC 61000-3-2 Immunity IEC 61326; IEC 61000-4-2/3/4/8 Safety IEC 61010-1 Vibration IEC 60068-2-6 (20 m/s^2 at 10 – 150 Hz) Shock IEC 60068-2-27 (15g/11ms half sine)	Yes Yes Yes Yes		
4.	**DOCUMENTATION**			
a	operating manuals shall be offered as both hard copies and soft copies in PDF format	Yes		
b	context sensitive online help shall be available	Yes		
5.	**CUSTOMER SUPPORT**			
a	Customer hotline on normal working days	Yes		
b	The Guaranteed response time shall not be greater than 1 working day	Yes		
c	Shall give the web site with all the contacts, user forums, etc.	Yes		
d	provision of future software updates for download on his web site for free	Yes		
6.	**REFERENCES, PROOF AND TEST CERTIFICATES**			
a	confirmed reference list with minimum 5 well-known (reputed) customers or large power utilities as users	Yes		

No	Item	Units	Required	Tendered
b	for each reference name / email / telephone of the contact person to contact	Yes		
c	calibration certificate from reputed third-party certification agency shall be provided with the multi-functional test system	Yes		
d	necessary proof to the satisfaction of CEB, manufacturer's experience in manufacturing portable DDR systems for at least ten (10) years & minimum of five (5) years of experience in manufacturing for contracts outside the country of the manufacturer	Yes Yes		
7.	**QUALITY**			
a	ISO 9001 certification for the manufacturer	Yes		
8.	**WARRANTY**			
a	comprehensive warranty covering entire instrument including accessories	3 year		

2 TECHNICAL PARTICULARS AND GURANTEES

B - CIVIL WORKS

2.15 AIR CONDITIONING & VENTILATING INSTALLATIONS

2.15.1 Air Conditioning Units

No	Item	Units	Required	Tendered
(a)	Split type Air Conditioning Unit			
	Manufacturer's name & address			
3.	Number of units			
	Country of origin			
	Type			
	Model No			
	Cooling duty (latent)	kW		
	Cooling duty (sensible)	kW		
	On – coil condition	DB/WB ^{0}C		
	Off – coil condition	DB/WB ^{0}C		
	Total electrical input	kW		
	Air volume	m^3/hr		
	Total electrical input	kW		
	Electrical supply	N/m^2		
	Pre-filter manufacturer and type			
	Pre-filter size and pressure drop (clean)			
	Thermal insulation for refrigerant pipe work (if applicable)			
(b)	Air Cooled Condensing Units			
	Number of Units			
	Manufacturer's name and address			
	Country of origin			
	Type			
	Model No.			
	Refrigeration effect	kW each		
	Compressor type			
	Compressor input	kW each		

No	Item	Units	Required	Tendered
	Suction temperature	^{0}C		
	Condenser ambient temperature	^{0}C		
	Fan motor(s)	Total kW		
	Capacity steps	%		
(c)	Self-contained Air Conditioning Units			
	Number of units			
	Manufacturer's name and address			
	Country of origin			
	Type			
	Model No.			
	Refrigeration effect	kW each		
	Compressor input	kW each		
	Fan Motor	kW each		

2.15.2 Ventilation Works

No	Item	Units	Required	Tendered
(d)	Ventilation Works			
	Manufacturer's name and address			
	Number of units			
	Air volume	M^3/hr		
	System resistance	N/m^2		
	Fan Motor size	KW		
	Corrosion protection			

2.16 FIRE SAFETY EQUIPMENT

No	Item	Units	Required	Tendered
(a)	Trolley Mounted Extinguishers CO_2 50kg			
	Manufactures name and address			
	Dimensions	mm		
	Total weight	kg		
	Length of hose	mm		
	Type of powder			
	Working Pressure	kg/cm^2		
	Test Pressure	kg/cm^2		
	Numbers to be provided at			
(b)	Wall Mounted Extinguishers CF 5.5 kg			
	Manufactures name and address			
	Dimensions	mm		
	Total weight	kg		
	Length of hose	mm		
	Type of powder			
	Working Pressure	kg/cm^2		
	Test Pressure	kg/cm^2		
	Number to be provided at			
(c)	Trolley Mounted Extinguishers BCF 50kg			
	Manufactures name and address			
	Dimensions	mm		
	Total weight	kg		
	Length of hose	mm		
	Type of powder			
	Working Pressure	kg/cm^2		
	Test Pressure	kg/cm^2		
	Numbers to be provided at			

2.17 EXTERNAL LIGHTING AND SMALL POWER SUPPLY SERVICES

No	Item	Units	Required	Tendered
(a)	Distribution Boards (fitted with fuses)			
	Manufacturer's name and address			
	Type and/or Figure No.			
	Rating	A		
	Fault rating	kA		
	Voltage	V		
(b)	Distribution Boards (fitted with Circuit breakers)			
	Manufacturer's name and address			
	Type and/or Figure No.			
	Rating	A		
	Fault rating	kA		
	Voltage	V		
(c)	PVC Cable			
	Manufacturer's name and address			
	Type			
	Voltage rating	V		
(d)	Conduit			
	Manufacturer's name and address			
	Type			
(e)	Conduit Accessories			
	Manufacturer's name and address			
	Type			
(f)	Cable Termination's			
	Manufacturer's name and address			
	Type			
	Material			
(g)	Switches			
	Manufacturer's name and address			

No	Item	Units	Required	Tendered
	Type			
	Rating	W		
(h)	Socket Outlets			
	Manufacturer's name and address			
	Type and/or Figure No.			
	Rating	W		
	Finish			
(i)	Contactors			
	Manufacturer's name and address			
	Type			
	Rating	W		
	Number of contacts			
	Rating of coil AC	VA		
(j)	Miniature Circuit Breakers			
	Manufacturer's name and address			
	Type			
	Rating	A		
	Fault rating	kA		
(k)	Earthing Material			
	Manufacturer's name and address			
	Material & size			
(l)	Clocks			
	Manufacturer's name and address			
	Type			
	Size			
	Type of operation			
(m)	Lighting fittings – Fluorescent			
	Manufacturer's name and address			
	Type			
	Rating			

No	Item	Units	Required	Tendered
	Harmonic content			
(n)	Lighting fittings - emergency			
	Manufacturer's name and address			
	Type			
	Rating	W		
(o)	Switch yard lighting			
	Manufacturer's name and address			
	Type			
	Rating	W		

3 TIMES FOR DELIVERY & COMPLETION AND CONTRACT COMPLETION TIMES

3.1 TIMES FOR DELIVERY AND COMPLETION

The individual dates are all contractually binding.

The times given include all necessary control, relay, metering, auxiliary power and ancillary equipment to enable the respective circuit or item of plant to be completely commissioned and put into commercial operation, together with such other associated equipment, e.g. busbar, etc. as well ensure that subsequent shut-downs are unnecessary or at least only of a temporary or short time nature.

The dates assume and order is placed by Week No. 1. Key to dates be provided as follows.

E - Target completion dates planned by CEB

D - Construction (delivery, erection and commissioning) date guaranteed by contractor.

C - Shipping completion dates guaranteed by contractor.

B - Date of arrival of first shipment guaranteed by contractor.

A - Earliest date by which access is required by the contractor.

Site	A Earliest Access Permitted Week No.	B Week No.	C Week No.	D Week No.	E Week No.
Mannar GSS Civil works 245kV Outdoor switchgear 220/33kV Transformer 36kV Indoor switchgear 36kV Outdoor switchgear SAS, Protection and Communication					

Site	A Earliest Access Permitted Week No.	B Week No.	C Week No.	D Week No.	E Week No.
Nadukuda GSS Civil works 245kV Outdoor switchgear 220/33kV Transformer 36kV Outdoor switchgear SAS, Protection and Communication					
Embilipitiya GSS Civil works 33kV Indoor switchgear 33kV Outdoor switchgear SAS, Protection and Communication					
Other GSS Electrical Works					

3.2 CONTRACT COMPLETION TIMES

The times entered below shall be those used to calculate the completion dates for the various sections of the Contract together with the overall Time for completion as referred to in Clauses and of the Conditions of Contract.

	Completion Time in Calendar months calculated from the date of Commencement
Completion Time for the Contract	- ……Months.
Completion Time for Works at Mannar	- ……Months
Completion Time for Works at Nadukuda	- ……Months
Completion Time for Works at Embilipitiya	- ……Months

4 DEPARTURES FROM SPECIFICATION

(To be completed by the Bidder).

Any details that will lead to deductions of final Bid price shall not be inserted.

The bidder shall list below all deviations of his bid to the commercial and technical bidding conditions / specifications of these bidding documents.

It shall not be necessary for the employer to examine the standard literature and documents of the manufacturer to determine the existence and extent of any exceptions or deviations from this specification.

No other deviation stated elsewhere in the bid would be considered as valid deviations during the contract period.

Volume	Clause No.	Proposed Deviations

5 MANUFACTURES' AND SUBCONTRACTORS' STATEMENT OF EXPERIENCE

5.1 TENDERER'S STATEMENT OF PREVIOUS EXPERIENCE

Tenderers are to complete this schedule giving details of substation contract of the same type of construction as this contract and which they have completed or which are in the course of completion by them. Failure to complete this schedule with full satisfactory details and documentary proof will render the offer liable to rejection.

Name of the Project					
Contract No.					
Country					
System Voltage kV					
Type of Construction					
Purchaser					
Consultant					
No. of Bays & Cap. of GSS MVA					
Contract Award Date					
Contractual Completion Date					
Actual Completion Date					
Contract Value					

5.2 KEY PERSONNEL

Designation	Name of (i) Nominee (ii) Alternate	Summary of Qualification Experience and Present Occupation	Year of Birth
<u>Headquarters</u> Project Director Project Manager Engineering Design Staff Other Key Staff (Give Designation) <u>Site Office</u> Project Manager Site Manager Deputy Site Manager Supervising Engineers Construction Supervisors Other Key Staff			

The Tenderer shall list in this Schedule the key personnel (including first nominee and the second choice alternate) he will employ from headquarters and from site office to direct and execute the works.

5.3 CONTRACTOR'S SITE PERSONNEL

Erection Staff

The contractor shall give below the status and numbers of staff required for erection of the plant and the estimated period for which they will be retained on site.

Supervisory and expatriate staff:	
(a) Bachelor status	
(b) Married status	

Position	Months
Headquarters Project Director Project Manager Other Key Staff (Give Designation) Project Office in Sri Lanka Project Manager Site Office Site Manager Deputy Site Manager Supervising Engineers Construction Supervisors Other Key Staff	

5.4 SUB-CONTRACTORS

Item	Element of work	Approximate value	Name and address of Sub	Statement of Similar Works

The tenderer shall enter in this schedule a list of the sections and appropriate value of the work for which the purposes to use sub-contractors, together with the names and addresses of the proposed sub-contractors. The tenderer shall also enter a statement of similar works

Previously executed by the proposed sub-contractors, including description, location and value of works, year completed, and name and addresses of the Employer Notwithstanding such information the tenderer, if awarded the contract, shall remain entirely and solely responsible for the satisfactory completion of the Works.

6 DOCUMENTS, DRAWINGS AND INFORMATION TO BE SUBMITTED WITH THE TECHNICAL BID

The following documents & drawings shall be submitted with the Technical BID.

6.1 Duly signed Part A – Scope of Works in Section VI – Employer's Requirement in Part 2 – Employer's Requirements in Volume 4 of 8.

6.2 Duly signed Part B – Technical Specification in Section VI – Employer's Requirement in Part 2 – Employer's Requirements in Volume 5 of 8.

6.3 Duly signed Part C – Drawings in Section VI – Employer's Requirement in Part 2 – Employer's Requirements in Volume 6 of 8.

6.4 Duly completed and signed Supplementary Information,

1. Manufacturers and place of manufacture and testing.
2. Technical particulars and guarantees.
3. Times for delivery and completion and contract completion.
4. Departures from the Specification.
5. Manufacturers' and subcontractors' statement of experience.
6. Documents, drawings and information to be submitted.
7. Confirmation of Adherence to the Environmental Acts, Regulation and/or Guidelines.

6.5 Duly signed Section VII - General Conditions in Part 3 – Conditions of Contract and Contract Forms in Volume 8 of 8.

6.6 Duly signed Section VIII - Particular Conditions in Part 3 – Conditions of Contract and Contract Forms in Volume 8 of 8.

6.7 Duly signed Section IX –Contract Forms in Part 3 – Conditions of Contract and Contract Forms in Volume 8 of 8.

6.8 All documents required to demonstrate bidder's ability and capability as specified in Section 3 – Evaluation and Qualification Criteria in Part I – Bidding Procedures in Volume I of 8.

This shall include but not limited to, verifiable evidence to prove that Bidder meets the qualification requirements in Item 2 of Section 3 – Evaluation and Qualification Criteria.

6.9 Verifiable evidence of manufacturers' experience in manufacturing comparable type of equipment offered under this bid to meet the criteria stated in Item 1.5 of Chapter 1 of Volume 5 of 8.

6.10 Verifiable evidence of service experience of equipment offered under this bid to meet the criteria stated in Item 1.5 of Chapter 1 of Volume 5 of 8.

6.11 Irrespective of the fact that the Bidder has a local agent or sub-agent, representative or nominee to act for or on behalf of the Bidder, the Bidder shall register himself with an appropriate authority (registrar) under Public Contract Act. No. 03 of 1987 and a copy of the certificate issued by the registrar shall be submitted along with the Bid. Registration Certificate shall be included in the bids without which they shall be rejected.

6.12 Certificates issued by an independent international organization to ensure compliance with the ISO 9001:2000 standards by the Bidder and Manufacturers of all main equipment listed below,

1. Circuit Breakers
2. Disconnectors
3. Surge Arrestors
4. Current Transformers
5. Voltage Transformers
6. Power Transformers
7. Earthing Transformers
8. Auxiliary Transformers
9. 36kV Indoor Switchgear
10. All control, protection and metering equipment
11. All HV cables and accessories
12. Communication equipment
13. All outdoor post insulators and bushings for current and voltage transformers
14. Energy meters.
15. Digital Disturbance Recorder
16. Power Quality Analyzer

6.13 Authorization letters shall be provided with the bid in respect of following items not manufactured by the bidder,

1. Circuit Breakers
2. Disconnectors
3. Surge Arrestors
4. Current Transformers
5. Voltage Transformers
6. Power Transformers
7. Auxiliary Transformers
8. Earthing Transformers

9. 36kV Indoor Switchgear
10. All control, protection and metering equipment
11. All HV cables and accessories
12. Communication equipment
13. All outdoor post insulators and bushings for current and voltage transformers
14. Energy meters.
15. Digital Disturbance Recorder
16. Power Quality Analyzer

6.14 The manufacturer's guarantee that they have an established department that will serve the Ceylon Electricity Board in supply of spares for at least 10 years for all equipment listed in 6.13 above.

6.15 The manufacturer's guarantee that they have an established department that will serve the Ceylon Electricity Board to provide advisory service with regard to maintenance and overhauling at least for 10 years for all equipment listed in 6.13 above.

6.16 Layout drawings of switchgear equipment at Switchyard.

6.17 General bar chart of the design, manufacturing, shipping, erection and commissioning schedule clearly showing the transmission line outage.

6.18 Type Test certificates in accordance with standards specified in relevant Chapters in Volume 5 of 8, issued by an independent laboratory or Type Tests witnessed by CEB for,

1. Circuit Breakers
2. Disconnectors
3. Earthing Switches
4. Surge Arrestors
5. Current Transformers
6. Voltage Transformers
7. Similar Power Transformers
8. Auxiliary Transformers
9. Earthing Transformers
10. 36kV Indoor Switchgear
11. All control, protection and metering equipment
12. All HV and MV cables and accessories
13. Communication equipment
14. Energy meters.
15. Digital Disturbance Recorder

16. Power Quality Analyzer

(note: It the offered equipment is manufacture under license, type test certificate for the equipment for the manufacture in the offered factory shall be submitted with the bid.)

6.19 Parent company guarantee in case of joint ventures and subsidiaries.

6.20 Descriptive information for equipment being offered including;

1. List of recommended spare parts with prices.
2. List of special tools or fixtures required for installation, testing, maintaining and operating the equipment.
3. List of cost of special tools, lifting devices required for installation, operation and maintenance.

6.21 Details/drawings of indoor 36kV switchgears.

6.22 Typical arrangement drawings of control, metering and relay panels similar to the panels offered.

6.23 Protection block diagrams and typical diagrams of unit protective equipment and bus bar zone protection similar to the system offered.

6.24 Typical diagrams of architecture of substation automation system and associated system similar to the architecture offered.

6.25 In case of alternative bids are submitted as per sub clause 13.3 of ITB,

1. Typical plan and section drawings.
2. Single line diagrams.
3. Typical arrangement diagram of control building.
4. General structural drawings of buildings.
5. Layout drawings of outdoor switchgear equipment at switchyards

6.26 Any other material required to be completed and submitted by bidders in accordance with the instruction to bidders.

7 ADHERENCE TO THE ENVIRONMENTAL ACTS, REGULATIONS AND / OR GUIDELINES

The Bidders shall submit with their Technical Bid, written confirmation certifying that they will comply with Environmental Safeguard Documents prepared under National Environmental Act (NEA) found under "Our performances" tab in http://www.ceb.lk/environment/.

Section 6 - Employer's Requirements

Part E - BANK GUARANTIES AND CERTIFICATES, VARIATIONS AND ADJUSTMENTS ORDERS

TABLE OF CONTENTS

8 CERTIFICATES

Form of Completion Certificate

Contract: [. . . . *insert name of contract and contract identification details.* . . . .]

Date: .....

Certificate No.: .....

To: [. . . . *insert name and address of contractor.* . . . .]

Dear Ladies and/or Gentlemen,

Pursuant to GCC Clause 24 (Completion of the Facilities) of the General Conditions of the Contract entered into between yourselves and the Employer dated [. . . . *insert date.* . . . .], relating to the [. . . *brief description of the Facilities* . . . .], we hereby notify you that the following part(s) of the Facilities was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Employer hereby takes over the said part(s) of the Facilities, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the Facilities or part thereof: [. . . *description* . . . .]

2. Date of Completion: [. . . *date* . . . .]

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

[. . . *Signature* . . . .]

Project Manager

Form of Operational Acceptance Certificate

Contract: [. . . . *insert name of contract and contract identification details*. . . . .]

Date: .....

Certificate No.: .....

To: [. . . . *insert name and address of contractor*. . . . .]

Pursuant to GCC Subclause 25.3 (Operational Acceptance) of the General Conditions of the Contract entered into between yourselves and the Employer dated [. . . *date*. . .], relating to the [. . . *brief description of the facilities*. . . .], we hereby notify you that the Functional Guarantees of the following part(s) of the Facilities were satisfactorily attained on the date specified below.

1. Description of the Facilities or part thereof: [. . . *description* . . .]

2. Date of Operational Acceptance: [. . . *date* . . .]

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

[. . . . *Signature* . . . . .]

Project Manager

9 CHANGE ORDERS

9.1 Change Order Procedure
9.1.1 General
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9.1.3 References for Changes

9.2 Change Order Forms
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9.2.7 Application for Change Proposal

9.1 CHANGE ORDER PROCEDURE

9.1.1 General

This section provides samples of procedures and forms for implementing changes in the Facilities during the performance of the Contract in accordance with GCC Clause 39 (Change in the Facilities) of the General Conditions.

9.1.2 Change Order Log

The Contractor shall keep an up-to-date Change Order Log to show the current status of Requests for Change and Changes authorized or pending. Entries of the Changes in the Change Order Log shall be made to ensure that the log is up-to-date. The Contractor shall attach a copy of the current Change Order Log in the monthly progress report to be submitted to the Employer.

9.1.3 References for Changes

(1) Request for Change as referred to in GCC Clause 39 shall be serially numbered CR-X-nnn.

(2) Estimate for Change Proposal as referred to in GCC Clause 39 shall be serially numbered CN-X-nnn.

(3) Acceptance of Estimate as referred to in GCC Clause 39 shall be serially numbered CA-X-nnn.

(4) Change Proposal as referred to in GCC Clause 39 shall be serially numbered CP-X-nnn.

(5) Change Order as referred to in GCC Clause 39 shall be serially numbered CO-X-nnn.

Note:

(a) Requests for Change issued from the Employer's Home Office and the Site representatives of the Employer shall have the following respective references:

Home Office	CR-H-nnn
Site	CR-S-nnn

(b) The above number "nnn" is the same for Request for Change, Estimate for Change Proposal, Acceptance of Estimate, Change Proposal and Change Order.

9.2 CHANGE ORDER FORMS

9.2.1 Request for Change Proposal Form

[*Employer's letterhead*]

To: [*Contractor's name and address*] Date:

Attention: [*Name and title*]

Contract Name: [*Contract name*]
Contract Number: [*Contract number*]

Dear Ladies and/or Gentlemen:

With reference to the captioned Contract, you are requested to prepare and submit a Change Proposal for the Change noted below in accordance with the following instructions within [*number*] days of the date of this letter [or on or before (*date*)].

1. Title of Change: [*Title*]
2. Change Request No./Rev.: [*Number*]
3. Originator of Change:
   Employer: [Name]
   Contractor (by Application for Change Proposal No. [Number Refer to Annex 6.2.7])
4. Brief Description of Change: [*Description*]
5. Facilities and/or Item No. of equipment related to the requested Change: [*Description*]
6. Reference drawings and/or technical documents for the request of Change:
   Drawing No./Document No. *Description*
7. Detailed conditions or special requirements on the requested Change: [*Description*]
8. General Terms and Conditions:
   (a) Please submit your estimate showing what effect the requested Change will have on the Contract Price.
   (b) Your estimate shall include your claim for the additional time, if any, for completing the requested Change.
   (c) If you have any opinion that is critical to the adoption of the requested Change in connection with the conformability to the other provisions of the Contract or the safety of the Plant or Facilities, please inform us in your proposal of revised provisions.
   (d) Any increase or decrease in the work of the Contractor relating to the services of its personnel shall be calculated.
   (e) You shall not proceed with the execution of the work for the requested Change until we have accepted and confirmed the amount and nature in writing.

[*Employer's name*]
[*Signature*]
[*Name of signatory*]
[*Title of signatory*]

9.2.2 Estimate for Change Proposal Form

[*Contractor's letterhead*]

To: [*Employer's name and address*] Date:

Attention: [*Name and title*]

Contract Name: [*Contract name*]
Contract Number: [*Contract number*]

Dear Ladies and/or Gentlemen:

With reference to your Request for Change Proposal, we are pleased to notify you of the approximate cost to prepare the below-referenced Change Proposal in accordance with GCC Subclause 39.2.1 of the General Conditions. We acknowledge that your agreement to the cost of preparing the Change Proposal, in accordance with GCC Subclause 39.2.2, is required before estimating the cost for change work.

1. Title of Change: [*Title*]
2. Change Request No./Rev.: [*Number*]
3. Brief Description of Change: [*Description*]
4. Scheduled Impact of Change: [*Description*]
5. Cost for Preparation of Change Proposal: [*insert costs, which shall be in the currencies of the contract*]

(a)	Engineering		(Amount)
	(i)	Engineer _____ hours (hrs) x _____ rate/hr =	_____
	(ii)	Draftsperson _____ hrs x _____ rate/hr =	_____
		Sub-total _____ hrs	_____
		Total Engineering Cost	_____
(b)		Other Cost	_____
		Total Cost (a) + (b)	_____

[*Contractor's name*]
[*Signature*]
[*Name of signatory*]
[*Title of signatory*]

9.2.3 Acceptance of Estimate Form

[*Employer's letterhead*]

To: [*Contractor's name and address*] Date:

Attention: *[Name and title]*

Contract Name: *[Contract name]*
Contract Number: *[Contract number]*

Dear Ladies and/or Gentlemen:

We hereby accept your Estimate for Change Proposal and agree that you should proceed with the preparation of the Change Proposal.

1. Title of Change: [*Title*]
2. Change Request No./Rev.: [*Request number/revision*]
3. Estimate for Change Proposal No./Rev.: [*Proposal number/revision*]
4. Acceptance of Estimate No./Rev.: [*Estimate number/revision*]
5. Brief Description of Change: [*Description*]
6. Other Terms and Conditions: In the event that we decide not to order the Change accepted, you shall be entitled to compensation for the cost of preparing the Change Proposal described in your Estimate for Change Proposal mentioned in para. 3 above in accordance with GCC Clause 39 of the General Conditions.

[*Employer's name*]
[*Signature*]
[*Name of signatory*]
[*Title of signatory*]

9.2.4 Change Proposal Form

[*Contractor's letterhead*]

To: [*Employer's name and address*] Date:

Attention: [*Name and title*]

Contract Name: [*Contract name*]
Contract Number: [*Contract number*]

Dear Ladies and/or Gentlemen:

In response to your Request for Change Proposal No. [Number], we hereby submit our proposal as follows:

1. Title of Change: [*Name*]
2. Change Proposal No./Rev.: [*Proposal number / revision*]
3. Originator of Change: Employer: [*Name*] / Contractor: [*Name*]
4. Brief Description of Change: [*Description*]
5. Reasons for Change: [*Reason*]
6. Facilities and/or Item No. of Equipment related to the requested Change: [*Facilities*]
7. Reference drawings and/or technical documents for the requested Change:
   [*Drawing/Document No./Description*]
8. Estimate of increase/decrease to the Contract Price resulting from the Change Proposal:

		Amount [*insert amounts in the currencies of the Contract*]
(a)	Direct material	_____
(b)	Major construction equipment	_____
(c)	Direct field labor (Total hrs)	_____
(d)	Subcontracts	_____
(e)	Indirect material and labor	_____
(f)	Site supervision	_____
(g)	Head office technical staff salaries	
	Process engineer _____ hrs @ _____ rate/hr	_____
	Project engineer _____ hrs @ _____ rate/hr	_____
	Equipment engineer_____ hrs @ _____ rate/hr	_____
	Procurement _____ hrs @ _____ rate/hr	_____
	Draftsperson _____ hrs @ _____ rate/hr	_____
	Total _____hrs	

(h) Extraordinary costs (computer, travel, etc.) _____

(i) Fee for general administration, % of Items _____

(j) Taxes and customs duties _____

Total lump sum cost of Change Proposal [*Sum of items (a) to (j)*]

Cost to prepare Estimate for Change Proposal [*Amount payable if Change is not accepted*]

9. Additional time for Completion required due to Change Proposal
10. Effect on the Functional Guarantees
11. Effect on the other terms and conditions of the Contract
12. Validity of this Proposal: within [Number] days after receipt of this Proposal by the Employer
13. Other terms and conditions of this Change Proposal:

    (a) You are requested to notify us of your acceptance, comments or rejection of this detailed Change Proposal within [Number] days from your receipt of this Proposal.

    (b) The amount of any increase and/or decrease shall be taken into account in the adjustment of the Contract Price.

    (c) Contractor's cost for preparation of this Change Proposal: [*. . . .insert amount. This cost shall be reimbursed by the employer in case of employer's withdrawal or rejection of this Change Proposal without default of the contractor in accordance with GCC Clause 39 of the General Conditions . . . .*]

[*Contractor's name*]
[*Signature*]
[*Name of signatory*]
[*Title of signatory*]

9.2.5 Change Order Form

[*Employer's letterhead*]

To: [*Contractor's name and address*] Date:

Attention: [*Name and title*]

Contract Name: [*Contract name*]
Contract Number: [*Contract number*]

Dear Ladies and/or Gentlemen:

We approve the Change Order for the work specified in the Change Proposal (No. [*number*]), and agree to adjust the Contract Price, Time for Completion, and/or other conditions of the Contract in accordance with GCC Clause 39 of the General Conditions.

1. Title of Change: [*Name*]
2. Change Request No./Rev.: [*Request number / revision*]
3. Change Order No./Rev.: [*Order number / revision*]
4. Originator of Change: Employer: [*Name*] / Contractor: [*Name*]
5. Authorized Price:
   Ref. No.: [*Number*] Date: [*Date*]
   Foreign currency portion [*Amount*] plus Local currency portion [*Amount*]
6. Adjustment of Time for Completion
   None Increase [*Number*] days Decrease [*Number*] days
7. Other effects, if any

Authorized by: _____ Date: _____
Employer

Accepted by: _____ Date: _____

9.2.6 Pending Agreement Change Order Form

[*Employer's letterhead*]

To: *[Contractor's name and address]* Date:

Attention: *[Name and title]*

Contract Name: *[Contract name]*
Contract Number: *[Contract number]*

Dear Ladies and/or Gentlemen:

We instruct you to carry out the work in the Change Order detailed below in accordance with GCC Clause 39 of the General Conditions.

1. Title of Change: [*Name*]
2. Employer's Request for Change Proposal No./Rev.: [*number/revision*] dated: [*date*]
3. Contractor's Change Proposal No./Rev.: [*number / revision*] dated: [*date*]
4. Brief Description of Change: [*Description*]
5. Facilities and/or Item No. of equipment related to the requested Change: [*Facilities*]
6. Reference Drawings and/or technical documents for the requested Change:
   [*Drawing / Document No. / Description*]
7. Adjustment of Time for Completion:
8. Other change in the Contract terms:
9. Other terms and conditions:

[*Employer's name*]
[*Signature*]
[*Name of signatory*]
[*Title of signatory*]

9.2.7 Application for Change Proposal Form

[*Contractor's letterhead*]

To: [*Employer's name and address*] Date:

Attention: [*Name and title*]

Contract Name: [*Contract name*]
Contract Number: [*Contract number*]

Dear Ladies and/or Gentlemen:

We hereby propose that the work mentioned below be treated as a Change in the Facilities.

1. Title of Change: [*Name*]
2. Application for Change Proposal No./Rev.: [*Number / revision*] dated: [*Date*]
3. Brief Description of Change: [*Description*]
4. Reasons for Change:
5. Order of Magnitude Estimation (amount in the currencies of the Contract): [*Amount*]
6. Scheduled Impact of Change:
7. Effect on Functional Guarantees, if any:
8. Appendix:

[*Contractor's name*]
[*Signature*]
[*Name of signatory*]
[*Title of signatory*]

10 PERSONNEL REQUIREMENTS

Using Form PER - 1 and PER - 2 in Section 4 (Bidding Forms), the Bidder must demonstrate that it has personnel who meet the following requirements:

No.	Position	Number of Persons	Total Work Experience [years]	Experience In Similar Work [years]
1	Project Manager	1	10	5
2	Design Engineers	2	10	5
3	Site Engineers	3	5	5
4	Construction Supervisors	3	5	5
5	Safety Officers	2	5	5

Project manager shall be dedicated for this project and shall be available for full time of the project period in Sri Lanka.
The Bidder shall provide details of the proposed personnel and their experience records in the relevant Information Forms included in Section 4 (Bidding Forms).

11 EQUIPMENT REQUIREMENTS

Using Form EQU in Section 4 (Bidding Forms), the Bidder must demonstrate that it has the key equipment listed below:

No.	Equipment Type and Characteristics	Minimum Number Required
1	**Equipment for civil construction**	
	Piling machine	3
	Excavators/ Loader	3
	Concrete Mixer	4
	Dump Truck	5
	Poker Vibrator	4
	Plate Compactor	3
	Roller Compactor	2
	De Watering Pump	4
	Theodolite/Surveying equipment	3
2	**Equipment for electrical construction**	
	Truck mounted crane	3
	Cable Drum Jack	4
	Cable Pulling Rollers	10
	Crimping Tools	3
3	**Equipment for testing and commissioning**	
	Contact Resistance Tester	6
	Insulation Tester (1kV)	3
	High Voltage Installation Tester	3
	Earth Resistance Tester	2
	Current Transformer Test	2
	Circuit Breaker Analyzer	2
	Primary Injection Set (Digital)	2
	Secondary Injection Set-1 Phase (Digital)	2
	Secondary Injection Set-3 Phase (Digital)	2
	SF6 Dew Point Tester	2
	SF6 Percentage Measuring Meter.	2
	High Voltage Test Unit for GIS panel commissioning	2