འབྲུག་གློག་མེ་ལས་འཛིན།།
Bhutan Power Corporation Limited
(An ISO 9001:2015, ISO 14001:2015 & ISO 45001: 2018 Certified Company)
Registered Office, Thimphu
Procurement Services Department
Thimphu, Bhutan

BPC/PSD/2023 Materials/2022/11/667 September 1, 2022

Subject: **Addendum No. 3**

Reference: BPC/PSD/2023 Materials/2022/11 dated August 13, 2022

Dear Sir(s),

This is in reference to the above-mentioned tender whereby PSD, BPC would like to issue the following addenda:

1. The Price Schedule of **Lot 3: Distribution Transformers, 11kV** is revised. Please check *Annexure-1* for the revised price schedule.

2. **Lot 4: Distribution Transformers, 33kV** is split into two lots. Please refer *Annexure-2* for the revised price schedule of Lot 4 and refer *Annexure-3* for the price schedule of **Lot 7: Power Transformers.**

3. The **Bid Security** of Lot 4: Distribution Transformers, 33kV and Lot 7: Power Transformers are shown below:

Lot Description	Bid Security (Nu.)
Lot 4: Distribution Transformers, 33kV	1,166,000.00
Lot 7: Power Transformers	8,000.00
Total	**1,174,000.00**

Please note that there is no change in the total Bid Security value. Preferably Bid Security should be submitted for the individual lots. Combined Bid Security would be also accepted. However, if the combined Bid Security is not sufficient in terms of total amount, the offer for the entire quoted lots would be treated as non-responsive as per ITB 22.4 and not considered for further evaluation.

4. The **mode of evaluation** for Lot 7: Power Transformers shall be "lot wise".

5. The **delivery and completion schedule** of Lot 7: Power Transformers is as shown below:

Lot No.	Lot Description	Location / Destination as specified in the BDS	Delivery Period
7	Power Transformers	Chief Manager, RSD, BPC, Pasakha, Phuentsholing	180 Days

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6. The **GTP** of Lot 7: Power Transformers is attached as *Annexure-4*. The same is updated in the Microsoft Excel format, please check serial No. 15 under Agency Documents on the website (www.tender.bt).

7. Please refer *Annexure-5* for the **Wiring Diagram of Item 2.33: Changeover Switch** under Lot 2: Pole Fittings.

8. **Technical Clarifications**: Queries received from the prospective Bidders and clarifications from the Purchaser are tabulated below:

Lot	Item	Queries	Clarification
Lot 2: Pole Fittings	Item 2.33: Changeover Switch	Which type is required to be supplied: 1. Box Type, 2. Side Handle Type, 3. Open Type?	Open Type
Lot 5: ARCB & Sectionalizer	General	Specify the quantity of Mobile workstation laptops required to be supplied.	Supply of Mobile workstation laptops and Training shall be excluded from Supplier's scope. Please check the revised Technical Specification attached as *Annexure-6*.

This addendum shall form a part of the bidding document and shall be binding. However, due to the above inclusion and additional information, no time extension shall be granted and the submission date and time shall remain unaltered.

Thanking you,

Yours sincerely,

(Thinley Dorji)
Officiating General Manager

Annexure-1

REVISED PRICE SCHEDULE Lot 3: Distribution Transformers, 11kV							
Item No.	**Description**	**Unit**	**Qty**	**Offered Brand and Model**	**Country of origin**	**Unit Price in DDP (Nu)**	**Amount in DDP (Nu)**
3.1	Dist. Transformer 16 kVA, 11/0.415 kV	SET	7				
3.2	Dist. Transformer 25 kVA, 11/0.415 kV	SET	22				
3.3	Dist. Transformer 63 kVA, 11/0.415 kV	SET	23				
3.4	Dist. Transformer 125 kVA, 11/0.415 kV	SET	19				
3.5	Dist. Transformer 250 kVA, 11/0.415 kV	SET	26				

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Annexure-1

REVISED PRICE SCHEDULE Lot 3: Distribution Transformers, 11kV							
Item No.	**Description**	**Unit**	**Qty**	**Offered Brand and Model**	**Country of origin**	**Unit Price in DDP (Nu)**	**Amount in DDP (Nu)**
3.6	Dist. Transformer 250 kVA, 11/0.415kV - ID	SET	1				
3.7	Dist. Transformer 315 kVA, 11/0.415 kV	SET	1				
3.8	Dist. Transformer 500 kVA, 11/0.415 kV	SET	23				
3.9	Dist. Transformer 500 kVA, 11/0.415kV - ID	SET	1				
3.10	Dist. Transformer 1250kVA, 11/0.415kV - ID	SET	1				

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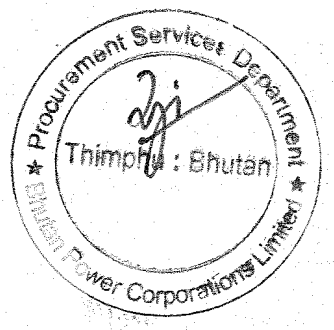
Annexure-1

REVISED PRICE SCHEDULE
Lot 3: Distribution Transformers, 11kV

Item No.	Description	Unit	Qty	Offered Brand and Model	Country of origin	Unit Price in DDP (Nu)	Amount in DDP (Nu)
3.11	1 phase Transformer 16KVA 11/0.230kV	SET	8				
3.12	1 Phase Transformer 11/0.240kV, 25kVA	SET	1				
						Total Lot Amount (Nu)	



Annexure-2

REVISED PRICE SCHEDULE Lot 4: Distribution Transformers, 33kV							
Item No.	**Description**	**Qty**	**Unit**	**Offered Brand and Model**	**Country of origin**	**Unit Price in DDP (Nu)**	**Amount in DDP (Nu)**
4.1	Dist. Transformer 25 kVA, 33/0.415 kV	SET	33				
4.2	Dist. Transformer 30KVA, 33/0.415 kV	SET	1				
4.3	Dist. Transformer 63 kVA, 33/0.415 kV	SET	44				
4.4	Dist. Transformer 125 kVA, 33/0.415 kV	SET	21				
4.5	Dist. Transformer 250 kVA, 33/0.415 kV	SET	18				
4.6	Dist. Transformer 315 kVA, 33/0.415 kV	SET	3				

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Annexure-2

REVISED PRICE SCHEDULE
Lot 4: Distribution Transformers, 33kV

Item No.	Description	Qty	Unit	Offered Brand and Model	Country of origin	Unit Price in DDP (Nu)	Amount in DDP (Nu)
4.7	Dist. Transformer 500 kVA, 33/0.415 kV	SET	17				
4.8	Dist. Transformer 16 kVA, 33/0.240 kV	SET	12				
4.9	Dist. Transformer, 33/0.240kV, 63kVA	SET	1				
4.10	1 Phase Transformer 33/0.24kV, 25kVA	SET	12				
4.11	IC Transformer, 250kVA, 33/6.6kV	NO	1				
						Total Lot Amount (Nu)	

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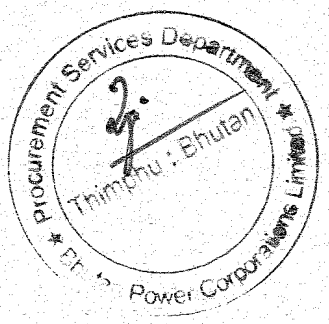
Annexure-3

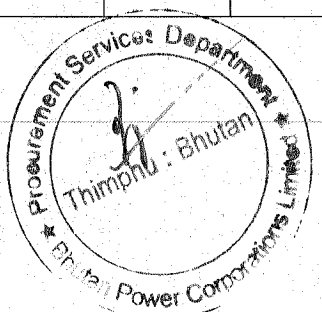
REVISED PRICE SCHEDULE Lot 7: Power Transformers							
Item No.	**Description**	**Unit**	**Qty**	**Offered Brand and Model**	**Country of origin**	**Unit Price in DDP (Nu)**	**Amount in DDP (Nu)**
7.1	Power Transformer 33/11kV, 2.5 MVA	NO	1				
7.2	Power Transformer 33/11kV, 5 MVA	NO	1				
						Total Lot Amount (Nu)	



Lot 7: Power Transformers

Annexure-4

Sl. No.	Description	Unit	Bidders to fill up	
			Item 7.1	Item 7.2
			Power Transformer 33/11kV, 2.5 MVA	Power Transformer 33/11kV, 5 MVA
1	Manufacturer & Country of Manufacture			
2	Manufacturer's Type No.			
3	Applicable Standards			
4	Rating	kV		
		MVA		
5	Installation (Outdoor/Indoor)			
6	No. of phases			
7	Frequency	Hz		
8	Type of cooling			
9	No load Ratio			
10	Tap changer			
10.1	Range	%		
10.2	Step	%		
11	Tap changing operations (Manual/Local)			
12	Impedance at principal tap	%		
13	Vector group			
14	System earthing			



Lot 7: Power Transformers

Sl. No.	Description	Unit	Bidders to fill up	
			Item 7.1	Item 7.2
			Power Transformer 33/11kV, 2.5 MVA	Power Transformer 33/11kV, 5 MVA
15	Design ambient	Deg. Celsius		
16	Temp. Rise			
16.1	Winding	Deg. Celsius		
16.2	Top Oil	Deg. Celsius		
17	Insulation			
18	Terminations			
18.1	HV			
18.2	LV			
19	Current Transformer			
20	Paint shade			
21	Altitude correction			
22	Maximum loss limit			
23	Maximum Noise level at 1 m	dB		
24	NCT			

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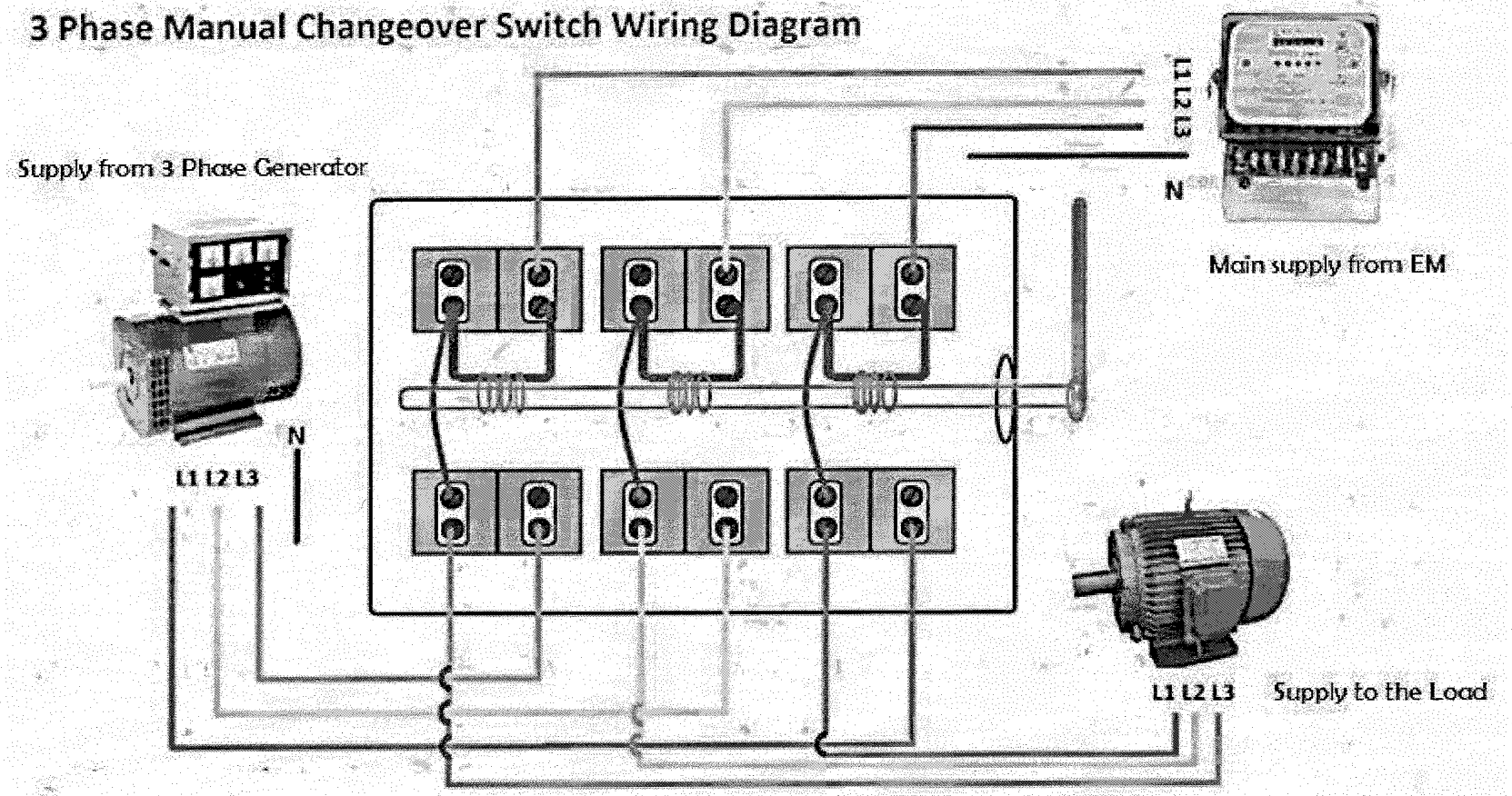
Annexure-5

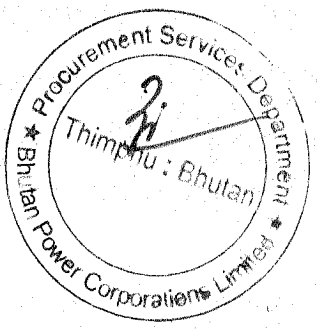
3 Phase Manual Changeover Switch Wiring Diagram



TECHNICAL SPECIFICATIONS

Lot 5: ARCB & Sectionalizer

Auto Recloser Circuit Breaker



1. Scope

- The specification covers the design, manufacturing, testing, supply and delivery of SCADA compatible Auto Recloser Circuit Breaker (ARCB also called as Auto Recloser) suitable for 3-phase 11kV and 33kV with bidirectional communication facility.
- For Local Communication/configuration via mobile workstation, the ARCBs shall have serial and TCP-IP port for communication. For remote communication the ARCBs shall have port(s) to facilitate communication with Control center.
- Each Auto Recloser shall include programmable protection features and integrated remote operation capability that are intended for installation on 11kV and 33kV feeders to facilitate complete distribution automation.
- The Auto Recloser shall be along with appropriate lightning arrestor at upstream as well as downstream terminals. The bidder shall provide hardware and clamping structures, conductors and lighting arrestors wherever required.
- The Auto Recloser shall either have its own power supply supplied or an auxiliary power supply by dry type resin cast double bushing transformer. A rechargeable sealed maintenance free battery (VRLA) and battery charger shall also be provided to provide stable power source to the controller and other communication equipment.
- Auto Recloser shall be connected to its controller using suitable connector by means of umbilical cable or equivalent cable.
- The vacuum interrupter shall be versatile to trip or close based on capability of interruption and it should be fully sealed in solid dielectric housing for lifetime of the recloser. Recloser shall be provided with magnetic actuator with all accessories in order to facilitate operation of the reclosers.

The technical specifications for Auto-reclosers in this Specification are minimum requirements. Manufacturer's standard design and/or technical alternative with latest technology may be accepted if the actual functions or performances are equal or of superior grade, compared with this Specification. However, if a proposed recloser does not comply with the major functional requirements, such a proposal will be deemed as technically non-responsive.

2. Standards applicable for ARCB

Unless otherwise specified elsewhere in this specification, the performance and testing of the Auto Reclosers shall conform to the following International Standards and all related International standards to be read with up to-date and latest amendments/revisions, thereof:

Sl. #	Standard No.	Title
1	IEC 62271 – 111	Overhead, pad mounted, dry vault and submersible automatic circuit reclosers and fault interrupters for alternating current systems up to 38kV
2	IEC 62271 – 200	AC Metal-enclosed switchgear and control gear for rated voltages above 1kV and up to and including 52kV
3	IEC 60255	Electrical Relay standards
4	IEC 60529	Degree of protection provided by enclosures
5	IEC 61000-4-2	Electrostatic Discharge standard
6	IEC 61000-4-3	Radiated electromagnetic field
7	IEC 61000-4-4	Electrical fast transient/burst immunity test
8	IEC 61000-4-5	Surge immunity
9	IEC 61000-4-6	Immunity to Conduced Disturbances
10	IEC 61000-4-8	Power Frequency Magnetic Field
11	IEC 61000-4-11	Voltage dips, short interruptions and voltage variations immunity tests
12	IEC 61000-4-16	Conducted common mode disturbances
13	IEC 61000-4-18	Damped oscillatory wave
14	IEC 68-2-6	Vibration in three axes

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3. Environmental conditions

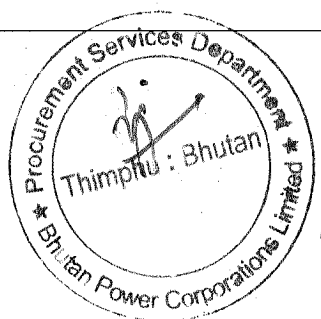
All materials supplied shall be capable of operating under following environmental conditions.

Sl No.	Particulars	Unit	Value
1	Minimum ambient temperature	^{0}C	-20
2	Maximum ambient temperature	^{0}C	40
3	Relative humidity	%	0 to 100
4	Maximum Altitude	m above sea level	3000

4. General operating parameters

General operating parameters required for the ARCB are as shown in the table below

Sl #	Particulars	33kV	11kV
1	Rated Voltage	33kV	11kV
2	Maximum system voltage	36kV	12kV
3	Applicable Standard	IEC 62271 – 111	
4	Type	Outdoor, pole mounted	
5	Frequency	50 Hz	
Insulation level			
6	Rated Power Frequency withstand Voltage (kV)	70	28
7	Rated Lightning impulse withstand Voltage (kV)	170	75
8	Insulator Creepage Distance	Min.900	Min. 300
9	Rated continuous current(Amps)	300 and above	300 and above
Rated Short Circuit Performance			
10	Fault make capacity (RMS)-kA	Minimum of 12.5	Minimum of 12.5
11	Fault make capacity (Peak)-kA	Minimum of 31.5	Minimum of 31.5
12	Fault breaking capacity (kA)	Minimum of 12.5	Minimum of 12.5
13	Metering/Measurement features	Voltage	Voltage
		Current	Current
		Frequency	Frequency
		Kilowatt (kW)	Kilowatt (kW)
		Power Factor	Power Factor
		Energy (kwh)	Energy (kwh)



		Outage Measurement	Outage Measurement
14	Communication features	Local: Serial/TCP/IP and USB port	Local: Serial/TCP/IP and USB port
		Remote: Serial/TCP/IP	Remote: Serial/TCP/IP
15	Mechanical operating life	Minimum of 10,000 operations	

Above values are the standard values at 1000 meters ASL. For installing at an altitude higher than 1000 m, the insulation withstand level of external insulation and the clearances shall be defined by the bidder considering altitude correction factor in accordance with an altitude as given in the Environmental conditions of this document.

5. Mounting structure of Auto Reclosers

The Auto Recloser shall be suitable for mounting on existing poles of the distribution network and a suitable mounting bracket shall be provided with an appropriate lifting lug provided at an appropriate position. There should be suitable mounting brackets for surge arrestor as well and all associated nut and bolts shall be galvanized. The terminals or bushings of Auto Recloser shall have laser cut markings indicating incomer side and load side. Means shall be provided to permit manual operation of the Auto Recloser through operating rod or built in extensible lever system from the ground level.

6. Bushing terminals

The material for bushing shall be outdoor Cycloaliphatic epoxy resin / hydrophobic Cycle aliphatic epoxy / HECP and preferred arrangement for connection to overhead conductor is using crimp lugs with holes. There shall be encapsulated CVTs for voltage measurement on bushings required for auto-reconfiguration of the network and CT for current measurement and protection. CT/current sensor shall be for each phase to measure phase currents and detect phase/earth faults. The CT ratio shall be -/1A (The minimum primary current shall be as per the rated continuous current). All components of the equipment shall be de-rated as per applicable international standards.

7. Lightning arrestors

Lightening arresters shall be mounted on the tank. Six numbers of lightening arrester, brackets for arresters, connecting cables, connectors and complete set of bolts, nuts, and washers shall be provided by the Supplier. The surge arresters shall be of the metal oxide, gapless, single pole type, suitable for outdoor use on a three-phase 50 Hz system and shall have the following parameters:

Parameters	33kV	11kV
Applicable standard	IS 3070, IEC 60099-4	
Rated Voltage (rms)	30 kV	9 kV
Nominal discharge current (kA)	10 kA	10 kA
MCOV	24.4 kV	7.65 kV
Maximum Residual Voltage for:		
Steep current impulse (1/20 micro sec.)	85 kV	26.5 kV
Lightning Impulse protection level (8/20 micro sec)	71.8 kV	21.7 kV
Switching impulse protection level (30/60 micro sec)	60 kV	18 kV
Minimum Creepage Distance	900	300
Phase-Phase Clearance	351	280
Phase-Earth Clearance	320	140
Type of housing insulator	Polymer with alternating sheds	
Moisture sealing system	Housing directly molded onto the arrester. Housing pressed on arrester with caps at the end not acceptable.	
Colour	Grey/Brown	

Note: Ground and line lead of the arrester is important. The lead voltage can contribute as much as the arrester protective level for long length. Therefore, arrester lead shall be as short and straight as possible.
Above values are the standard values at 1000 meters ASL. For installing at an altitude higher than 1000 m, the insulation withstand level of external insulation and the clearances shall be defined by the bidder considering altitude correction factor in accordance with an altitude as given in the Environmental conditions of this document.

8. Switching Equipment

8.1 The pole mounted outdoor type ARCB shall have Current Transformer, Capacitive Voltage Transformer and vacuum interrupter contained in the outdoor circuit switching unit.

8.2 The current transformer shall be as per applicable international standards with appropriate ratio not lower than continuous rated current and 5P10 or better protection accuracy class. This shall be able to detect and record the lowest line current in a rural feeder at any instant of time. A capacitive voltage transformer meeting service requirements as per international standard shall be available to measure the voltage.

8.3 There shall be manual trip/close or lock options provided externally in the events of faults or line maintenance.

8.4 The ARCB shall be provided with a position indicator, or other suitable means, which will clearly indicate the position OFF and ON and the indicator shall be visible from the ground.

8.5 Switching equipment shall be adequately sealed with an ingress protection rating of IP 65 or better.

8.6 All accessories required for switching components shall be supplied

9. Control equipment

9.1 The pole mounted weather proof outdoor control cabinet for Auto Recloser shall be manufactured from 304 or better grade stainless steel and it should house battery, battery charger, switches, relay and other required communication equipment.

9.2 The control cabinet shall be connected to the Auto Recloser with multi-pin weatherproof connector using 10 meters long umbilical cable or equivalent or ultraviolet-resistant cable. It should be possible to disconnect the cable when recloser is connected to power system, without causing damage or malfunction.

9.3 Control cabinet shall be adequately sealed with ingress protection rating of IP65 or better.

9.4 The supplier shall ensure that the equipment housed in the control cabinet can withstand the heating effect of direct solar radiation without causing failure and/or malfunction.

9.5 Cabinet shall be with additional provision for bottom entry of three cables and all holes shall be pre-punched and suitably blanked off. There should be provision at bottom of cabinet for the connector cable to be connect to the switching unit.

9.6 The cabinet shall be designed to avoid hydrogen build-up inside the cabinet.

9.7 The door of the cabinet shall be fitted with a secure and robust locking arrangement and there should be minimum of two latching points. The door shall be removable for replacement at site and door stay shall be fitted to keep door open while operators are attending the unit.

9.8 There shall not have any sharp edges and there shall not be any danger of pinching or guillotining an operator's fingers or hands inside the cabinet.

9.9 All connections that could potentially expose the operator to dangerous voltages shall be shielded as per applicable standards. These connections shall include the terminals used for current transformers, primary power supply and voltage measurement inputs.

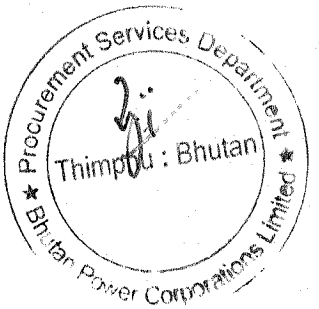
9.10 The controller, upon opening of panel's door, shall also have separate button for manual trip and close of the Auto Recloser from control panel.

9.11 The controller shall be equipped with standard size Liquid Crystal Display (LCD) as Human Machine Interface Unit (HMI) to access

- Close/open operation log
- View configuration or setting
- View event log and messages
- View, modify and change configuration or setting

9.12 There shall be toggle buttons available to select, move up, move down, move left, move right and exit. There shall also be local/remote selector button available with the controller.

9.13 The controller relay shall be of same make to that of the outdoor switching equipment.



9.14 The components inside the control panel shall be compact and well cabled.

9.15 The cabinet shall be easily removable for workshop repair purposes.

9.16 The cabinet shall be fitted with an external M10 earthing stud with a nut, lock nut and a serrated washer.

9.17 The connector between control cabinet and switching equipment (breaker) shall be detachable from both the ends.

10. Protection characteristics

10.1 General

12.1.1 The ratio of drop-off current to pick-up current shall be at least 90% for all protection functions. The SEF function shall be equipped with harmonic filtering to prevent operation when harmonics are present in the primary residual earth currents. A low pass filter with 3rd harmonic rejection > 28dB shall be supplied. Both the SEF function and its filter shall be described in the tender documentation. All protection functions, i.e. over-current (O/C), earth fault (E/F) and sensitive earth fault (SEF) shall have elements with characteristics that comply with IEC 60255.

10.1.2 The sequence of trip and auto-reclose characteristics for O/C, E/F and SEF shall be programmable to enable:

- the selection of any combination of the available elements for each trip in the trip-and-reclose sequence; and
- separate trip-and-reclose sequences for O/C, E/F and SEF with the same number of reclosing intervals for O/C and E/F.

10.1.3 Loss of Phase (LOP) protection shall be provided to ensure the protection functionality of ARCB as below:

- ARCB should trip with no auto-reclose if there is a loss of voltage on one or two phases on the upstream part of the line. Loss of supply on all three phases shall not generate the protection trip.
- Facility to turn LOP ON or OFF without affecting other protection functions of the device. Password or other form of access control shall be provided

- The parameters of configuration of LOP shall include the voltage level (phase to ground) and time of loss of supply on one or two phases. The voltage level shall be configurable from 5000 to 10000 Volts with steps not greater than 250 V. Time range shall be configurable from 1 to 60 sec with steps not greater than 1 sec.
- The information about LOP operation in case of the protection trip shall be recorded accordingly with indication of the phase(s) causing the trip of ARCB. The information about LOP operation shall be easily assessable.

10.1.4 Directional Blocking shall be provided to ensure the protection functionality of ARCB as specified below:

- ARCB and Control Element shall be capable to detect the direction of the fault current. Minimum time to determinate fault direction for O/C and E/F shall be not greater than 50 msec. For Sensitive Earth Fault (SEF) the time to determinate the fault direction shall not be greater than 1 sec.
- Configuration for Directional Blocking shall include the separate settings for Characteristic Angle for O/C and E/F elements. The range for setting of characteristic Angle shall be from -180 Deg to 180 Deg with the step not greater than 5 Deg.
- The Directional Blocking shall have the facilities to configure ARCB to trip or block for upstream and downstream faults. This shall be configured separately for O/C, E/F and SEF.
- The information about Directional Blocking operation in case of the protection trip shall be recorded accordingly in history.

10.1.5 The ARCB and Control element shall support multiple protection groups and this shall meet the requirements specified below:

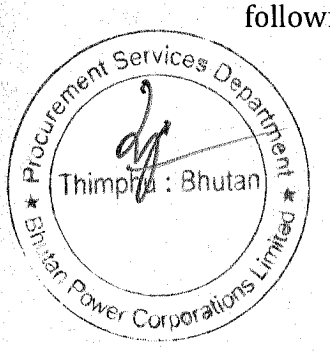
- The ARCB shall have minimum 4 independent protection groups. The Protection Groups shall have clear indication and shall be marked as "I, II, III, IV" or "A, B, C, D"
- Each protection group shall have the facility to configure O/C, E/F and SEF trip current and specify the number of the protection trips independently from

others. The protection functions and parameters used in one of the protection groups shall be available for use in any or all of the other protection groups.

- Changes to any of the protection parameter to any of the not active protection group shall not affect the protection functionality of the active protection group.
- Information about activation of any of the protection group shall be recorded in history and shall be easily assessable. Information about protection trip shall clearly indicate the protection group, active at the time of fault.
- ARCB and Control element shall have the facility for Automatic protection group selection. Automatic Protection Group Selection shall have the facility to be turned ON or OFF with password protection or other form of access control.

10.2 Over-current function

10.2.1 Delayed protection operation shall be possible by selecting an IDMT protection element with definite time (DT), standard inverse (SI), very inverse (VI), extremely inverse (El) or long time inverse (LTE) curves. Provision shall also be made for customised protection curves. Both the process and software tools required creating these protection curves should be described in the tender documentation. The over-current pick-up setting range shall be selectable from 5 A to 1250 A in the steps not greater than 5 A. Rapid protection operation shall be possible by selecting a fast curve or instantaneous protection element. Co-ordination of the fast curves or instantaneous protection elements between two devices in series shall be possible either by selecting suitable curves from a family or by addition of a selectable time increment, typically 0.05s to 3s, in 0.01s steps, or any other acceptable solution. Long protection operating times associated with fault levels marginally above the pick-up setting of the IDMT protection element shall be avoided by the provision of a Low Set Definite Time element with the following features:



- it shall be possible to enable or disable the element. When enabled it shall be active simultaneously as an overlay with all selected elements;
- the element shall have the same pick-up current setting as the IDMT element; and
- the time delay shall be selectable from 2s to 10s, in 1s steps. The time delay shall be independent of any curve manipulation.

10.2.2 A High Set Instantaneous element with a selectable time delay shall be provided, with the following features:

- it shall be possible to enable or disable the element. When enabled it shall be active simultaneously as an overlay with all selected elements;
- circuit-breaker lock-out as a result of an operation due to the High Set Instantaneous element shall be selectable;
- the pick-up setting range of this element shall be at least 100% to 1500% of the over-current setting and shall be independent of any curve manipulation; and
- the time delay shall be selectable from instantaneous to 0s to 10s, in 0.01s steps. The time delay shall be independent of any curve manipulation.

10.2.3 A cold load pick-up (CLP) feature shall be provided that allows user selectable modification of protection element characteristics under conditions of system power restoration. The CLP function may be provided in one of the following two ways:

- The instantaneous O/C element and the Low Set Definite Time O/C element could be blocked for the CLP time duration; and
- The pick-up current setting of the IDMT O/C element and the Low Set Definite Time O/C element may be modified with a settable factor to increase the pick-up current of these elements for the CLP duration. The instantaneous O/C element should be blocked for this time. This is the preferred method.

10.2.4 The CLP function shall have the following characteristics:

- the CLP function shall not in any way interfere with any of the other functions'/elements' pick-up current settings except as mentioned above;

- the CLP functionality shall be such that the active duration of the CLP is selectable from 0 min to 200 min in 1 min steps; and
- the modification factor should be settable from 1 to 5 in steps of 0,1.

10.2.5 The Time Multiplier for all IDMT protection element shall be selectable from 0.01 to 2 in steps of 0.01.

10.3 Earth fault function

10.3.1 The earth fault setting range shall detect primary earth fault currents down to 20 A.

10.3.2 Delayed protection operation shall be possible by selecting an IDMT element with SI, VI, El or LTI curve, or a definite time protection element with time delay from 0s to 10s in 0.01s steps. Rapid protection operation shall be possible by selecting a fast curve or instantaneous protection element. Co-ordination of the fast curves or instantaneous protection elements between two devices in series shall be possible either by selecting suitable curves from a family or by addition of a selectable time increment, typically 0.01s to 3s, in 0.01s steps, or any other acceptable solution. A High Set Instantaneous element with a selectable time delay shall be provided with the following features:

- it shall be possible to enable or disable the element. When enabled it shall be active simultaneously as an overlay with all selected elements;
- circuit-breaker lockout as a result of an operation due to the High Set Instantaneous element shall be selectable;
- the pick-up setting range of this element shall be at least 100% to 1500% of the earth fault setting and shall be independent of any curve manipulation; and
- the time delay shall be selectable from 0.01s to 10s, in 0.01s steps. The time delay shall be independent of any curve manipulation.

10.3.3 The Time Multiplier for all IDMT protection elements shall be selectable from 0.01 to 2 in steps of 0.01.

11. Sensitive earth fault (SEF) function

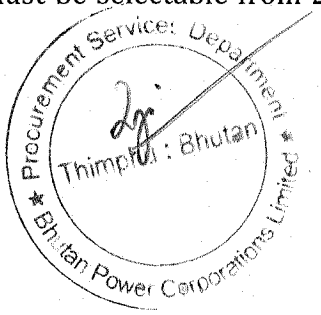
A primary earth fault current of 4A to 20A in steps not exceeding 1A shall be detectable. Delayed protection operation shall be possible by selecting a definite time protection element with time delay from 3s to 25s, in 1s steps.

12. Auto-reclose operation parameters

- The number of sequential trips to reach lockout shall be selectable to be 1, 2, 3 or 4.
- Reset times shall ideally be separately selectable for SEF and the combination of over-current and earth fault functions. The reset time shall be selectable from 5s to 120s in 1s steps. Dead times shall ideally be selectable for SEF and the combination of over-current and earth fault functions. The dead time between each successive recloser shall be independently selectable from instantaneous to 5s for the first recloser and from a minimum of 2s up to a maximum of 120s for subsequent reclosers. A close instruction initiated locally or remotely during a dead time shall result in lockout if the fault is still present upon closure.

13. Over/Under frequency protection

The over frequency protection function shall detect frequencies above the normal system frequency. An over frequency trip setting up to 5Hz, in steps of 0.1Hz, above the system frequency shall be detectable. The number of continuous cycles at and above the Over Frequency threshold before a trip will occur must be selectable from 2 to 1000 cycles. Under frequency protection settings shall be separate to the over frequency setting. The setting range down to 5Hz, in steps of 0.1Hz, below the system frequency shall be provided. The number of continuous cycles at and below the Under Frequency threshold before a trip will occur must be selectable from 2 to 1000 cycles. It shall be possible to separately enable /



disable the Over and Under Frequency protection functions. An Auto close function shall be provided to enable the ARCB to close once the frequency returns to normal.

14. Over/under voltage protection

The over voltage protection function shall detect voltages above the normal system voltage. An over voltage trip setting of 100% up to 150%, in steps of 1%, above the nominal system voltage shall be detectable. The time delay at and above the Over voltage threshold before a trip will occur must be selectable from 0s to 60s, in steps of 0.1s. Under voltage protection settings shall be separate to the over voltage setting. The setting range of 50% to 100%, in steps of 1%, below the nominal system voltage shall be provided. The time delay at and below the under voltage threshold before a trip will occur must be selectable from 0s to 60s, in steps of 0.1s. It shall be possible to separately enable / disable the Over and Under Voltage protection functions. An Auto close function shall be provided to enable the ARCB to close once the voltage returns to normal.

15. Auto Recloser Measurement characteristics

16. Local control and indication

1. The local control and indication shall be as given below (minimum specification of local controls and indications)

1 - Item	2 - Features	3 - Remarks
Local control	Local/Remote	2 position key switch-able
	Circuit-breaker open Circuit-breaker close AR ON/OFF SEF ON/OFF Protection ON/OFF Earth protection ON/OFF	(See note 1, 2 & 3) Secure control Secure control Secure or Toggled control Secure or Toggled control
Local indication	Local/Remote	(See note 1, 2 & 3)
	Circuit-breaker open Circuit-breaker closed Circuit-breaker lockout	

1 - Item	2 - Features	3 - Remarks
	AR ON/OFF SEF ON/OFF Protection ON/OFF Earth protection ON/OFF	
	Protection operation	
	Controller not healthy	(See Note 1, 2&3)
	AC fail	
	DC fail	
Local Analog indication (See note 1, 2 & 3)	• r.m.s. phase-to-phase and phase to ground voltage of all three phases • r.m.s current per phase • three-phase active power in kW three-phase reactive power in kVARs • total three-phase active energy in kWh • Power factor • Maximum demand	

Notes (preferable)

Note 1: The local control and the local indication features on the control panel shall be labeled as presented in column 2, where applicable. The type of switch used for local control shall not allow for a conflict to exist between the switch position and the function status.

Note 2: The 'Controller not healthy' indication shall indicate the control equipment not healthy (watchdog) function operated. It shall not operate during the normal pole-mounted switch operating cycle. This indication should remain active until the unhealthy state that initiated it returns to normal.

Note 3: The two-position switch (labeled as below) shall allow the ARCB controller to be set in the following modes:

Remote: In this mode a local operator can trip the ARCB and change the mode. A remote operator can trip or close the ARCB.

Local: In this mode a local operator can trip and close the ARCB. A remote operator can only trip the ARCB.

2. All local controls and indications shall be accessible in adverse weather condition. The ARCB shall be provided with external levers to permit manual operation, using an insulated operating stick, to open, close, lock-out and reset the ARCB from ground level. Where these operations can be performed at the control

cabinet, it shall only be necessary to provide a mechanical means to open and lockout the circuit breaker using an insulated operating stick. The ARCB status shall be clearly visible from ground level. "Opened" shall be indicated with a green "O". A red "I" shall indicate "Closed". Alternative indications shall be subject to approval by the purchaser. Pressure relief facilities shall be provided to enable the ARCB to withstand safely the effects of excessive pressure rise due to an internal fault. Malfunction of the ARCB shall not pose a safety hazard to the operator due to the recoil or backlash of items such as external operating rods, cranks and levers.

17. Remote control and indication

1. Minimum specification of remote controls and indications shall be as follows:

Item	Features	Remarks
Remote control	Circuit-breaker open Circuit-breaker close AR ON / OFF SEF ON / OFF Protection ON/OFF Earth protection ON/OFF	Secure control Secure control Secure or Toggled control Secure or Toggled control
Remote indication	Local/Remote Circuit-breaker open Circuit-breaker closed AR lock-out AR ON / OFF SEF ON / OFF IDMT O/C Trip Low Set DTL O/C Trip Rapid O/C Trip High Set O/C Trip IDMT E/F Trip Rapid E/F Trip High Set E/F Trip SEF Trip AR Controller not healthy A.C. fail D.C. fail	(See Note 4, 5&6)

Item	Features	Remarks
Analog indication	• r.m.s. phase-to-phase and phase to ground voltage of all three phases • r.m.s current per phase • three-phase active power in kW • three-phase reactive power in kvars total three-phase active energy in kWh • Power factor • Maximum demand	

Notes (Preferable)

Note 4: The 'Controller not healthy' indication shall indicate the control equipment not healthy (watchdog) function operated. It shall not operate during the normal pole-mounted switch operating cycle. This indication should remain active until the unhealthy state that initiated it returns to normal.

Note 5: The two-position switch (labeled as below) shall allow the ARCB controller to be set in the following modes:

Remote: In this mode a local operator can trip the ARCB and change the mode. A remote operator can trip or close the ARCB.

Local: In this mode a local operator can trip and close the ARCB. A remote operator can only trip the ARCB.

Note 6: The ARCB indication shall give an alarm with any ARCB attempt.

2. The switchgear should be configurable for remote monitoring and control using specified communication protocols through specified ports. The device in the field should be able to automatically dial in to the monitoring computer and report the abnormal conditions. Similarly, user should be able to dial to the switchgear/control panel and make necessary setting changes. There should be a provision to supply power to modem/FRTU/RTU.

18. Local engineering

1. The ARCB controller shall contain a clock (with leap year support) that can be set both locally and remotely. The accuracy of the clock shall be stated in the tender documentation. A facility for selecting all the protection, operating and communications characteristics shall be locally available in the control cabinet. Optional password protection against unauthorized changes shall be available.