SECTION V

4.3 GUARANTEED TECHNICAL PARTICULARS

FOR

MAJOR MATERIALS AND EQUIPMENT

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4.3 GUARANTEED TECHNICAL PARTICULARS FOR MATERIALS AND EQUIPMENT

4.3.1 **Preamble**

4.3.2 The Guaranteed Technical Particulars Schedules MUST be filled in, signed and stamped by manufacturer for each LOT and submitted with the bidding document. Type test reports and Certificate of Accreditation from testing body/Laboratory MUST be provided for evaluation. Also, all relevant manufacturer's equipment technical documents MUST be provided for reference to support the guaranteed values.

4.3.3 Bidder shall offer only one type of equipment/material for each of the equipment/material required and from ***one manufacturer only.*** No more than one equipment/material of each type required shall be offered from more than one manufacturer. Where the bidder offers more than one equipment/material of one type from different manufacturers contrary to this clause, the employer shall choose ***only one of the equipment for evaluation***. All other equipment shall not be considered.

4.3.4 Only guaranteed technical particulars provided herein shall be filled **(*Do not fill guaranteed technical particulars in the attachments of KPLC technical specifications).***

4.3.5 All data entered in the Guaranteed Technical Particulars are guaranteed values by the manufacturer and shall not be departed from whatsoever.

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SCHEDULE 1: GUARANTEES TECHNICAL PARTICULARS FOR LINE TOWERS AND FOUNDATIONS

Item	Particulars	Unit	Guaranteed Values					
			Types of Monopole towers					
			S	L	M	H	HS	T
1	Country of origin and name of manufacturer							
2	Type of towers (Mult circuit self-supporting, tubular monopole)	State						
3	2 Nos. Lattice self-supporting steel tower (Optional)	State						
4	Design Service conditions (Temperature and Altitude)	State						
5	Type test report and Accreditation certificates	Provide						
6	Manufacturing experience (Mini.10 years)	State						
	Service outside country of manufacturer (Mini.7 years)	State						
7	Reference design standards	State						
8	Tower steel material shall be high tensile steel (Grade S355J2G3 and S420)	State						
9	Basic design span (200-300 m)	m						
10	Factor of Safety for Normal and Broken conductor	State						
11	Design spans for towers (Basic/Wind/Weight and Upright)	Provide						
12	Minimum design loads for towers (Wind, Max. conductor tension and horizontal)							
13	Minimum Pole sections (bottom, Middle and taper) diameter and wall thickness	State						
14	Quality assurance Plan	Provide						
15	Towers Overall height (standard tower height)	m						
16	Tower body extensions (+0m)	m						
17	Step Bolts and Ladder	State						
18	Tower corrosion protection							
a	Hot-dip galvanization zinc coating thickness	µm						
b	Epoxy paint coating thickness for base plate and bottom member	State						
19	Tower identification and marking	State						
20	Base plate minimum thickness and diameter	mm/m						
21	Tower earthing and lightning protection	State						
22	Cross-Arm material and type of design	State						

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Item	Particulars		Unit	Guaranteed Values					
				Types of Monopole towers					
				S	L	M	H	HS	T
23	Design of conductor cross-Arm spacing as per AB CHANCE Live line maintenance		m						
24	Type and minimum length of cross-Arm		m						
25	Vertical clearance between OPGW top Phase conductor		m						
	Width of Tower body at: Top Cross-Arm Middle level Bottom level (+0m)		 m m m						
	Weight of Towers: +0m body extension +3m body extension +6m body extension		 kg kg kg						
26	Earthing/grounding of Towers	Max. Earth resistance	Ω						
27	Tower member steel minimum thickness		6 mm						
28	Members Slenderness Ratio	Compression -250 Tension - 350	ratio						
29	Tower Accessories (Step-bolts, Ladder, Number and danger plates, anti-climb device								
30	Type of foundation reinforcement steel bars		State						
31	Minimum tower foundation diameter		State						
32	Minimum foundation Design Depth: +0m body extension +3m body extension +6m body extension	2400	 mm mm mm						
33	Width of Base Pad +0m body extension +3m body extension +6m body extension	Design 2800	 mm mm mm						
	Minimum thickness of Base Pad +0m body extension +3m body extension	500	 mm mm mm						

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Item	Particulars		Unit	Guaranteed Values					
				Types of Monopole towers					
				S	L	M	H	HS	T
	+6m body extension								
	Minimum width of Column (where applicable) +0m body extension +3m body extension +6m body extension	1200	mm mm mm						
34	Bitumastic Paint	Pad & Column	State						
35	Soil geotechnical investigation levels Resistivity Ground water Minimum Backfilling	S/L 1-3 and M/HS/T:1-4 Every tower spot S-5%, H/T-All 300 mm layers	State Ω State State						
36	Concrete Trial mix Cement strength Structural strength Precast strength	Before works 42.5 25 30	State N/mm^2 N/mm^2 N/mm^2						
37	Stub provisions	Earthing point/Cleats	State						
38	Stub Length: +0m body extension +3m body extension +6m body extension Stub Size & Thickness	3000 S-40, H-50	mm mm mm mm						
39	Anchor bolts/Stub setting out	Setting template	State						
40	Tower Test as per IEC 60652 and 60826	S+6 - 1 H+6 – 1	State						
41	Foundation Test as per IEC 61936-1, BS EN 50341, 1997, BS 1377 and 224tt	S+6 - 1 H+6 – 1	State						

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SCHEDULE 2: GUARANTEED TECHNICAL PARTICULAR - PHASE CONDUCTOR

GURANTEES FOR PHASE CONDUCTOR			Guaranteed Value	Ref. Doc
Item	**Particulars**	**Unit**	**223 mm^2 ACCC**	
1	**Phase Stranded conductor**			
	Manufacturer and Country of manufacture	State		
	Type of Conductor/Code Name	State		
	Year of service outside country of manufacture (5 years Mini)	Years		
	Manufacturing experience (7 years minimum)	Years		
	Operating design Service condition	state		
	Reference IEC/BS Standards	state		
	Type test reports and Accreditation certificate	state		
2	**Conductor Size and Characteristics**			
	Conductor construction design	state		
	Aluminium wire	Nos/mm		
	Steel wire	Nos/mm		
	Overall conductor diameter	mm		
	Nominal cross-sectional area of conductor	mm^2		
	Minimum current rating at Ambient temperature	A		
	Cross-section of Aluminium area	mm^2		
	Cross-section of Steel area	mm^2		
	Weight per km	kg		
	Rated tensile strength	KN		
	Maximum DC resistance at 20 ^oC	Ω/m		
	Maximum AC resistance at 75 ^oC	Ω/m		
	Resistivity at 20 ^oC	mm^2/m		
	Continuous max. operating temperature	^oC		
	Modulus of Elasticity	kg/mm^2		
	Conductor lay	state		
	Minimum weight of grease	Kg/km		
	Length of conductor per drum	m		
	Approximate net weight per drum	kg		
3	**ACCC Conductor Core**			
	Nominal cross-sectional area	mm^2		
	Core diameter	mm		
	Rated strength	(KN)		
	Core tests during of FAT	State		
	Weight of core	Kg/km		
4	**Individual wires before stranding**			
	Tolerance of diameter of Aluminium wire	%		
	Tolerance of diameter of Steel wire	%		
	Minimum tensile strength of Al. wire	kg/mm^2		
	Minimum tensile strength of Steel wire	kg/mm^2		
	Conductivity of AL	%		
	Minimum twisting number of steel wire: -100 x diameter (length)	Nos.		
	Galvanization: - Min. coating weight of Zinc	grams/m^2		

SCHEDULE 3: GUARANTEED TECHNICAL PARTICULARS FOR 132 KV CIRCUIT BREAKERS

132 KV OUTDOOR CIRCUIT BREAKER				
Item	**Particulars**	**Unit**	**Guaranteed Value**	**Ref. doc.**
1	Circuit Breakers type (Model)	State		
2	Manufacturer and Country	State		
3	Reference IEC/BS Standards	State		
4	Operating service conditions (Temperature and Altitude)	State		
5	Year of service outside the country of origin (Min. 5yrs)	Years		
6	Manufacturing experience (Min. 10 year)	Years		
7	Type test reports and accreditation certificate of testing laboratory	provide		
8	Arc quenching Medium	State		
9	Pole design operation (ganged)	State		
10	Tank design type (Dead type)	State		
11	Rated voltage	kV		
12	Nominal rated Voltage	kV		
13	Rated frequency	Hz		
14	Rated continuous current at 50°C	A		
15	Lightning Impulse withstand voltage 1.2/50µs	kVpeak		
16	One minute power frequency withstand voltage, dry and wet	kVrms		
17	Rated short-time (short circuit) current/3sec.	kArms		
18	Rated short circuit making current	kA		
19	Maximum contact resistance of Main Contact	Ohms		
20	Rated operation Sequence	state		
21	Current Breaking capacity	kA peak		
22	Bushing type	state		
23	First pole to clear factor	state		
24	Minimum creepage distance of insulator	mm		
25	Minimum clearance between phases	mm		
26	Minimum clearance to earth	mm		
27	Opening time	state		
28	Closing time	state		
29	Type of operating mechanism for circuit Breaker	state		
30	Rated control voltage for Tripping/Closing coil	Vdc		
31	Spring charging motor/Control voltage	Vdc		
32	Main contact material	state		
33	Charging spring status indication	state		

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34	Terminal connector material (Tinned Bi-metallic)	state		
35	Number of Auxiliary contacts (NO and NC)	state		
36	Number operations permissible before maintenance	state		
37	**SF_6 gas Pressure**	state		
a	Normal gas density for SF6 (gas pressure)	state		
b	-at 20°C	Bar		
c	-at 40°C	Bar		
d	Minimum gas density for safe operation	Bar		
38	Manual ON and OFF operation Switch	state		
39	Anti-pumping device	state		
40	Castle Keys for Interlock	state		
41	Auxiliary supply (Single phase-240 Vac/50hz)	Vac		
42	Circuit Breaker Position Indication	state		
43	Anti-pumping control	state		
44	Heaters and Hygrometer	state		
45	Mechanical emergency Trip device	state		
46	Rated Minimum number of operations within lifespan	state		
47	Control cubicle IP Class	state		
48	Control cubicle powder coating colour shade	state		

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SCHEDULE 4: GUARANTEED TECHNICAL PARTICULAR FOR 132 KV ISOLATORS WITH AND WITHOUT EARTH SWITCHE

Item	Particulars	Unit	Guarant. Value	Refer. Doc
GUARANTEED SCHEDULES FOR ISOLATORS WITH &W/O EARTHSWITCH			**132 KV**	
1	Disconnector type/Model	State		
2	Manufacturer and country	State		
3	Disconnector design type (Double side break and opening horizontally)	State		
4	Operating service conditions (Altitude and temperature)	State		
5	Reference Standards	State		
6	Type test reports and Accreditation certificate	State		
7	Manufacturing experience (10 years minimum)	Years		
8	Years of service outside country of manufacture (5 years minimum)	Years		
9	Rated Voltage	kV		
10	Nominal voltage	KV		
11	Lightening Impulse withstands voltage 1.2/50ms			
	Contacts Closed	kV peak		
	Contacts Open	kV peak		
12	Rated Power frequency withstands Voltage (Wet and dry)			
	Contacts Closed	kVrms		
	Contacts Open	kVrms		
13	Rated frequency	50 Hz		
14	Rated Continuous operating current	Amps		
15	Rated short circuit withstand current for 3 seconds	KA/3Sec		
16	Minimum creepage distance of Insulators	mm		
17	Mechanical endurance (Min. Open–Close)	Cycle		
18	Maximum open and Closing time	Seconds		
19	Drive mechanism Motor protection	State		
20	Contact resistance of Main contacts	micro-Ω		
21	Main contact material	(Tinned Copper)		
22	Thickness of Silver/Tin coating	microns		
23	Isolator Mechanical handle	State		
24	Electrical and mechanical operations before maintenance	State		
25	Motor Control Voltage	Vdc		
26	Auxiliary supply (Single phase)	Vac		
27	Integral earths Switch where required	State		

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Item	Particulars	Unit	Guarant. Value	Refer. doc.
	GUARANTEED SCHEDULES FOR ISOLATORS		**66KV**	
28	Earth switch Mechanical and electrical operation before maintenance	State		
29	Earth Switch mechanical handle	provide		
30	Isolator and Earth switch mechanical interlock (Available /Not available)	State		
	Isolator and Earth switch Electrical interlocks (Available/not Provided)	State		
31	Minimum no. of spare Auxiliary NO and NC contacts	Nos		
32	Control Box IP degree of protection	State		
33	Padlocking facility required	State		
34	Thickness of zinc galvanization of ferrous parts	State		
35	Earthing points	State		
36	Insulator material (Brown glazed porcelain)	State		

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SCHEDULE 5: GUARANTEED TECHNICAL PARTICULAR – OUTDOOR 132KV CURRENT TRANSFORMERS

Item	Particulars	Unit	Guarant. Value	Refer doc
1	Current transformer type (Oil-hermetically sealed)	State		
2	Manufacturer and Country	State		
	Manufacturing experience (10 years minimum)	Years		
3	Service operating conditions (Altitude/Temperature)	State		
4	Years of service outside country of manufacture (5 years min.)	Years		
5	Type test reports and Accreditation certificate	State		
6	Reference IEC/BS standards	State		
7	Rated Highest voltage	kV		
8	Nominal Voltage	kV		
9	Current transformer tank design type (Dead tank)	State		
10	Rated frequency	Hz		
11	One-minute Power frequency withstands Voltage			
a	Primary winding	kVrms		
b	Secondary winding Insulation level	kVrms		
12	Lightning impulse withstands voltage 1.2/50µms	kVpeak		
13	Primary Rated currents ratios	A		
14	Rated secondary current	A		
15	CTs Core, Class and Burden	Core 1 Core 2 Core 3 Core 4		
16	Short circuit withstand current for 3seconds	kA peak		
17	Safety factor	State		
	Instrument Security factor	State		
18	Maximum Temperature rise (Winding/Oil)	State		
19	Number of cores	No		
20	Primary and Secondary winding material	State		
21	Primary terminal material	State		
22	Bushing type	State		
23	Minimum creepage distance of insulator	mm		
24	Secondary and Primary Earthing points	State		
25	IP Class of terminal box	State		
26	Marking/Labelling	State		

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SCHEDULE 6: GUARANTEED TECHNICAL PARTICULARS - OUTDOOR VOLTAGE TRANSFORMERS

GURANTEES FOR 132 KV VOLTAGE TRANSFORMER				
Item	**Particulars**	**Unit**	**Guarant Values**	**Refer. doc.**
1	Voltage transformer type	State		
2	Manufacturer and Country	State		
	Manufacturing experience (10 years minimum)	Years		
3	Years of service outside country of manufacture (5 years Min.)	Years		
	Service operating conditions (Altitude and temperature)	State		
4	Type test reports and Accreditation certificate	State		
5	Reference IEC/BS standards	State		
6	Rated Highest voltage	kV		
7	Nominal Voltage	kV		
8	Voltage transformer tank design type	State		
9	Rated frequency	Hz		
10	One-minute Power frequency Voltage withstand			
a	Primary winding	kVrms		
b	Secondary winding Insulation level (minimum 2.5kV)	kVrms		
11	Lightning impulse withstand voltage 1.2/50µs	kVpeak		
12	Short circuit withstand current for 3 Seconds	kApeak		
13	Burden and Accuracy class	State		
14	Number of cores	State		
15	Protection winding Class, Burden at 0.8Pf lagging	State		
16	Measuring winding Class and Burden at 0.8Pf lagging	State		
17	Voltage Ratio (Primary/Secondary)	State		
18	Maximum Temperature rise (Winding/Oil)	State		
19	Rated Voltage safety factor	State		
20	Instrument Security factor	State		
21	Permissible partial discharge (PD): PD test Voltage (r.m.s) = Um/√3 PD test Voltage (r.m.s) = 1.2Um√3	State		
22	Primary and secondary winding material	State		
23	Primary terminal	State		
24	Bushing type (Brown glazed porcelain)	State		
25	Minimum creepage distance	mm		
26	Secondary and Primary Earthing Point	State		
27	IP Class of terminal box	State		
28	Markings/Labelling	State		

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SCHEDULE 7: GUARANTEED TECHNICAL PARTICULARS FOR COMPOSITE INSULATORS (TENSION AND SUSPENSION TYPE)

Item	Particulars	Unit	Guaranteed Value		Refer Doc.
			Suspension type	Tension type	
			132 KV	132 KV	
1.	Insulator type (Polymeric)	State			
2.	Design type/Model	State			
3.	Manufacturer and Country	State			
4.	Reference IEC/BS Standards	State			
5.	Service operating condition	State			
6.	Manufacturing experience (10 yrs min.)	Years			
7.	Year of service outside country of manufacture (5 yr min)	Year			
8.	Type test reports and Accreditation certificate	Provide			
8.	Rated highest Voltage (kV)	kV			
9.	Nominal Voltage	kV			
10.	Failing tensile load/strength	KN			
	Cantilever failing load	KN			
11.	Pollution Category	State			
12.	Dielectric material	State			
13.	One-minute power frequency withstand voltage, 50 Hz, wet and dry	kV_{rms}			
14.	Lighting impulse withstand voltage, 1.2/50µs	kV_{peak}			
15.	Minimum creepage distance	mm			
16.	Insulator Housing characteristics				
	One-minute power frequency withstand voltage, 50Hz, wet and dry	kV_{rms}			
	Lighting impulse withstand voltage, 1.2/50µs	kV_{peak}			
17.	Short circuit withstand current for 3sec	kA			
18.	Housing shield resistance	kΩ			
19.	Permissible head load (Static)	N			
	Permissible head load (dynamic)	N			
21.	Insulator of fittings	Provide			
22.	Material of housing and sheds (HTV silicon)	State			
23.	Minimum distance between sheds	State			
24.	Zinc coating thickness of ferrous parts	State			
25.	Colour of final insulator housing	State			
26.	Minimum sheath thickness of Silicon	State			

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SCHEDULE 8: GUARANTEED TECHNICAL PARTICULARS FOR 132 KV POST INSULATORS (VERTICAL AND HORIZONTAL TYPE)

Item	Particulars	Unit	Guaranteed Value		Refer Doc.
			Horizontal	Vertical	
			132 KV	132 KV	
1.	Insulator type (Porcelain)	State			
2.	Design type	State			
3.	Manufacturer and Country	State			
4.	Reference IEC/BS Standards	State			
5.	Service operating conditions (Altitude and temperature)	State			
6.	Manufacturing experience (10 years min)	Years			
7.	Year of service outside the country of manufacture (5 years min.)	Year			
8.	Type test reports and Accreditation certificate	Provide			
9.	Rated highest Voltage (kV)	kV			
10.	Nominal Voltage	kV			
11.	Maximum Mechanical failing Load	KN			
12.	Pollution Category	State			
13.	Dielectric material (Silicon rubber)	State			
14.	One-minute power frequency withstand voltage wet and dry	kV_{rms}			
15.	Lighting impulse withstand voltage, 1.2/50µs	kV_{peak}			
16.	Minimum creepage distance	mm			
17.	Nominal total height	mm			
18.	Short circuit withstand current/3sec	kA			
19.	Housing shield resistance	kΩ			
20.	Shed spacing –projection ratio	state			
	Minimum distance between sheds	mm			
21.	Creepage clearance ratio	State			
22.	Cantilever failing load	kN			
23.	Maximum Puncture rated voltage	kV			
24.	Insulator of fittings	Provide			
25.	Minimum sheath thickness	mm			
26.	Material of housing and sheds (Porcelain)	State			
27.	Minimum distance between sheds	State			
28.	Zinc coating thickness on ferrous parts	State			
29.	Colour of final insulator housing	State			

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SCHEDULE 9: GUARANTEED TECHNICAL PARTICULARS FOR SURGE ARRESTORS

132 KV SURGE ARRESTORS				
Item	**Particulars**	**Unit**	**Guaranteed Values**	**Refer. doc**
1	Surge arrestor type (Metal Oxide (MOV) Gapless	State		
2	Manufacturer and country of origin	State		
3	Service operating conditions (Altitude and temperature)	State		
4	Reference IEC/BS Standards	State		
5	Type test reports and Accreditation certificate	Provide		
	Manufacturers experience (10 years minimum)	Years		
6	Minimum years of service outside country of manufacture (5 years)	Years		
7	Surge arrestor housing (Polymeric)			
8	Highest system Voltage (Um, KV)	kV		
9	Rated frequency	Hz		
10	Rated Voltage (Ur, KV)	kV		
11	Max, continuous Operating Voltage	kVrms		
12	Nominal discharge current	kA		
13	Nominal discharge current	kA		
14	Short circuit withstands current Asymmetrical peak	kA		
15	Maximum duration of Earth fault as per IEC 60099-4	Sec		
16	Long duration discharge class	A/µS		
17	Partial discharge	pC		
18	Energy discharge capability at Ur	KJ/KV		
19	Temporary Over voltage with stand for 1Sec.	kV rms		
20	Temporary Overvoltage withstand for 10 Sec.	kV rms		
22	Distribution and Discharge class	kA/Class		
23	Earth fault factor as IEC 60099-4	State		
24	Maximum response time/operation time	Micro-sec		
25	System Lightning Impulse withstand voltage 1.2/50µs	kV peak		
26	One minute power frequency withstands Voltage, dry and wet	kV rms		
27	Short circuit current withstands	kA/3Sec.		
28	Housing shield resistance	kΩ		
29	Creepage distance	mm		
30	Maximum residual Voltage at steep lightning and switching impulse currents at;			
a	10kA (1/2µS)	State		
	40kA (80/20µS)	State		
b	500kA (30/70µS)	State		
	2kA (30/70µS)	State		
	Max. Lightning Impulse Protection Level	kVpeak		
31	Steep current impulse protection level	kVpeak		
32	Operation counter and Leakage current meter/Indicator	State		
33	Number of units per complete insulator	No		

SCHEDULE 10: GUARANTEED TECHNICAL PARTICULARS - PROTECTION IEDS (RELAYS)

SCHEDULE 10A: GUARANTEES FOR DISTANCE PROTECTION RELAY				
Item	**Particulars**	**Units**	**Guarat Value**	**Refer. Doc**
1.	Manufacturer's Name and Country	State		
	Type or designation name of Relay	State		
	Minimum of 10 years Manufacturing experience	state		
	Minimum of 5 years in service outside country of manufacture	state		
	Type test report and Accreditation certificate	Provide		
	Manufacturing reference standards	State		
	Ratings: Ac Inputs: 1-5Amp	State		
	Power Supply Voltage: 110VDC or (Universal 24-240Vdc).	State		
	Evidence of sales in 3 other continents outside the continent of manufacture (state Countries)	State		
	Applicable protocol: IEC 61850-8-1and Goose messaging	State		
	Model design type (numerical)	state		
	Supported communication protocols 60870- 5-103, 61850-9-2	State		
	Mounting design (Flush)	State		
	suitable for use on a feeder in a 1&1/2 Breaker substation arrangement. (suitable/not suitable)	state		
2.	High speed output relays for circuit breaker opening (state no. of output relay).	State		
	Full Scheme Distance relay (scheme type)	state		
	Number of similar Relay sold to date to the export market: requirement; minimum number 1000	State		
	Minimum operating voltage and current for impedance measurement/directional sensitivity	State		
	Operating time for fast operating output relays	State		
	Operating time for other output trip relays	State		
3.	Tripping logic			
4.	Number of Zones of protection (state 1 or 2 or 3 or 4)	State		
5.	Zone Impedance Comparator Characteristics (state: mho, Quadrilatel.)	State		
6.	Impedance setting range for each Zone (state for Z1,Z2,Z3 and Z4)	State		
7.	Communication Aided Schemes for Distance Protection	state		
8.	Communication Aided schemes for Directional Earth Fault (DEF) Protection	state		
	Pick up setting range for the DEF element (state in amps)	state		
	Load Encroachment Discrimination feature(available/not available)	state		
9.	Fuse Failure Supervision (available/ not available)	state		
10.	Weak end in feed & Echo feature (available/not available)	state		
11.	Current reversal guard Feature(available/not available)	state		
12.	Power Swing Tripping & Blocking function(available/not available)	state		
13.	Voltage Memory Function (available/not available)	state		
14.	SOTF Function (available)	state		
	Settings range for the SOTF Function (time delay)	State		

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15.	Back-up Overcurrent and Earth fault protection function	State		
	(available/not available)			
16.	Under-Frequency and rate of frequency change Protection function	State		
17.	Settings range for the Backup Overcurrent and Earth Fault Protection	state		
18.	Circuit Breaker contact wear feature(available/unavailable)	state		
19.	Broken Conductor detection(available/unavailable)	state		
20.	Auto-reclose Function that is able to operate as per the specifications	State		
21.	Accuracy for Distance to Fault Location (in %)	State		
	Automatic display of fault details on the Relay- List the fault data displayed	State		
22.	Storage capacity for disturbance records, trip/fault records and events records (No. of events and No of records)	indicate		
23.	Fault Locator with automatic Distance to Fault indication on the LCD screen in km. (available/unavailable)	state		
24.	Relay configuration & parameter settings, Event & Fault records and LED status are retained upon loss of relay DC Power supply	State		
25.	Metering provided	State		
26.	Number of Binary Inputs	State		
27.	Number of Binary outputs	state		
28.	Ratings for output relay contacts (current and voltage)	State		
29.	Number of LEDs	indicate		
30.	Communication protocols	state		
31.	Communication ports provided	State		
32.	Type and size of connection terminals for cable termination at the back of relay (type and diameter size)	state		
33.	Relay to Laptop connection cables offered (number and type).	state		
34.	Software for relay configuration and parameter setting and fault data Analysis offered with the relay in CD form.	indicate		

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SCHEDULE 10B: GUARANTEES FOR RESTRICTED EARTH FAULT RELAY				
Item	**Particulars**	**Units**	**Guarat. Value**	**Refer. doc**
1.	Manufacturer and country of origin name	State		
2.	Model and designation name of relay	indicate		
3.	Ratings: Ac Inputs: 1-5Amp	State		
4.	Power Supply Voltage: 110VDC or (Universal24-240VDC).	State		
5.	Design type: Numerical conforming to protocol IEC 61850-8-1and Goose messaging	State		
6.	Number of similar Relay sold to date to the export market: Requirement; 1000	State		
7.	Relay must have been sold to other two continents outside continent of manufacture (give names of the continents)	state		
8.	Experience in manufacture of Restricted Earth Fault Relay (number of years of manufacture)	Years		
9.	Minimum of 10 years Manufacturing experience	state		
10.	Minimum of 5 years in service outside country of manufacture	state		
11.	Complete order number for offered Relay	State		
12.	Applicable for High Impedance operating principle	indicate		
13.	Minimum pick up & setting range	State range		
14.	Relay Operating time at 5 x setting current (time in seconds)	indicate time		
15.	Number of LEDs	State		
16.	Number of Binary inputs	State		
17.	Number of Binary outputs	State		
18.	Ratings of output relay contacts (current and voltage)	State		
19.	Keypad for relay parameter settings and data access (available/unavailable)	State		
20.	Relay self-diagnostic with watchdog contact, relay healthy LED (green) and red LED for relay failure (available/unavailable)	State		
21.	Software for relay configuration and parameter setting. Software to be offered in CD form(yes/no)	Indicate		
22.	Connection cable from Laptop to Relay to be offered(yes/no)	Indicate		
23.	**Stabilizing Resistor**			
24.	Type and reference number of Stabilizing Resistor offered.	State		
25.	Setting Range of Offered resistor in Ohms (range in ohms).	State		
26.	Maximum through fault for the REF scheme calculation (in kA).	State		
27.	**Voltage Dependent Resistor (Metrosil)**			
28.	Type and reference number of Voltage Dependent Resistor (VDR) Metrosil offered. Rated voltage of VDR based on maximum fault current of 25kA.	State		
29.	Both Stabilising Resistor and Voltage dependent resistor are housed in a single box with external connection terminals suitable panel mounting.	State		
30.	Software for relay configuration and parameter setting	State		
31.	Communication cable from Laptop to relay offered	State		

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SCHEDULE 10C: GUARANTEES FOR 3-PHASE UNIDIRECTIONAL OVERCURRENT & E/ FAULT RELAY				
Item	**Particulars**	**Units**	**Guarat. Value**	**Refer. Doc**
1.	Manufacturer and Country	State		
2.	Type or Model of the relay	type		
3.	Complete order number for offered Relay	State		
4.	Ratings: Ac Inputs: 1-5Amp	State		
5.	Power Supply Voltage: 110VDC or (Universal 24-240VDC).	State		
6.	Design type: Numerical conforming to protocol: IEC 61850-8-1and Goose messaging	State		
7.	Number of similar Relay sold to date to the export market: (Required minimum number is 1000)	Number		
8.	Experience in manufacture of Three Phase Overcurrent and Earth Fault relay (10 years minimum)	state		
9.	Years of Service outside country of Origin (Minimum 5 years)	state		
10.	Design (Numerical type)	State		
11.	Mounting design (Flush)	State		
12.	Protection Functions offered and parameters setting range for all protection elements	indicate		
13.	Time-current characteristics available for various Overcurrent, Earth fault elements and other protection elements	State		
14.	Broken Conductor Function (available/unavailable)	State		
15.	Under frequency Protection(available/unavailable)	state		
16.	Circuit Breaker contact wear feature(available/unavailable)	State		
17.	Number of LEDs provided	state		
18.	Number of Binary Inputs	state		
19.	Number of Binary outputs	state		
20.	Ratings of output relays contacts (current, voltage)	state		
21.	Communication ports (type and number)	state		
22.	Communication protocols	state		
23.	Circuit Breaker maintenance(available/unavailable)	state		
24.	Relay self-diagnostic with watchdog contact, relay healthy LED (green) and red LED for relay failure (available/not available)	indicate		
25.	Configuration of Start and trip contacts (possible/not possible)	State		
26.	Storage capacity for disturbance, event and trip/fault records	State		
27.	Metering/Measurement capability (P,Q,I,V,CosØ)	Indicate		
28.	Size of LCD screen	State		
29.	Relay Keypad for relay parameter setting and data access	state		
30.	Software for relay configuration and parameter setting.	State		
31.	Connection cable from Laptop to Relay offered	state		
32.	Type and size of relay terminals for cable connection			

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SCHEDULE 10D: GUARANTEES FOR SENSITIVE EARTH FAULT RELAY				
Item	**Particulars**	**Units**	**Guarat. Value**	**Refer. Doc**
1.	Manufacturer and Country	State		
2.	Type or designation name of relay	Type		
3.	Ratings: Ac Inputs: 1-5Amp	State		
4.	Power Supply Voltage: 110VDC or (Universal 30-300VDC).	State		
5.	Experience in manufacture of SEF Relay (10 years minimum)	state		
6.	Design type: Numerical conforming to protocol: IEC 61850-8-1	State		
7.	Years of Service outside country of origin (5 years Minimum)	state		
8.	Complete order number for offered Relay	State		
9.	Number of similar Relay sold to date to the export market: (Required minimum number is 1000)	Number		
10.	Current setting range for earth fault relay - 0.005In-0.8In	State		
11.	Definite time delay characteristic; Setting range, 0- 30 Seconds.	State		
12.	Circuit Breaker Maintenance function	State		
13.	Fault records, Event Records and disturbance records.	State		
14.	Drop off /pickup ratio >90%	State		
15.	Low transient overreach < 10%	State		
	Auto reclose function			
i.	Autoreclose function shall be enabled in the distance relay or in the overcurrent and earth fault rely	State		
ii.	Selectable 1 - 3 Autoreclose shots	State		
iii.	Independent set dead time for each shot	State		
iv.	Independent set dead time for each shot	State		
v.	Autoreclose inhibit after manual close	State		
vi.	Autoreclose inhibit for Overcurrent high set-element	State		
16	Connection cable from Laptop to Relay offered	state		
17	Software for relay configuration and parameter setting.	State		

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SCHEDULE 10E: GUARANTEES FOR FEEDER PROTECTION AND BAY CONTROL IED				
Item	**Particulars**	**Employer's requirement**	**Guara Value**	**Refer. Doc**
1.	Manufacture and country	State		
2.	Applicable protocol IEC 61850-8-1and Goose messaging	State		
3.	Model of the IED	State		
4.	Manufacturing reference standards	State		
5.	Ratings: Ac Inputs: 1-5Amp	State		
6.	Power Supply Voltage: 110VDC or (Universal 24-240VDC).	State		
7.	Number of similar Relay sold to date to the export market: Required minimum1000 pcs	State		
8.	Experience of 10 years in manufacture of BCU/BCPU	state		
	Years of Service outside country of Origin (5 years minimum)	state		
9.	Numerical design (numeric)	State		
10.	Protection functions and features in the IED i. Three phase overcurrent ii. Earth fault iii. Sensitive Earth Fault iv. Broken Conductor detection v. 3phase Autoreclose function vi. Under and Over Frequency Protection	State		
11.	Earth Fault and Sensitive Earth Fault Protection in separate element	State		
12.	Earth Fault and Sensitive earth fault elements shall have separate CT Inputs.	State		
13.	Two stages of High Set Element for both overcurrent and earth fault protection function-setting range of 1-20In (minimum) and a definite time delay setting of 0-60 seconds (minimum).	State		
	Current setting range for overcurrent 0.5In-2.0In (minimum)	State		
14.	Current setting range for earth fault 0.05In-0.8In (minimum)	State		
15.	Auto reclose function: i. Three phases auto reclose ii. Selectable 1-3 autoreclose shots iii. Independently set dead time for each shot iv. Autoreclose inhibit after manual close v. Autoreclose inhibition for over current high set element	State		
16.	Minimum of eight (8) each LEDs for alarms and trip annunciation.	State		
17.	Binary inputs and Outputs- minimum twelve (12 each)			
18.	Mounting design (Flush)	State		
19.	Number of CT inputs	State		
20.	Number of VT inputs	State		
21.	Protection and control Functions: Parameter setting range for each function including time-current characteristics O/C, E/F, SEF, etc.	State		

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SCHEDULE 10F: GUARANTEES FOR BUS BAR PROTECTION IED				
Item	**Particulars**	**Employer's requirement**	**Guara. Value**	**Refer. Doc**
1.	Manufacturer and Country	State		
2.	Model of offered relay	State		
	Manufacturing reference standards	State		
3.	Ratings: Ac Inputs: 1-5Amp	State		
4.	Power Supply Voltage: 110VDC or (Universal 24-240VDC).	State		
5.	Design type: Numerical conforming to protocol: IEC 61850-8-1and Goose messaging	State		
6.	Protection principle (low impedance on numeric principle)	State		
7.	Minimum of 10 years' experience in manufacture of Bus bar protection Relay	state		
8.	Minimum of 5 years in service outside country of Origin	state		
9.	Bus bar protection- centralized and phase segregated	State		
10.	Dynamic bus replica feature for each zone of protection	State		
11.	Mounting design (Flush)	State		
12.	Reference standards	state		
13.	Number of similar Relay sold to date to the export market: - (Required minimum number is1000)	State		
14.	Evidence of sales in two other continents outside the continent of manufacture (state countries)	State		
15.	Minimum operating time	Indicate		
16.	Check criteria for trip (check relay, zone relay)	Indicate		
17.	Detection of CT saturation within a few milliseconds into an external fault	State		
18.	Integral CT correction ratio feature and setting range	required		
19.	CTs trouble monitoring for each protected zone	required		
20.	Display of differential and Line current on LCD screen	required		
21.	Storage capacity for disturbance, Event and Fault records and Oscillographs (Input analogue to cover 20nos. bays)	indicate for each		
	Relay trip Indication by Red LED	required		
22.	No of Binary Inputs	State		
23.	No. of Binary Outputs	State		
	Ratings of relay output contacts (current and voltage)	State		
24.	Number of LEDs	State		
25.	Ability to latch output contacts	required		
26.	Relay self-diagnostic with watchdog contact, relay healthy LED (green) and red LED for relay failure (available/Unavailable)	required		
27.	LCD screen and Keypad for programming relay parameter settings and data access (available/unavailable)	required		
28.	Communication protocols (IEC 61850-8-1)	State		

29.	Communication ports provided	State		
30.	Overcurrent back up and end-fault protection (available/Not available)	State		
31.	Type and size of terminals for cable connection	State		
32.	Software offered for relay configuration and programming	Indicate		
33.	Laptop to relay connection cable (offered /not offered)	Indicate		
34.	Metering capability (U,I,P,Q,S,F,F& Cos Ø)	Indicate		
35.	Connection cable from Laptop to Relay offered	State		
36.	Software for relay configuration and parameter setting.	State		

Item	SCHEDULE 10G: GUARANTEED TECHNICAL PARTICULARS FOR LINE DIFFERENTIAL RELAY			
	Particulars	**Employers' requirement**	**Guar. Value**	**Refer. Doc**
1.	Country of manufacture/origin			
2.	Manufacturer's Name	State		
3.	Type or Designation name of Relay	State		
4.	Test reports and accreditation certificate of testing laboratory	provide		
5.	mounting design (Flush)	state		
6.	Design (Numerical, modular, others)	State		
7.	Number of similar Relay sold to date to the export market: Requirement; 1000	State		
8.	Experience in manufacture of Line Current Differential relay (minimum 13years)	state		
9.	Minimum of 7 years of relay service outside country of manufacture	state		
10.	Minimum operating voltage and current for impedance measurement/directional sensitivity	State		
11.	Minimum operating current /relay sensitivity	State		
12.	Minimum operating time	State		
13.	Simultaneous Tripping at both ends of the line even with no in feed at one end.			
14.	Phase segregated measurement of current magnitude and phase angle (phase segregation available/unavailable)	State		
15.	High Speed relay operation suitable for protection of Transmission Line (high speed relay available, time of tripping)	state		
16.	Transformer Inrush restraint and ratio and phase angle compensation (available/unavailable)	State		
17.	Direct Transfer of Trip Function between the relays via fibre optical cable (available/unavailable)	State		
18.	Operates with directly connected fibre cables (direct connection/via multiplexer)	state		
19.	Differential Protection blocks upon loss of communication to prevent mal-operation (blocks/does not block)	State		
20.	Auto-reclose Function: Available modes of Auto-reclose (SPAR+DAR)	State		
21.	Integrated Distance Protection (available/unavailable)	State		
22.	Number of Zones for integrated distance Protection	State		
23.	Zone Impedance Comparator Characteristics (mho, quadrilateral, both)	state		
24.	Impedance Settings range for each Zone	State		
25.	Automatic Display on the LCD screen of Distance to Fault in km (available/unavailable)	State		
26.	Back up Overcurrent and Earth Fault Protection (available/unavailable)	State		
27.	Settings range for Back up Overcurrent and Earth fault Protection Elements (current range)	state		
28.	Storage capacity for **disturbance records**, **trip records** and **events record**	capacity for each		
29.	Metering capability (U,I,P,Q,S,F,F&CosØ)	State		
30.	Number of Binary Inputs	State		
31.	Number of Binary outputs	state		
32.	Ratings for relay output contacts (current, voltage)	state		

33.	Ratings for relay input contacts	State		
34.	Number of LEDs	State		
35.	Relay self-diagnostic with watchdog contact, relay healthy LED (green) and red LED for relay failure(available/unavailable)	State		
36.	Communication protocols	State		
37.	Communication ports provided	state		
38.	Type and size of connection terminals for cable termination	state		
39.	Relay to Laptop connection cables offered	State		
40.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	Indicate		

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SCHEDULE 11: GUARANTEED TECHNICAL PARTICULARS FOR OPGW CABLE

GUARANTEES FOR OPGW AND FO UNDERGROUND CABLE					
Item	**Particulars**	**Unit**	**KPLC requirement**	**Guart. Value**	**Refer. Doc**
1	Manufacturer and Country		State		
2	Minimum experience in manufacture of OPGW	Years	10		
3	Minimum years of service outside country of Origin	Years	7		
4	Number of fibers	OPGW	≥48		
	Single mode fiber type		G655		
5	Core diameter	µm	8.3/9 with 3% tolerance		
6	Fiber Cores per loose tube		12		
7	Fiber Color Coding –12 number		TIA-598 - C		
8	Clad diameter	µm	125.0 + 2		
9	Core-clad concentricity		< 2%		
10	Coating diameter	µm	250.0 + 15		
11	Coating concentricity	>	0.70		
12	Attenuation: 1310 nm 1550 nm	dB/km	< 0.40 < 0.25		
13	Bending attenuation: 1310nm 1550nm	dB/km	≤ 0.40 < 0.25		
14	Temperature dependence	dB/km	≤0.05 (-20°C to +85°C)		
15	Cut-off wavelength	nm	< 1250		
16	Chromatic dispersion:				
17	Zero dispersion at	nm	1310 ± 12 1550 + 15		
18	Zero dispersion slope (max.)	ps/nm^2 (km)	0.092 0.085		
19	Mode field diameter				
	1300 nm 1550 nm	m m	9.30 ± 0.50 10.50 ± 1.00		
20	IL-proof test level	g/m2	35 x 106		
21	Splice attenuation	dB/ splice	0.02		
22	Connector loss	dB/connector	< 0.5		
	Approach Underground Cable				
23	Manufacturer's Name and country	-	State		
24	Type	-	Armoured		
25	Number of fibers	-	>48		
26	Fibers per tube	NO	12		
27	Long term Loading tensile	IEC 60794-1-2-E1A	1200N		
28	Short term Loading tensile	IEC 60794-1-2-E1B	2700N		
29	Crush Performance, Long term	IEC 60794-1-2-E3	800N/10cm		

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GUARANTEES FOR OPGW AND FO APPROACH CABLE					
Item	**Particulars**	**Unit**	**Employer's requirement**	**Guarat Value**	**Refer. Doc/.**
30	Crush Performance, Short term	IEC 60794-1-2-E3	3000N/10cm		
31	Minimal installation Bending radius	IEC 60794-1-2-E11	15 x OD		
	ODF				
32	Manufacturer's Name and country	-	State		
33	Type/model	-	State		
34	Number of fiber interconnections	-	≥48		
35	Connector loss	DB/connector	< 0.5		
36	Screw on type connectors	-	yes		
37	Wall mounted cabinet	-	yes		
38	Fiber Optic Cable routine tests as per IEC 60794-1-2E/F	No	State all tests		

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SCHEDULE 12: GUARANTEED PARTICULARS FOR MEASURING INSTRUMENTS

GUARANTEES FOR MEASURING INSTRUMENTS				
Item	**Particulars**	**Unit**	**Guart. Value**	**Refer. doc**
1	**Indicating Instruments**			
	AC and DC Ampere meter, and Voltmeter, Wattmeter, VAr - meter, Frequency-meter and other indicating instruments:	State		
i	Physical dimension Instrument for: (A, V (AC), V (DC), W, etc.)	(mm)		
ii	-Reference standard	list		
iii	- Error	%		
iv	- Max. admissible current	$\%.I_N$		
v	- Max. admissible voltage	$\%.I_N$		
2	**Energy meters (to be filled for each meter)**			
i	Meter for (MWh, MVArh) Physical dimension	mm		
ii	-Error with 5% load	%		
iii	-Error with 10% load	%		
iv	-Error with 20% load	%		
v	-Error with 100% load	%		
vi	-Max. admissible current	$\%.I_N$		
3	**Metering Converters (Transducers)**			
i	- Converter for (MW, MVAr, A, etc):			
ii	- Error	%		
iii	- Linearity	%		
iv	- Max. admissible current for 0.5 seconds	$\%.I_N$		
v	- Max. admissible current continuously	$\%.I_N$		
vi	- Max. admissible voltage for 0.5 seconds	$\%.I_N$		
vii	- Max. admissible voltage continuously	$\%.I_N$		
4	**Alarm/Trip Annunciators**			
i	- Reference standard	State		
ii	- Digital type	State		
	(i) Digital and Analogue inputs/output	State		
iii	- Number of windows per annunciators (minimum 8)	No		
iv	- Physical size of each annunciator (area of the cap)	mm		
	i) Reset and mute button	State		

***Note*: To be filled in for each Measuring Instrument**

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SCHEDULE 13: GUARANTEED TECHNICAL PARTICULRAS FOR LV CABLES

GUARANTEES FOR CONTROL AND SIGNAL CABLE					
Item	**Particulars**	**Unit**	**Employer's requirement**	**Guant. value**	**Refer. Doc**
1	**Low Voltage Cables (Auxiliary Supply)**				
i	- Conductor material		Copper		
	Design type		Concentric and stranded		
ii	- Current carrying capacity at $75^{O}C$	A	State		
	(iv) Rated Voltage	kV	state		
	(v) 1min. power withstfrequency voltage	KVrms	state		
iii	(vi) Short circuit current withstands for 3secs	KA	State		
iv	- Insulation material		PVC		
v	- Steel wire Armoure and screen		Required		
vi	- Protective coating		Required		
vii	- minimum nominal diameter		$25mm^2$		
viii	- Weight of heaviest reel, including cable - Number of cores	Kg No	Kg four		
2	**Control, Protection and Measuring Cables**				
i	- Conductor material		Copper		
	ii) Design type		Concentric and stranded		
ii	- Insulation material		PVC		
	- Current carrying capacity at $75^{O}C$	A	State		
	(viii) Rated Voltage	kV	1		
	(ix) 1min. power frequency voltage withstand	KVrms	3		
iii	- Steel wire Armouring and screen		required		
iv	Protective coating		required		
v	- Nominal diameter per core		$2.5mm^2$		
vi	- Overall diameter of cable and number of core	mm/No	state		
vii	- Weight of heaviest reel, including cable	kg	state		
viii	- Size of biggest reel, diameter/width	mm/mm	state		
3	**Telecommunication and Relay/Control Panel internal wiring cables**				
i	- Conductor material		Copper		

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ii	Design type (Concentric and stranded)		State		
iii	- Rated voltage	V	600		
iv	- Insulation material		PVC		
v	-1min. power frequency voltage withstand	KVrms	state		
vi	- Flexible stranded single core		state		
vii	- Nominal diameter per core (minimum)		$1.5mm^2$		
viii	- Overall diameter of cable and number of cores	Mm/No	State		
ix	- Weight of heaviest reel, including cable	Kg	State		
x	- Size of biggest reel, diameter/width	mm	State		
4	**Special Cables (where applicable)**				
i	-Special signal and data applicable		state		
ii	-Conductor material		state		
iii	-Insulation material		state		
iv	-Mode of protection		state		
v	-Diameter per core		state		
vi	-Overall diameter of cable reel		state		

SCHEDULE 14: GUARANTEED TECHNICAL PARTICULRAS FOR EARTH CONDUCTOR

GUARANTEES FOR EARTHING CONDUCTOR					
Item	**Particulars**	**Unit**	**KPLC requirement**	**Guar. Value**	**Ref. Doc**
1	Maximum Earth ground resistance desired values				
2	Under the Control building	Ohms	State		
	Under the Switchyard (HV Earthing system)	Ohms	State		
	LV Earthing system	Ohms	State		
3	Material for Main Grid and Risers earthing conductor		Copper		
4	Resistance of Main earth grid conductor at $20^{O}C$	Ω/km	State		
5	Minimum nominal cross section area of main grid and risers	mm^2	95		
6	Max. temperature of earth conductor during 3 Sec. rated phase - ground fault	$O^{0}C$	State		
7	Rated Phase to ground fault current of main grid conductor at rated maximum temperature	kA	State		
8	Material for Earth rods		Copper		
9	Maximum resistance of each Earth rod	Ohms	State		
10	Length and diameter of earth rods	m/mm	State		
11	Method of interconnecting earth grid conductors		State		

SCHEDULE 15: GUARANTEED TECHNICAL PARTICULRAS FOR RTU EQUIPMENT

GUARANTEES REMOTE TERMINAL UNITS (RTUS) FOR SCADA INTERFACE				
NO.	**Particulars**	**Employers' requirements**	**Guarat. Value**	**Refr. Doc**
1.	Manufacturers Name and address	State		
2.	Country of Manufacture	State		
3.	Model or Type of RTU	State		
4.	Equipment applicable standards	State		
5.	Minimum RTU Manufacturing experience (10 years)	State		
6.	Minimum years of service outside country of Manufacture (5years)	State		
7.	Service working conditions	Specify		
8.	Safety and environmental compliance	State		
9.	Free standing Panel dimension	Specify		
10.	Relays shall be encapsulated type	Specify		
11.	Accommodate signal from both Analogue and Digital transducers	Specify		
12.	Tele information plan requirement interfacing	required		
13.	single command outputs, double command outputs	Specify		
14.	regulation command outputs e.g. raise/lower command outputs for transformer tap changer control	Specify		
15.	analogue set point transmission and output	Specify		
16.	single, double and multiple state digital inputs	Specify		
17.	analogue measured inputs	Specify		
18.	metering pulse inputs for acquisition of energy meter values	Specify		
19.	Sequential Event recording (SER) with time stamping of events at the RTU	Specify		
20.	RTU time synchronization	Specify		
21.	Self-testing and diagnostic functions for detection and reporting of any error	Specify		
22.	Automatic re-starting function corresponding control centre with downloading function.	Specify		
23.	Support encryption and LAN/WAN Access	Specify		
24.	Shall support IEC 61850 protocol for process communication	Specify		
25.	RTU to be fully equipped for 8 substation bays plus spare capacity of 25% for each type of data	Specify		
	RTU shall be expandable in the field by at least 50% of the size of the initial point capacity by addition of Input and Output cards only	Specify		
	Addition of enclosures, internal cabling/wiring, chassis, or power supplies shall not be necessary when adding these I/O cards.	Specify		
26.	RTU shall be accessible through the communication network for the Supervisory Control & Data Acquisition (SCADA) System at the National Control Centre (NCC) and Regional Control Centres (RCC) to scan.	Specify		
27.	Plug-in type relays shall be used with sockets directly mounted on a DIN rail.	Specify		
	RTU firmware requirements			
28.	RTU firmware characteristics	Specify		
29.	Use of standard firmware	Specify		
30.	It shall not be necessary to perform modification to firmware, logic, or data for expansion within the sizing parameters defined for the RTU	Specify		

GUARANTEES REMOTE TERMINAL UNITS (RTUS) FOR SCADA INTERFACE				
NO.	**Particulars**	**Employers' requirements**	**Guarat. Value**	**Refr. Doc**
31.	all firmware delivered must be up to date and in final form, including all standard firmware changes	Specify		
32.	Firmware shall be loadable by service notebook locally at minimum, download of firmware and parameter sets trough SCADA system, using the data communication links.	Specify		
33.	Changing of EPROMs or similar devices shall not be necessary when updating RTUs firmware	Specify		
34.	230V AC power outlets	Provide		
35.	DC Power supply			
36.	Any hardware required to convert the 48 V battery voltage to the required internal voltages for the RTU hardware shall be provided and adequate	Specify		
37.	The RTUs shall be capable of operating with ungrounded or grounded (either polarity) input power.	Specify		
38.	Dielectric strength/Impulse voltage test (≥2.5kV, 1 minute)	Specify		
	Interposing Relays	Specify		
39.	Tele commands	Specify		
40.	Coil voltage shall be 48 VDC; Coil voltage variation shall be ±20%.	Specify		
41.	Signal voltage on the contact circuit shall normally be 110 VDC	Specify		
42.	The rated contact current shall be minimum 5ADC making/breaking.	Specify		
43.	Telecommunication indications	specify		
44.	Coil voltage shall be 110 VDC; Coil voltage variation shall be ±20%.	Specify		
45.	Signal voltage on the contact circuit shall normally be 48VDC	Specify		
46.	The rated contact current shall be minimum 3ADC making/breaking.	Specify		
47.	2NO and 2NC contacts for interposing relay	Specify		
48.	Relays shall be fitted with a visual operation indicator (either mechanical or LED)	Specify		
	Transducers			
49.	Electrical parameters – Current, voltage, active power, reactive power, apparent power, frequency and power factor transducers	requires		
50.	Four programmable analogue outputs, two digital outputs and RS-485 Modbus functionality for transducers.	Specify		
51.	programmed via easy-to-use software compliant with IEC 60688	Specify		
52.	Relays Characteristics of the digital programmable transducers	Specify		
53.	Measurement Accuracy Class (0.2 and 0.5)	specify		
54.	Current circuit (In)	1-5 A		
55.	Transducer supply- 40-120 VDC /110Vac	Specify		
56.	Communication Ports	Required		
	Serial USB port-USB Mini-B connector Modbus RTU 38400 baud (auto)	Specify		
	Serial RS485 port- Three screw terminals for ≤ 6 mm2 Modbus RTU 1200 – 38400 baud	Specify		
57.	Digital outputs (No)	2		
58.	Analogue outputs (No)	4		
59.	MFM devices	Required		

SCHEDULE 16: GUARANTEED TECHNICAL PARTICULARS FOR 132 KV POWER CABLE

132 KV SINGLE CORE 800 mm^2 ALUMINUM XLPE CABLE					
Item	**Particulars**		**Unit**	**Guaranteed Value**	**Refer. doc**
1.	Manufacturer and country of origin				
2.	Minimum manufacturing experience (10 years minimum)		Years		
3.	Years of service outside country of manufacture (5 years minimum)		Years		
4.	Service Condition (altitude above sea level and Temperature)		state		
5.	Type test report and accreditation certificate of testing laboratory		provide		
6.	Applicable IEC/BS standard(s)				
7.	Rated Continuous operating temperature		^{O}C		
8.	Short with withstand temperature for 5Secs.		^{O}C		
9.	Conductor material		State		
10.	Minimum insulation thickness and resistivity at $90^{O}C$		mm/Ω		
11.	Insulation	Material (XLPE)			
		Minimum Thickness	mm		
		Screen tape around the conductor	State		
12.	Water barriers				
13.	Metallic Screen	Type and material	State		
		Min. Tape/Wires screen area	State		
		Thickness of separation layer	mm		
		Short time current of tape/Wire screen for 3sec at 90 - 200 ^{O}C	kA/3Sec		
14.	Extruded PVC Over sheath	Withstand power frequency at 90 ^{O}C for 1sec	kVrms		
		Over sheath min. thickness	mm		
		Anti-termite protection	State		
		Fire resistance	State		
		Marking	State		
15.	Wire Armour	Material of armour wire and tape	State		
		Nominal armour wire diameter	mm		
16.	**Ratings and Characteristics**				
	Conductor nominal cross-sectional area		Sqr mm		
	Voltage rating Uo/U(Um)		kV		
	Conductor shape		State		
	Maximum conductor DC resistance at $20^{o}C$		Ω/km		
	Maximum conductor AC resistance at $90^{o}C$		Ω/km		
	Minimum conductor diameter		mm		
17.	Current capacity	Buried underground	A		
		In air (trench)	A		
18.	Power frequency withstands test voltage for 5min		kVrms		
19.	Short Circuit rating of conductor for 3sec at (90-250 ^{O}C)		kA/3Sec		
20.	Maximum Capacitance/km		µF/km		
21.	Impedance @50Hz@90 ^{O}C		Ω/km		
22.	Reactance /km@50Hz		Ω/km		
23.	Inductance/km		mH/km		
24.	Maximum charging current/km		A/km		
25.	Impulse withstand voltage as per IEC60230		kVpk		
26.	Minimum bending radius (Static)		mm		
27.	Weight per Km (kg/km)		Kg/km		

SCHEDULE 17: GUARANTEED TECHNICAL PARTICULARS FOR 33 KV POWER CABLE

33 KV SINGLE CORE 300 mm² ALUMINUM XLPE CABLE					
Item	**Particulars**		**Unit**	**Guaranteed Value**	**Refer. doc**
1.	Manufacturer and country of origin				
2.	Minimum manufacturing experience (10 years minimum)		Years		
3.	Years of service outside country of manufacture (Mini. 5 years)		Years		
4.	Service Condition		State		
5.	Applicable IEC/BS standard(s)		State		
6.	Rated Continuous operating temperature		^{O}C		
7.	Short with withstand temperature for 5Secs.		^{O}C		
8.	Conductor material		State		
9.	Minimum insulation thickness and resistivity at 90^{O}C		mm/Ω		
10.	Insulation	Material (XLPE)	State		
		Minimum Thickness	mm		
		Screen tape around the conductor	State		
11.	Water barriers				
12.	Metallic Screen	Type and material	State		
		Min. Tape/Wires screen area	State		
		Thickness of separation layer	mm		
		Short time current of tape/Wire screen for 3 sec. at 90 - 200 ^{O}C	kA/3Sec		
13.	Extruded PVC Over sheath	Withstand power frequency at 90 ^{O}C for 1sec	kVrms		
		Over sheath min. thickness	mm		
		Anti-termite protection	State		
		Fire resistance	State		
		Marking	State		
14.	Wire Armour	Material of armour wire and tape	State		
		Nominal armour wire diameter	mm		
15.	**Ratings and Characteristics**				
	Conductor nominal cross-sectional area		Sqr mm		
	Voltage rating Uo/U(Um)		kV		
	Conductor shape		State		
	Maximum conductor DC resistance at 20ºC		Ω/km		
	Maximum conductor AC resistance at 90ºC		Ω/km		
	Minimum conductor diameter		mm		
16.	Current capacity	Buried underground	A		
		In air (trench)	A		
17.	Power frequency withstands test voltage for 5min		kVrms		
18.	Short Circuit rating of conductor for 3sec at (90-250 ^{O}C)		kA/3Sec		
19.	Maximum Capacitance/km		µF/km		
20.	Impedance @50Hz@90 ^{O}C		Ω/km		
21.	Reactance /km@50Hz		Ω/km		
22.	Inductance/km		mH/km		
23.	Maximum charging current/km		A/km		
24.	Impulse withstand voltage as per IEC60230		kVpk		
25.	Minimum bending radius (Static)		mm		
26.	Weight per Km (kg/km)		Kg/km		

pl

SCHEDULE 18: GUARANTEED TECHNICAL PARTICULARS FOR 11KV POWER CABLE

11KV THREE CORE 300 mm² ALUMINIUM XLPE CABLE					
Item	**Particulars**		**Unit**	**Guarant Value**	**Refer. doc**
1.	Manufacturer and country of origin				
2.	Minimum manufacturing experience (10 years minimum)		Years		
3.	Years of service outside country of manufacture (5 years minimum)		Years		
4.	Type test report and accreditation certificate of testing laboratory		Provide		
5.	Service condition (altitude and temperature)		State		
6.	Applicable IEC/BS standard(s)		State		
7.	Rated Continuous operating temperature		^{O}C		
8.	Short with withstand temperature for 5Secs.		^{O}C		
9.	Conductor material				
10.	Minimum insulation thickness and resistivity at 90^{O}C		mm/Ω		
11.	Insulation	Material (XLPE)	State		
		Minimum Thickness	mm		
		Screen tape around the conductor	State		
12.	Water barriers				
13.	Metallic Screen	Type and material	State		
		Min. Tape/Wires screen area	State		
		Thickness of separation layer	mm		
		Short time current of tape/Wire screen for 3sec at 90 - 200 ^{O}C	kA/3Sec		
14.	Extruded PVC Over sheath	Withstand power frequency at 90 ^{O}C for 1sec	kVrms		
		Over sheath min. thickness	mm		
		Anti-termite protection	State		
		Fire resistance	State		
		Marking	State		
15.	Wire Armour	Material of armour wire and tape	State		
		Nominal armour wire diameter	mm		
16.	**Ratings and Characteristics**				
	Conductor nominal cross-sectional area		Sqr mm		
	Voltage rating Uo/U(Um)		kV		
	Conductor shape		State		
	Maximum conductor DC resistance at 20ºC		Ω/km		
	Maximum conductor AC resistance at 90ºC		Ω/km		
	Minimum conductor diameter		mm		
17.	Current capacity	Buried underground	A		
		In air (trench)	A		
18.	Power frequency withstand test voltage for 5min		kVrms		
19.	Short Circuit rating of conductor for 3sec at (90-250 ^{O}C)		kA/3Sec		
20.	Maximum Capacitance/km		µF/km		
21.	Impedance @50Hz@90 ^{O}C		Ω/km		
22.	Inductance/km		mH/km		
23.	Maximum charging current/km		A/km		
24.	Impulse withstand voltage as per IEC60230		kVpk		
25.	Minimum bending radius (Static)		mm		
26.	Weight per Km (kg/km)		Kg/km		

pl

4.4 SECTION V - ATTACHMENTS TO GUARANTEED TECHNICAL PARTICULARS

1. KPLC detailed technical specification for Equipment and Materials

4.5 SECTION V- FORMS FOR CHANGE IN WORK ELEMENT

Form 1: Take-Over/Completion Certificate

Date: _____

Tender No: _____

_____

To: _____

Dear Ladies and/or Gentlemen,

Pursuant to clause 10 of the General Conditions of Contract entered into between yourselves and the Employer dated _____, relating to the _____, we hereby notify you that the following part(s) of the Facilities was 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: _____

2. Date of Completion: _____

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,

_____

Title
(Project Manager)

Form2: Operational and Acceptance Certificate

Date: _____

Tender No: _____

To: _____

Dear Ladies and/or Gentlemen,

Pursuant to Clause 10.7 of the General Conditions of the Contract entered into between yourselves and the Employer dated _____, relating to the _____, we hereby notify you that the performance 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: _____

2. Date of Operational Acceptance: _____

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,

_____

Title
(Project Manager)

Form3: Request for Change Proposal

(Employer's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

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 _____ days of the date of this letter _____.

1. Title of Change: _____
2. Change Request No. _____
3. Originator of Change: Employer: _____
   Contractor (by Application for Change Proposal No. _____:
4. Brief Description of Change: _____
5. Facilities and/or Item No. of equipment related to the requested Change: _____
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: _____
8. General terms and Conditions:

(a) Please submit your estimate to us 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 completion of the requested Change.

(c) If you have any opinion negative 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 of your opinion 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 it in writing.

_____
(Employer's Name)

_____
(Signature)

_____
(Name of signatory)

_____
(Title of signatory)

Form 4: Estimate for Change Proposal

(Contractor's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

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 of preparing the below-referenced Change Proposal in accordance with General Condition of Contract. We acknowledge that your agreement to the cost of preparing the Change Proposal, in accordance with GCC is required before estimating the cost for change work.

1. Title of Change: _____

2. Change Request No./Rev.: _____

3. Brief Description of Change: _____

4. Scheduled Impact of Change: _____

5. Cost for Preparation of Change Proposal-(N/A)

(a)	**Engineering**		**(Amount)**
(i)	Engineer	_____ 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)

Form 5: Acceptance of Estimate

(Employer's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____
Contract Number: _____

Dear Ladies and/or Gentlemen:

We hereby accept your Estimate for Change Proposal and agree that you shall proceed with the preparation of the Engineering design for the change Proposal

1. Title of Change: _____
2. Change Request No./Rev.: _____
3. Estimate for Change Proposal No./Rev.: _____
4. Acceptance of Estimate No./Rev.: _____
5. Brief Description of Change: _____

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 preparation of Change Proposal described in your Estimate for Change Proposal in accordance with the General Conditions of contract.

_____
(Employer's Name)

_____
(Signature)

_____
(Name and Title of signatory)

Form 6: Change Proposal

(Contractor's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____
Contract Number: _____

Dear Ladies and/or Gentlemen:

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

1. Title of Change: _____
2. Change Proposal No./Rev.: _____
3. Originator of Change: Employer: _____

   Contractor: _____
4. Brief Description of Change: _____
5. Reasons for Change: _____
6. Facilities and/or Item No. of Equipment related to the requested Change: _____
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 Change Proposal

	Description	(Amount)
(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 _____ 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

_____
(Contractor's Name)

_____
(Signature)

_____
(Name of signatory)

_____
(Title of signatory)

Form 7: Change Order

(Employer's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____
Contract Number: _____

Dear Ladies and/or Gentlemen:

We approve the Change Order for the work specified in the Change Proposal (No. _____), and agree to adjust the Contract Price, Time for Completion and/or other conditions of the Contract in accordance with General Conditions of contract.

1. Title of Change: _____
2. Change Request No. /Rev.: _____
3. Change Order No. /Rev.: _____
4. Originator of Change: Employer: _____
   Contractor: _____
5. Authorized Price:

   Ref. No.: _____ Date: _____

   Foreign currency portion _____ plus Local currency portion _____
6. Adjustment of Time for Completion

   None_____Increase _____ days Decrease _____ days
7. Other effects, if any

   Authorized by: _____ Date: _____
   (Employer)

   Accepted by: _____ Date: _____
   (Contractor)

Form 8: Pending Agreement Change Order

(Employer's Letterhead)

To: _____ Date: _____

Dear Ladies and/or Gentlemen:

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

1. Title of Change: _____
2. Employer's Request for Change Proposal No. /Rev.: _____dated: _____
3. Contractor's Change Proposal No. /Rev.: _____ dated: _____
4. Brief Description of Change: _____
5. Facilities and/or Item No. of equipment related to the requested Change: _____
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)

Form 9: Application for Change Proposal

(Contractor's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

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

1. Title of Change: _____
2. Application for Change Proposal No./Ref._____. dated: _____
3. Brief Description of Change: _____
4. Reasons for Change:
5. Order of Magnitude Estimation (in the currencies of the Contract):
6. Scheduled Impact of Change:
7. Effect on Functional Guarantees, if any:
8. Appendix:

_____
(Contractor's Name)

_____
(Signature)

_____
(Name of signatory)

_____
(Title of signatory)