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Bhutan Power Corporation Limited

(An ISO 9001:2015, ISO 14001:2015 & OHSAS 18001:2007 Certified Company)

Registered Office, Thimphu

Electrification Division

Distribution Construction Department

Distribution Services

Thimphu : Bhutan

BPC/DS/DCD/ED/C-03/F-1/ 709

December 16, 2020

Subject: Amendment No. 1

Bid Document: BPC/DS/DCD/ED/C-03 (Supply & Construction of UG Distribution Network for Dhamdum Industrial Park, Samtse)

Dear Sir (s),

This amendment is issued with changes in the following documents and will form a part of the bidding document.

a) Technical Specification for Ring Main Unit (RMU)
b) Technical Specification for Package Secondary Substation (PSS)
c) Schedule for Bill of Quantities (BOQ)
d) Single Line Diagram (SLD)
e) Submission due date extension

Bidders are advised to note the changes and all other terms and condition shall remain unchanged.

Thanking you,

Yours sincerely,

16/12/2020

(Pushpa Lal Acharya)
Sr. Manager

Tele # 02-321846, Fax # 02-321847 ; Email : ued@bpc.bt

1. Scope

1.1 This technical specification specifies the minimum requirement for design, manufacture, inspection and testing of Ring Main Unit (RMU) to be installed at 33 kV junction points to have continuous supply by isolating faulty sections. The RMU shall be of extensible type for future expansion and shall consist of either circuit breaker feeders or LBS feeders or combination of both. The number of ways (feeders) of RMU and feeder configuration shall be mentioned in BOQ. The RMU shall be of single bus bar SF6 gas insulated outdoor or indoor metal enclosed type and shall be suitable for installation in severe outdoor environmental conditions.

1.2 **SCADA compatibility of RMUs:** The RMUs shall be suitable for remote operation i.e. All the functions within the RMU (circuit Breakers / LBS) shall be fitted and supplied with motorized operation. The RMU should be provided with provision of necessary terminal blocks which shall be used for connecting the RTUs/FRTUs for automations. The RMU should have compatibility with IEC – 104 SCADA system and suitable to indicate ON/OFF position of CB, Earth Switch, Gas pressure, RMU door open, common power supply healthy, spring charges status, FPI indication and etc. All analog data from RMU (viz. from relay, meters etc.) should be available in an open protocol format for integration to SCADA through RTUs or FRTUs.

2. Applicable Codes and Standards

Unless otherwise specified elsewhere in this specification, the RMU, Switchgears, Instrument Transformers and other associated accessories shall conform to the latest revisions and amendments thereof of the following standards.

Device	Description	Standard
Switchgear	General requirement for Metal Enclosed Switchgear and Control gears, Bus bars	IEC62 271- 1
		IEC 62 271-200
Enclosure	HV/LV prefabricated substation	IEC 62271-201/IEC 61330
Devices	Circuit Breakers	IEC 62 271-100
	Load Break Isolators and Earthing switches	IEC 62 271-102
	Voltage detecting systems	IEC 61 243-5
	Fault passage indicators	IEC 61869-2
Degree of Protection	Degree of protection provided by enclosures	IEC 60 529
SF6 Gas	Specification and acceptance of new Sulphur hexafluoride	IEC 60376
Insulation Coordination	Definition, principles & Rules	IEC 60 071- 1
Instrument Transformers	Current Transformers	IEC 60 044-1
	Voltage Transformers	IEC 60 044-2

3. Service Condition

- The general operating temperature shall be from -10°C to +40°C.
- Manufacturer shall declare whether the RMU is able to operate in air temperature higher than +40 °C and confirm that current de-rating is not necessary.
- The RMU shall be capable of being exposed to high relative humidity and ambient air pollution.

4. System Parameters

Description	Parameters	
		33 kV
Network		Three phases – Three wires
Rated Voltage		36 kV
Service Voltage		33 kV
System Frequency		50 Hz
Lightning Impulse withstand Voltage		170 kV (p)*
Power Frequency withstand voltage		70 kVrms*
Rated Normal Current		630 A
Rated Short time withstand current kA rms(3 sec)		20 kA (Minimum)
Rated breaking current (kA rms)		20 kA
Rated making current (kAp)		50 kAp

** For installations at an altitude higher than 1000 m, the insulation withstand level of external insulation (i.e. phase-phase, phase-earth clearances of cables, BIL of CTs & PTs) at the service location shall be determined by multiplying the rated insulation levels by a factor Ka in accordance with figure 1 of IEC 62271-1 standard.*

5. RMU Enclosure for Outdoor Installation

The enclosure with ring main unit fitted must be a compact metallic suitable for outdoor installation and to be operated on three phase three wire / 33 kV, 50 Hz system with short time current rating of 20 kA for 3 sec. The enclosure shall be protection degree of IP 54 rating for outdoor application. The enclosure with RMU fitted shall be internal arc classified to from front, lateral and rear and type tested according to IEC 62271-202/IEC 61330. The enclosure shall consist of two wide opening access doors with holdbacks, allowing easy operator access to switchgear and shall be provided with door locking mechanism for security. Two earth points internal or external to the enclosure to be specified. The roof of the enclosure shall be tilted to 20° to avoid accumulation of water.

6. Color of the Enclosure

The color of an enclosure can be RAL 7032.

7. Switch Board Requirement (Main Tank)

The RMU shall meet the criteria for compact, metal-enclosed indoor switchgear in accordance with IEC 62271-200. The main tank of the RMU shall include, within the same stainless steel / metallized epoxy enclosure, the number of MV functional units required for connection and power supply, the circuit breaker feeders, LBS feeders and earthing switches. The SF6 gas tank shall be made of TIG welded stainless steel to have the best welded quality. The gas cubicle shall be metal enclosed with stainless steel of minimum 2 mm thickness and should be provided with a pressure relief arrangement away from the operator. The gas tank shall be of completely welded construction.

The switchgear and bus bar enclosure shall be filled with SF6 at 0.2 bar to 0.8 bar relative pressure to ensure the insulation and breaking functions. Sealed for life, the enclosure shall meet the "sealed pressure system" criterion in accordance with the IEC 62271 – 200 standard, a system for which no handling of gas is required throughout 30 years of service life. So, refilling valve is not required. In addition, manufacturer shall confirm that maximum leakage rate is lower than 0.1 % / year. The SF6 gas pressure inside the tank shall be constantly monitored by providing appropriate indicator (green and red pressure zones) on the front side of the panel. The tank shall be of stainless steel sheet of minimum 2.5 mm thickness and shall have IP67 protection index. The tank shall be able to withstand an accidental internal overpressure of at least 2.2 bars and suitable pressure withstand test report should be submitted with the bid. Also the bursting pressure of the tank should not be less than 5.5 bars. Any accidental over pressure inside the sealed chamber shall be limited by the opening of a pressure-limiting device in the rear or bottom part of the enclosure. Gas will be released to the rear of the switchgear away from the operator. All the manual operations should be carried out on the font of the switchgear.

Each switchboard shall be identified by an appropriately sized label which clearly indicates the functional units and their electrical characteristics. The tank shall be of internal arc classification of IAC A and type tested for internal arc tests as per IEC on front, lateral and rear side.

8. Dielectric Medium

SF6 gas shall be the dielectric medium for RMUs. SF6 gas used for the filling of the RMU shall be in accordance with IEC 376. There shall be an absorption material fitted inside the tank to absorb the moisture from the SF6 gas and to regenerate the SF6 gas following arc interruption.

9. Bus bars

Bus bars shall consisted of three numbers of EC grade tinned copper of current rating 630 Amps. The Short time rating current shall be 20 kA for 3 seconds for 33 kV system. The Bus bar connections shall be of anti-oxide greased.

10. Load Break Switches (LBS)

The LBS provided must be fully insulated by SF6 gas. The operating mechanism shall be spring assisted mechanism with operating handle for ON /OFF. All the mechanical interlocking must also work when the LBS are operated by motor drive. The earth switch shall be naturally interlocked to prevent the main and earth switch being switched 'ON' at the same time. The selection of the main and earth switch is made by a lever on the facia, which is allowed to move only if the main or earth switch is in the off position. Each LBS shall be of the triple pole (open-disconnected, closed and earthed). The rated current of LBS shall be 630 Amps continuous at maximum ambient temperatures. Motor is to be provided for spring charging mechanism along with suitable battery and its charger. The LBS shall be provided with a motorized operating mechanism that can be remotely monitored and controlled from the SCADA.

11. Earthing Switches

There shall be continuity between the metallic parts of the switch board and cables so that there is no electric field pattern in the surrounding air, thereby ensuring the safety of people. The substation frames shall be connected to the main earth busbar without dismantling any busbar.
Earthing of the main circuit: The cables shall be earthed by an earthing switch with short-circuit making capacity, in compliance with IEC 62271-2 standard. The earthing switch can only be operated when the switch is open.
The earthing switch shall be fitted with its own operating mechanism and manual closing shall be driven by a fast-acting mechanism, independent of operator action. The moving contacts of the earthing switch shall be visible in the closed position through transparent covers. Mechanical interlocking systems shall prevent access to the operating shaft to avoid all operator errors such as closing the earthing switch when the LBS or CB is closed.

12. Circuit-breaker

The circuit breakers shall have 3 positions: open-disconnected, closed and earthed and shall be constructed in such a way that natural interlocks prevent all unauthorized operations. Closing and opening operation of the Circuit Breaker shall be done from remote by using shunt trip coil. Spring charging shall be done with motorized spring operating mechanism. The circuit breaker shall be fitted with a mechanical indicator on the panel front facia for indicating VCB ON/OFF positions.

It shall be fitted with a local system for manual tripping by an integrated push button. There shall be no automatic reclosing. The position of the power and earthing contacts shall be clearly visible on the front of the switchboard. The position indicator shall provide positive contact indication in accordance with relevant standards. The circuit shall be associated with an integrated protection unit that will operate without any auxiliary power supply and shall include:

a) Three toroid transformers;
b) Self-powered microprocessor relay supplied should be compatible to communicate to FRTU/SCADA equipment on MODBUS protocol;

c) A low energy release;
d) A "fast-on" test receptacle for protection testing (with or without CB tripping);
e) The protection system will ensure circuit breaker tripping as of a minimum operating current (Is) which is the rated current of the underground network to be protected and maybe set to following ratings from 10 A to 600 A.
Following settings shall be available:

Range 1 - 10 to 50 A
Range 2 - 40 to 200 A
Range 3 - 63 to 312 A
Range 4 - 250 to 600 A

f) The phase and earth fault protection shall have two separately adjustable settings;
g) Interlocking of RMU panels i.e. for breaker panel and cable compartments must be designed according to IEC 62271-200;
h) The rated operating sequence shall be O-3min-CO-3 min-CO;
i) The Circuit Breaker shall be provided with a motorized operating mechanism that can be remotely monitored and controlled from the SCADA;
j) The arc quenching medium for interrupter shall be either of SF6 or Vacuum;
k) The MAKEs of the interrupter of the CB shall be restricted to following brands:
- ABB
- SIEMENS
- Schneider
- L & T

The interrupter Makes is restricted to the brand as mentioned above and bidders are to quote accordingly. The Item/lots for which brands are restricted, no alternative/ substitute brand shall be accepted and shall be considered as non-responsive for that particular item/lot.

13. Cable Compartment

The ring main units must be equipped with the outer cone connection bushings in compliance with DIN 47 636, part 6 with M-16 inside thread. The cover of cable compartment should not be of bolted type. The access to the cable compartment shall be available preferably from the front side apart from any other access as per the manufacturer's design.

The connection points of each outgoing feeder must be horizontally situated in one level at a height of approximately 700mm starting from the bottom of the unit. The cable boxes shall be suitable for connection of 3 CORE HV XLPE cables of assorted sizes up to 400 Sq. mm.

Connecting possibilities for angle plugs and T plugs shall be provided. Cable brackets inside the cable connecting compartments must be vertically and horizontally adjustable. The cable compartment shall be arc resistant as per IEC 62271-200 amended up to-date. The internal arc fault test on cable compartment shall be carried out as per IEC. The degree of protection for cable

covers shall be IP 3X. The cable bushings inside the cable compartment shall have the minimum clearances as follows:

Parameters	unit		33 kV
Air insulation of cable bushings* • Phase to Phase • Phase to Earth	mm		 350 222
Basic Insulation Level of cable bushings * • Lightning impulse voltage • Power frequency voltage	kVp kV rms		170 70

**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 corrected in accordance with relevant standard for the altitude of the site.*

14. Cable Bushings

The units shall be fitted with the standardized bushings that comply with IEC standard. All the bushings shall be at the same height from the gland plate and shall be protected by a cable boot. Necessary suitable cable boots shall be supplied as a part of RMU.

15. Voltage indicator lamps and phase comparators

Each function shall be equipped with a fixed type voltage indicator box on the front of the device to indicate whether or not there is voltage in the cables. The capacitive dividers will supply low voltage power to the lamps. Three inlets can be used to check the synchronization of phases. This device shall be in compliance with IEC 61243-5 standard.

16. Fault Passage Indicators (FPIs)

FPI shall be provided per Isolators (LBS). The device should be in compliance with IEC 61869-2 standard. These shall facilitate quick detection of faulty section of line. The fault indication may be on the basis of monitoring fault current flow through the device. The unit should be self-contained requiring no auxiliary power supply. The FPI shall be integral part of RMU and shall have LCD/LED display, automatic reset facility. They shall be fully field-programmable for earth fault and phase to phase fault. It shall also have potential free contracts for SCADA.

17. Front plate

The front plate shall have an IP2X degree of protection. The front shall include a clear mimic diagram which indicates the different functions. The position indicators shall give a true reflection of the position of the main contacts. They shall be clearly visible to the operator. The lever operating direction shall be clearly indicated in the mimic diagram. The manufacturer's plate shall include the switchboard's main electrical characteristics.

18. RMUs Motors

a) RMUs must be fitted with motors to operate LBS and circuit-breaker functions. The motors shall be provided in the RMU and shall be, 24 V, DC Motor (with smooth mechanical operation/ prefer electrical operation);
b) Installation on site shall be possible with the RMU fully energized and manufacturer should provide detailed instructions for installation to the control mechanism. Auxiliary contacts for remote indication of switch status are also required;
c) The fitting of the motors to the mechanism must not in any way impede or interfere with the manual operation of the switches. An auxiliary contact to prevent motorized operation of the mechanism while the operating handle is inserted into the operating point must also be provided;
d) A 24V battery (2 nos. 12V battery) shall be provided with at least 1 hour backup;
e) The RMU shall be provided with potential-free contacts and control contacts for DI/DOs to be interfaced with FRTU so that the RMU is capable of being monitored and controlled by SCADA/DMS.

19. Battery Charger

The battery charger shall have input voltage of 230V AC, 50Hz and output voltage of 24V DC. Battery shall be sealed maintenance free, lead acid 12V batteries of two numbers.

20. HT Current Transformer and Potential Transformer (Metering & Protection)

The RMU shall be provided with 2 core HT epoxy cast resin type CTs for metering and protection. The CT ratio, accuracy class and burden shall be as follows:

Voltage	Parameters	Functions	
		Metering	Protection
33 kV	Ratio	As per SLD	As per SLD
	Accuracy	0.5s	5P10
	Burden	2.5	2.5 VA

21. Space Heater

Space heater should be provided in the HV cable termination compartment with thermal sensors. The space heater shall be 230 V, 15 Watt with thermostat.

22. Tests

Following type test shall be submitted and the type test report should have been carried out within 5 years from the date of opening of the tender.

- Power frequency and Impulse withstand test of the complete RMU Unit;
- Temperature-rise test of the completed RMU Unit,
- Short-time withstand current and duration test of the complete RMU Unit,
- Mechanical operation test on breakers,
- Degree of protection test for each compartment,

- Making and breaking test of an apparatus i.e. Circuit Breaker, Load Breaker Switch & Earthing
- Switches.
- Internal arc withstand test for main tank and cable compartment inside the enclosure
- Partial discharge test for complete RMU unit
- Pressure withstand test

Acceptance and routine tests shall include the following:

- Withstand voltage at power frequency for all current carrying parts including wiring.
- Measurement of resistance of the Main circuit.
- Gas leakage Test.
- Partial Discharge test.
- Withstand voltage on Auxiliary Circuit.
- Operation of Function Locks, interlocks, Signaling Devices and Auxiliary Devices.
- Suitability & correct operation of Protection, Control Instruments and electrical connections of the circuit breaker operating mechanism (Primary & Secondary Injection).

1 General Specifications

1.1 General

This specification covers minimum requirement for design, manufacture, testing and supply of unitized/packaged substation which shall be used for outdoor and indoor installation, non-walk in type. It should essentially include:

- The enclosure of the unitized substation which shall be sized to house ring main unit (RMU)
- Transformer
- LV switch board
- HT meters with CT PT and
- Other operating accessories

1.2 Applicable Standard

Unless otherwise specified elsewhere in this specification, the equipment should be designed, manufactured and tested in compliance with the latest revision and amendments thereof of the following standards:

Device	Description	Standards
Switchgear	General Requirement for Metal Enclosed Swtichgears and control gears	IEC 62271 - 1 IEC 62271-200
Enclosure	HV / LV prefabricated substation	IEC62271-202/IEC 61330
Devices	Circuit Breaker	IEC 62271-100
	Load Break Isolator & Earthing switches	IEC 62271 - 102
	Voltage detecting systems	IEC 61243 - 5
	HT meters	IEC 60687, IEC 61036, IEC 61268, IEC 61107
Degree of protection	Degree of protection provided by enclosures (IP code)	IEC 60 529
SF6 Gas	Specification and acceptance of new Sulphur hexafluoride	IEC 60376
Insulation Coordination	Definitions, Principles and Rules	IEC 60 071-1
Instrument Transformers	Current Transformers	IEC 60 044-1
	Voltage Transformers	IEC 60 044-2
Transformer	Distribution transformers Noise level	IEC 76 (1-5) & IS 1180 IEC 551

Insulating Oil for Transformers	Mineral oils	IEC 296
LV Switchboard	LV switchgear and control gears assemblies	IEC 439-1
HT Energy Meter	Electricity Metering Equipment (AC)-General Requirements, tests and test conditions	IEC 62052-11:2003
	Class 0.5 alternating current watt hour meter	IEC 62053-22:2003
	AC STATIC WATIHOUR METERS, CLASS 0.5 AND 0.2 - SPECIFICATION	IS 14697
	Standardization of AC Static Electrical Energy Meter	CBIP 325
	Polycarbonate Moulding and Extrusion Materials.	IS 14434 (1998)
	Electricity Metering Equipment (AC)-General Requirements, tests and test conditions	IEC 62052-11:2003

1.3 Service condition

- The general operating temperature shall be from -10°C to +40°C.
- Manufacturer shall declare whether the RMU is able to operate in air temperature higher than +40 °C and confirm that current de-rating is not necessary.
- The RMU shall be capable of being exposed to high relative humidity and ambient air pollution.

1.4 System Parameters

Description	**Parameters**
Voltage	**33 kV**
Network	Three phases – Three wires
Rated Voltage	36 kV
Service Voltage	33 kV
System Frequency	50 Hz
Lightning Impulse withstand Voltage	170 kV (p)*
Power Frequency withstand voltage	70 kVrms*
Rated Normal Current	630 A
Rated Short time withstand current kArms (3Sec)	20 kA (Minimum)
Rated breaking current (kA rms)	20 kA

Rated making current (kAp)	50 kAp

** For installations at an altitude higher than 1000 m, the insulation withstand level of external insulation (i.e. phase-phase, phase-earth clearances of cables, BIL of CTs & PTs) at the service location shall be determined by multiplying the rated insulation levels by a factor Ka in accordance with figure 1 of IEC 62271-1 standard. The calculation of design parameters considering altitude correction factor shall be the responsibility of the bidder in accordance with an altitude of installation site.*

1.5 Outdoor Enclosure of USS

- The enclosure shall be made of hot dip galvanized steel sheet with minimum 2 mm thickness tropicalized to extreme weather Conditions. The preferred color shall be RAL 7032.
- The sheet shall be with polyurethane rust proof paint (80 microns)
- The powder coated metal base shall be at least made of 4mm hot dip galvanized steel and should ensure rigidity for easy transport and installation.
- The structure of the substation shall be capable of supporting the gross weight of all equipment.
- The roof of the substation compartment shall be designed to support loads up to 250 kg/m^2 and be slanted to 20°
- Intermediate ceiling roof shall be provided. A minimum clearance shall be left between the top of any component installed in the substation and the roof of the substation.
- Degree of Protection for the MV and LV compartment shall not be less than IP 54 and transformer compartment should not be less than IP 23D.
- Ventilation apertures at transformer compartment shall be provided for natural ventilation (Class K10).
- RMU and LV compartments shall be accessible on the sides of the substation through double doors equipped with key lock, and rubber seals. The doors shall be suitable for padlocking and/or lock protected. The transformer compartment shall be accessible from one of the sides. Bolted type opening door is not acceptable.
- The outgoing of the distribution transformer is to be connected directly to the incomer of the LV switchboard through busbars.
- All metallic compartments shall be earthed to a common earthing point.
- Internal lighting to be activated by associated switch for each compartment.
- The substation enclosure shall have a name plate details bearing company name, transformer capacity, name of the manufacturer and the year of manufacturing.
- Internal Arc classification and Test of the enclosure with transformer and RMU fitted shall be of IAC A FLR as per IEC.
- The top/roof of the enclosure shall be slightly tilted to 20° to avoid accumulation of water.

2 RING MAIN UNIT

The RMU shall be of extensible type for future expansion and shall consist of either circuit breaker feeders or LBS feeders or combination of both. The number of ways (feeders) of RMU and feeder configuration shall be mentioned in BOQ. The RMU shall be of single bus bar SF6 gas insulated indoor metal enclosed type and shall be suitable for installation in severe outdoor environmental conditions.

2.1 SCADA compatibility of RMUs

The RMUs shall be suitable for remote operation i.e. All the functions within the RMU (circuit Breakers / LBS) shall be fitted and supplied with motorized operation. The RMU should be provided with provision of necessary terminal blocks which shall be used for connecting the RTUs/FRTUs for automations. The RMU should have compatibility with IEC – 104 SCADA system and suitable to indicate ON/OFF position of CB, Earth Switch, Gas pressure, RMU door open, common power supply healthy, spring charges status, FPI indication and etc. All analog data from RMU (viz. from relay, meters etc.) should be available in an open protocol format for integration to SCADA through RTUs or FRTUs.

2.2 Switch Board Requirement (Main Tank)

The RMU shall meet the criteria for compact, metal-enclosed indoor switchgear in accordance with IEC 62271-200. The main tank of the RMU shall include, within the same stainless steel / metallized epoxy enclosure, the number of MV functional units required for connection and power supply, the circuit breaker feeders, LBS feeders and earthing switches. The SF6 gas tank shall be made of TIG welded stainless steel to have the best welded quality. The gas cubicle shall be metal enclosed with stainless steel of minimum 2 mm thickness and should be provided with a pressure relief arrangement away from the operator. The gas tank shall be of completely welded construction.

The switchgear and bus bar enclosure shall be filled with SF6 at 0.2 bar to 0.8 bar relative pressure to ensure the insulation and breaking functions. Sealed for life, the enclosure shall meet the "sealed pressure system" criterion in accordance with the IEC 62271 – 200 standard, a system for which no handling of gas is required throughout 30 years of service life. So, refilling valve is not required. In addition, manufacturer shall confirm that maximum leakage rate is lower than 0.1 % / year. The SF6 gas pressure inside the tank shall be constantly monitored by providing appropriate indicator (green and red pressure zones) on the front side of the panel. The tank shall be of stainless steel sheet of minimum 2.5 mm thickness and shall have IP67 protection index. The tank shall be able to withstand an accidental internal overpressure of at least 2.2 bars and suitable pressure withstand test report should be submitted with the bid. Also the bursting pressure of the tank should not be less than 5.5 bars. Any accidental over pressure inside the sealed chamber shall be limited by the opening of a pressure-limiting device in the rear or bottom part of the enclosure.

Gas will be released to the rear of the switchgear away from the operator. All the manual operations should be carried out on the font of the switchgear.

Each switchboard shall be identified by an appropriately sized label which clearly indicates the functional units and their electrical characteristics. The tank shall be of internal arc classification of IAC A and type tested for internal arc tests as per IEC on front, lateral and rear side.

2.3 Dielectric Medium

SF6 gas shall be the dielectric medium for RMUs. SF6 gas used for the filling of the RMU shall be in accordance with IEC 376. There shall be an absorption material fitted inside the tank to absorb the moisture from the SF6 gas and to regenerate the SF6 gas following arc interruption.

2.4 Bus bars

Bus bars shall consisted of three numbers of EC grade tinned copper of current rating 630 Amps. The Short time rating current shall be 20 kA for 3 seconds for 11 kV and 33 kV system. The Bus bar connections shall be of anti-oxide greased.

2.5 Load Break Switches (LBS)

The LBS provided must be fully insulated by SF6 gas. The operating mechanism shall be spring assisted mechanism with operating handle for ON /OFF. All the mechanical interlocking must also work when the LBS are operated by motor drive. The earth switch shall be naturally interlocked to prevent the main and earth switch being switched 'ON' at the same time. The selection of the main and earth switch is made by a lever on the facia, which is allowed to move only if the main or earth switch is in the off position. Each LBS shall be of the triple pole (open-disconnected, closed and earthed). The rated current of LBS shall be 630 Amps continuous at maximum ambient temperatures. Motor is to be provided for spring charging mechanism along with suitable battery and its charger. The LBS shall be provided with a motorized operating mechanism that can be remotely monitored and controlled from the SCADA.

2.6 Earthing Switches

There shall be continuity between the metallic parts of the switch board and cables so that there is no electric field pattern in the surrounding air, thereby ensuring the safety of people. The substation frames shall be connected to the main earth busbar without dismantling any busbar.
Earthing of the main circuit: The cables shall be earthed by an earthing switch with short-circuit making capacity, in compliance with IEC 62271-2 standard. The earthing switch can only be operated when the switch is open.
The earthing switch shall be fitted with its own operating mechanism and manual closing shall be driven by a fast-acting mechanism, independent of operator action. The moving contacts of the earthing switch shall be visible in the closed position through transparent covers. Mechanical interlocking systems shall prevent access to the operating shaft to avoid all operator errors such as closing the earthing switch when the LBS or CB is closed.

2.7 Circuit-breaker

The circuit breakers shall have 3 positions: open-disconnected, closed and earthed and shall be constructed in such a way that natural interlocks prevent all unauthorized operations. Closing and opening operation of the Circuit Breaker shall be done from remote by using shunt trip coil. Spring charging shall be done with motorized spring operating mechanism. The circuit breaker shall be fitted with a mechanical indicator on the panel front facia for indicating VCB ON/OFF positions.

It shall be fitted with a local system for manual tripping by an integrated push button. There shall be no automatic reclosing. The position of the power and earthing contacts shall be clearly visible on the front of the switchboard. The position indicator shall provide positive contact indication in accordance with relevant standards. The circuit shall be associated with an integrated protection unit that will operate without any auxiliary power supply and shall include:

a) Three toroid transformers;
b) Self-powered microprocessor relay supplied should be compatible to communicate to FRTU/SCADA equipment on MODBUS protocol;
c) A low energy release;
d) A "fast-on" test receptacle for protection testing (with or without CB tripping);
e) The protection system will ensure circuit breaker tripping as of a minimum operating current (Is) which is the rated current of the underground network to be protected and maybe set to following ratings from 10 A to 600 A.
   Following settings shall be available:

   Range 1 - 10 to 50 A
   Range 2 - 40 to 200 A
   Range 3 - 63 to 312 A
   Range 4 - 250 to 600 A

f) The phase and earth fault protection shall have two separately adjustable settings;
g) Interlocking of RMU panels i.e. for breaker panel and cable compartments must be designed according to IEC 62271-200;
h) The rated operating sequence shall be O-3min-CO-3 min-CO;
i) The Circuit Breaker shall be provided with a motorized operating mechanism that can be remotely monitored and controlled from the SCADA;
j) The arc quenching medium for interrupter shall be either of SF6 or Vacuum;
k) The MAKEs of the interrupter of the CB shall be restricted to following brands:
   - ABB
   - SIEMENS
   - Schneider
   - L & T

The interrupter Makes is restricted to the brand as mentioned above and bidders are to quote accordingly. The Item/lots for which brands are restricted, no alternative/ substitute brand shall be accepted and shall be considered as non-responsive for that particular item/lot.

2.8 Cable Compartment

The ring main units must be equipped with the outer cone connection bushings in compliance with DIN 47 636, part 6 with M-16 inside thread. The cover of cable compartment should not be of bolted type. The access to the cable compartment shall be available preferably from the front side apart from any other access as per the manufacturer's design.

The connection points of each outgoing feeder must be horizontally situated in one level at a height of approximately 700mm starting from the bottom of the unit. The cable boxes shall be suitable for connection of 3 CORE HV XLPE cables of assorted sizes up to 400 Sq. mm.

Connecting possibilities for angle plugs and T plugs shall be provided. Cable brackets inside the cable connecting compartments must be vertically and horizontally adjustable. The cable compartment shall be arc resistant as per IEC 62271-200 amended up to-date. The internal arc fault test on cable compartment shall be carried out as per IEC. The degree of protection for cable covers shall be IP 3X. The cable bushings inside the cable compartment shall have the minimum clearances as follows:

Parameters	**unit**	**33 kV**
Air insulation of cable bushings* • Phase to Phase • Phase to Earth	mm	 350 222
Basic Insulation Level of cable bushings * • Lightning impulse voltage • Power frequency voltage	 kVp kV rms	 170 70

**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 altitude of installation site.*

2.9 Cable Bushings

The units shall be fitted with the standardized bushings that comply with IEC standard. All the bushings shall be at the same height from the gland plate and shall be protected by a cable boot. Necessary suitable cable boots shall be supplied as a part of RMU.

2.10 Voltage indicator lamps and phase comparators

Each function shall be equipped with a fixed type voltage indicator box on the front of the device to indicate whether or not there is voltage in the cables. The capacitive dividers will supply low voltage power to the lamps. Three inlets can be used to check the synchronization of phases. This device shall be in compliance with IEC 61243-5 standard.

2.11 Fault Passage Indicators (FPIs)

FPI shall be provided per Isolators (LBS). The device should be in compliance with IEC 61869-2 standard. These shall facilitate quick detection of faulty section of line. The fault indication may be on the basis of monitoring fault current flow through the device. The unit should be self-contained requiring no auxiliary power supply. The FPI shall be integral part of RMU and shall have LCD/LED display, automatic reset facility. They shall be fully field-programmable for earth fault and phase to phase fault. It shall also have potential free contacts for SCADA.

2.12 Front plate

The front plate shall have an IP2X degree of protection. The front shall include a clear mimic diagram which indicates the different functions. The position indicators shall give a true reflection of the position of the main contacts. They shall be clearly visible to the operator. The lever operating direction shall be clearly indicated in the mimic diagram. The manufacturer's plate shall include the switchboard's main electrical characteristics.

2.13 RMUs Motors

a) RMUs must be fitted with motors to operate LBS and circuit-breaker functions. The motors shall be provided in the RMU and shall be rated single phase, 24 V, DC Motor (with smooth mechanical operation/ prefer electrical operation);
b) Installation on site shall be possible with the RMU fully energized and manufacturer should provide detailed instructions for installation to the control mechanism. Auxiliary contacts for remote indication of switch status are also required;
c) The fitting of the motors to the mechanism must not in any way impede or interfere with the manual operation of the switches. An auxiliary contact to prevent motorized operation of the mechanism while the operating handle is inserted into the operating point must also be provided;
d) A 24V battery (2 nos. 12V battery) shall be provided with at least 1 hour backup;
e) The RMU shall be provided with potential-free contacts and control contacts for DI/DOs to be interfaced with FRTU so that the RMU is capable of being monitored and controlled by SCADA/DMS.

2.14 Battery Charger

The battery charger shall have input voltage of 230V AC, 50Hz and output voltage of 24V DC. Battery shall be sealed maintenance free, lead acid 12V batteries of two numbers.

2.15 HT Current Transformer and Potential Transformer (Metering & Protection)

The RMU shall be provided with 2 core HT epoxy cast resin type CTs for metering and protection. The CT ratio, accuracy class and burden shall be as follows:

Voltage	Parameters	Functions	
		Metering	Protection
33 kV	Ratio	As per SLD	As per SLD
	Accuracy	0.5s	5P10

	Burden	2.5VA	2.5 VA

2.16 Space Heater

Space heater should be provided in the HV cable termination compartment with thermal sensors. The space heater shall be 230 V, 15 Watt with thermostat.

2.17 Tests

Following type test shall be submitted and the type test report should have carried out within 5 years from the date of opening of the tender.

- Power frequency and Impulse withstand test of the complete RMU Unit;
- Temperature-rise test of the completed RMU Unit,
- Short-time withstand current and duration test of the complete RMU Unit,
- Mechanical operation test on breakers,
- Degree of protection test for each compartment,
- Making and breaking test of an apparatus i.e. Circuit Breaker, Load Breaker Switch & Earthing
- Switches.
- Internal arc withstand test for main tank and cable compartment inside the enclosure
- Partial discharge test for complete RMU unit
- Pressure withstand test

Acceptance and routine tests shall include the following:

- Withstand voltage at power frequency for all current carrying parts including wiring.
- Measurement of resistance of the Main circuit.
- Gas leakage Test.
- Partial Discharge test.
- Withstand voltage on Auxiliary Circuit.
- Operation of Function Locks, interlocks, Signaling Devices and Auxiliary Devices.
- Suitability & correct operation of Protection, Control Instruments and electrical connections of the circuit breaker operating mechanism (Primary & Secondary Injection).

3 DISTRIBUTION TRANSFORMERS

3.1 General

Transformers shall be restricted **to Marson's Electrical Industries, India ; Kanohar Electrical Ltd., India; Nucon Switchgear Ltd., India; Kotsons Pvt. Ltd., India ; NEEK, Nepal ; Uttam Bharat, India ; Universal Power Transformer, India ; Kirloskar Electrical Company, India ; Schneider Electric Infrastructure Limited, India brands only.**

Transformers shall be oil-immersed type hermetically sealed with corrugated tank for indoor use. It shall have electrostatic screen which shall be earthed.

3.2 Transformer Weights and Special Bracing of Windings

Transformer winding shall be so braced / fitted internally to protect the windings against excessive movement and vibration during transportation and particularly during hand carriage to the site.

3.3 Packing

Where applicable, transformers shall be delivered filled with oil and supplied with all accessories mounted or installed. Gaskets and bolts shall be correctly installed or tightened, to ensure no leakage of oil.

3.4 Capitalization of losses for the bid evaluation

The fixed (iron) and running (copper) losses shall be as low as possible, consistent with reliability and economical use of materials. The supplier shall provide the guaranteed values of losses in the Schedule of Guaranteed Technical Particulars enclosed with the Bid document. Maximum losses and percentage impedance of the transformer should be as follows:

Sl #	DESCRIPTION	Max losses (kW)	
		No load Losses	Load Losses
1	33/0.415 kV, 750 kVA	1.20	10.00

Bidders are to design the transformer based on the above losses only and no tolerance will be permitted beyond the above values. Those bidders who do not meet the above losses will be out-rightly rejected.

3.5 Technical Specification

This specification represents the minimum requirements for the works. The Supplier shall provide equipment, which meets or exceeds these minimum requirements. These items are being sought as additions to existing networks; it is essential to maintain compatibility with existing hardware and line design, as well as with established local work practices and methods.

3.6 Technical Parameters

3.6.1 Ratings

The distribution transformers shall be rated as given in the price schedule.

3.6.2 Operating Characteristics

In addition to the common technical requirements specified, the following minimum operating characteristics shall apply to all the distribution transformers covered in this Specification:

Sl. No	Characteristics	Unit	Parameters
1	Type	-	Oil-filled
2	Secondary voltage (no load)	V	415 V
3	Vector group	-	Dyn11 with solidly earthed neutral
4	Rated frequency	Hz	50
5	Number of phases	Ph	3
6	Type of tap changer link	-	Off circuit link
7	Off-load tapping (primary side)	%	-5 to +5
8	Tap Step	%	-2.5 to +2.5
9	Short circuit impedance voltage at 75°C	%	4 % to 5 %
10	Materials of conductor	-	Electrical Grade Copper
11	Cooling type	-	ONAN
12	Insulation class (IEC 76)	-	A
13	Maximum winding temperature rise	°C	40
14	Maximum top oil temperature rise with conservator	°C	50
15	Maximum allowable noise level		As per IEC 551
16	Type of terminal connection		
a)	HV Side		Suitable to connect to RMU with adequate rating
b)	LV Side		Suitable to connect to ACB with adequate rating
c)	Secondary neutral end		One bushing each inside and outside cable box
17	Windings		
a)	One minute power frequency withstand voltage (dry & wet)	kV (rms)	33 kV 70
b)	1.2/50µs full wave impulse withstand voltage	kV (peak)	170
18	*Minimum clearance between Bushings		
a	HV: Phase –Phase & Phase -Earth	mm	350/222
b	LV: Phase –Phase & Phase -Earth	mm	25/20
19	Painting		Power coated
20	Colour		RAL 7032

** For installations at an altitude higher than 1000 m, the insulation withstand level of external insulation (i.e. phase-phase, phase-earth clearances of cables, BIL of CTs & PTs) at the service location shall be determined by multiplying the rated insulation levels by a factor Ka in accordance with figure 1 of IEC 62271-1 standard.*

3.6.3 Construction

The core shall be constructed from M4 grade cold rolled, non-ageing, grain oriented silicon sheet steel having maximum of 1.11watt/kg. The primary and secondary windings shall be constructed from super enamelled insulated high conductivity copper. All turns of windings shall be adequately supported top and bottom, to prevent movement. In cases where turns are spaced out, a suitable inter-turn packing shall be provided. The insulation between core and bolts and core and clamps shall withstand 2,000V for one minute.

All steel sections used for supporting the core shall be thoroughly shot or sand blasted after cutting, drilling and welding. Core laminations shall be annealed and burrs removed after cutting. Cut edges shall be insulated. The framework and clamping arrangements of core and coil shall be securely earthed inside the tank by a copper strap connected to the tank. The core clamping structure shall be design to minimize the eddy current loss. The core shall be provided with lugs suitable for lifting the complete core and coil assembly.

No material which can be deleteriously affected by the action of oil under the operating conditions of the transformers shall be used in the transformers or leads or bushings.

3.6.4 Transformer tank and covers

The transformer tank and covers shall be fabricated from high-grade sheet steel and shall be of robust construction. All seam, flanges, lifting lugs, braces, and other parts attached to the tank shall be welded.

Tanks with corrugations shall be tested for leakage test at a pressure of 0.15kg/ sq. cm measured at the top of the tank. All matching faces of joints to be made oil tight shall be finished with a smooth surface to ensure that the gasket material will make a satisfactory joint. Bolts shall be spaced at sufficiently close intervals to avoid buckling of either flange or covers and provide reasonably uniform compression of the gasket.

Each transformer shall be provided with a minimum of two closed lifting lugs. The minimum diameter of the hole or width of the slot shall be 25 mm. The two lifting lugs shall be so located that there will be a minimum clearance of 100 mm between the lifting chain and the nearest part of the bushings.

Tank shall be provided with a pressure release device, which shall operate at a pressure below the test pressure for tank and radiators. The device shall be provided with device visible from ground

to indicate operation. The device shall be provided with potential free contacts for alarm and tripping. Alternatively, a separate pressure relay shall be provided for this purpose.

3.6.5 Transformer Sealing

For sealed units, a satisfactory lid sealing gasket shall be provided on each of these transformers to maintain the seal at extremes of operating temperature. A cold oil level mark shall be provided inside each transformer marked C.O.L.

3.6.6 Internal and external finish

Internal and external tank and radiator surfaces shall be thoroughly cleaned by shot blasting or be given an acid and phosphate dip treatment to remove rust and scale and to provide an adherent, moisture resistant coating. Due care shall be given to avoid over pickling, resulting in pitting or unduly heavy deposit of phosphate. This resultant coating shall provide a surface, which shall offer good paint adhesion and a resistance to corrosion. The interior surfaces of the tank and cover above the lowest oil level shall be given one coat of oil and acid resisting paint, after cleaning.

The exterior surfaces of the complete transformer shall, where appropriate, be protected by a paint system which shall be applied strictly in accordance with the paint manufacturer's instructions. The system shall consist of not less than two priming coats and two finishing coats of oil and weather resisting paint.

The total thickness of the paint shall be not less than 0.120 mm with a minimum total thickness of priming and finishing paint of 0.06 mm each. Attention shall be paid to the need to achieve adequate coverage at metal edges, where breakdown of the paint film often begins. The paint system and the colour of the final coat shall be RAL 7032.

3.6.7 Rating Plate

A stainless steel rating plate, of at least 1 mm thickness, shall be fitted to each transformer and shall carry all the information as specified in the Standards.

3.6.8 Terminal Markings

All transformers shall have the primary and secondary terminal markings plainly and indelibly marked on the transformer adjacent to the relevant terminal.

3.6.9 Terminal Leads

Outgoing leads shall be specially supported, to withstand the effects of vibration and handling during transport, hand cartage and short circuits.

Air filled cable boxes if provided shall be of adequate dimensions and designed in such a manner that they can be opened for inspection without disturbing the incoming cable.

The provision shall be made for earthing the body of each cable box and Cable box shall be complete with necessary glands, lugs and armour grips.

3.6.10 Bushings

All bushings shall be porcelain clad, and shall be sealed to prevent ingress of moisture and to facilitate removal. The neutral bushings and stems shall be identical to those provided for phase terminations. Bushing palms shall be made of brass and have one 14 mm dia. hole.

3.6.11 Earthing Connections

All internal metal parts of the transformers shall be earthed at one point only. The magnetic circuit shall be connected to the clamping structure at one point only. The frame work and clamping arrangements of core and coil shall be securely earthed by copper strip connection to the main frame and enclosure.

Two earthing connections shall be provided with connection facilities. The bolts shall be located on the lower side of the transformer and be of M12 size. Each connection shall be indicated clearly with an engraved 'earth' symbol. The transformer shall be earth to the USS body with a copper flat of suitable rating.

3.6.12 Gaskets

Gaskets provided with the transformers shall be suitable for making oil tight joints, and there shall be no deleterious effects on either gaskets or oil when the gaskets are continuously in contact with hot oil. Exterior gaskets shall be weatherproof and shall not be affected by strong sunlight/UV. The material for gaskets shall be cork, neoprene or equivalent.

3.6.13 Drying Out, Filling, Transformer Oil

All transformers shall be thoroughly dried out at the manufacturer's works. Oil immersed type transformers shall be delivered filled with oil to normal level, ready for service.

All transformers shall be filled to the required level with new, unused, clean, standard mineral oil in compliance with IEC-60296 and shall be free from all traces of polychlorinated biphenyl (PCB) compounds.

3.6.14 Fittings

All transformers shall be, as a minimum, fitted with the following:

SL. No	Description
1	Rating and diagram plate
2	Two Earthing terminals
3	Lifting lug
4	Oil temperature indicator
5	Winding temperature indicator
6	Pressure relief valve
7	Drain cum bottom filter valve with plug
8	Thermometer pocket
9	Accessories for clamping to the foundation channel in order to withstand earthquake forces.
10	HV terminals: - indoor cast resin. The manufacturer shall connect HV terminal and RMU through suitable Aluminum cable/busbar of suitable rating.
11	LV terminals: The manufacturer shall connect LV terminals by Aluminum cable/busbar of suitable rating.
12	Skid base with cross bracing
13	Externally operated off load tap switch lock and keys
14	4" dia. Thermometer
15	W.T.I and O.T.I suitably fitted and connected to the transformers.

3.6.15 Radio Interference

When operated at voltages up to 10% in excess of the normal system rating, transformers shall be substantially free from partial discharges; i.e., corona discharges in either internal or external insulation, which are likely to cause interference with radio or telephone communications.

3.6.16 Test

The type test report should have been carried out within 5 years from the date of opening the tender and following minimum type test of the transformer shall be submitted with the offer:

1. Lightning impulse and power frequency test;
2. Temperature rise test;
3. Short circuit current test;
4. Pressure test.

4 LV SWITCHBOARD

4.1 Construction Features

The LV Switch board shall be enclosed in the USS and should be smooth finished, leveled and free from wobbling.

Doors, removable covers, if any and plate shall be gasket all around with neoprene gaskets, and this is essential to prevent ingress of dust and vermin. All live parts shall be provided with at least phase to phase and phase to earth clearance in air of 25 mm and 20 mm respectively.

The construction system shall provide a complete set of elements for installing fixed or withdrawal switching and protective devices, measuring devices and control/monitoring devices in the switchboard. Approval shall be made for brought out items.

4.2 Main Busbar

Main busbar shall be of Aluminum alloy of grade E91E, conforming to relevant IEC standards.

All busbar shall be a solid strip without joints and shall be rated continuously. The maximum temperature of the busbar under operating conditions when carrying rated normal current at rated frequency should not exceed 85°C.

Busbar shall be adequately supported on insulators to withstand dynamic stresses due to short circuit current. Busbar support insulators shall conform to relevant standard IEC standards.

Busbar should not be painted and all performance characteristics specified shall be obtained with unpainted busbars.

4.3 Air Circuit Breaker (ACB)

The ACB shall be provided in the LT side of the transformer with the following parameters:

Sl. No.	Description	Unit	Particulars
1	Rated Frequency	Hz	50
2	Phase	Ph	3
3	Rated Current	Amps	1250
4	Rated operational voltage	V	415
5	Release	-	Microprocessor based
6	Breaking capacity	kA	50

4.4 Moulded Case Circuit Breaker (MCCB)

MCCBs shall be heavy duty type, mounted on bases, having a rupturing capacity of 50kA at 415V A.C. 50 Hz. Incoming MCCBs are to be supplied and installed as part of the completed LV

switchboard with the following parameters:

Sl. No.	Description	Unit	Particulars
1	Rated Frequency	Hz	50
2	Phase	Ph	3
3	Rated Current	Amps	630 (1No), 200 (5nos)
4	Rated operational voltage	V	415
5	Breaking capacity	kA	36
6	Release	-	Static (thermal overload and magnetic short circuit)
7	Type	-	Manual/Fixed
8	Altitude	m	Given in general specification

4.5 Interior Lighting of LV Switchboard

Each panel should be provided with a compact fluorescent lamp (CFL) lighting fixture (11W) or LED lamp rated for 240V, 1 phase, 50Hz supply for the interior illumination of the panel during maintenance. Switching of the fitting shall be controlled by the respective panel door switch. All CFL lamps shall be with pin type holder.

4.6 Labels

All LV Switchgear shall be provided with labels or name plates, giving a description of the equipment, together with information regarding the nominal voltage, nominal current and the like under which the item of plant in question has been designed to operate.

5 ENERGY METERS

Energy meters shall be restricted to **Actaris, Iskrameco, Solvakia, landis-Gyer, Secure Meter brands only.**

5.1 General technical requirement

- Application : 3 phase 3 wire system or 3 phase 4 wire or
- Rated Secondary Voltage : 63.5 volts (Phase to Neutral)
- Rated secondary Current (I Basic) : 1 Amps
- Rated Frequency : 50 Hz.
- Accuracy class : 0.5s as per meter category
- Power Factor : Unity to Zero (all power factor lag / or lead)
- The meter shall start and continue to register on application of 0.1% of basic current at Unity P.F., as per relevant standards and shall work satisfactorily up to maximum continuous current of 2 times rated basic current with the following supply system variation:

Voltage: Vref ± 30%

Frequency: 50 Hz ±5%

- Temperature: The standard reference temperature for performance shall be 27 °C. The mean temperature co-efficient shall not exceed 0.03%.
- The reactive accuracy class of the meter shall be same as the active accuracy class

5.2 Influence quantities

The meter should be designed and protected such that all external effects and influences shall not change its performance & shall work satisfactorily within guaranteed accuracy limits, as specified in IS 14697: 1999 / CBIP technical report – 304, under the presence of influence quantities.

5.3 Construction

The case, winding, voltage circuit, sealing arrangements, registers, terminal block, terminal cover & name plate etc, shall be in accordance with the relevant standards. The meter should be compact & reliable in design, easy to transport & immune to vibration & shock involved in the transportation & handling. The construction of the meter should ensure consistence performance under all conditions especially during storms/heavy rains/very hot weathers. The insulating materials used in the meter should be non-hygroscopic, non-ageing & have tested quality. The meter should be sealed in such a way that the internal parts of the meter become inaccessible.

The meter should employ latest technology such as Application Specific Integrated Circuit (ASIC) to ensure reliable performance. The mounting of the components on the PCB should be Surface Mounted Technology (SMT) type except some power supply related component. The electronic components used in the meter should be of high quality.

5.4 General mechanical requirements

The construction of the meter shall be rigid & suitable to withstand shock & vibration involved in transportation & handling, as specified in IS 14697. Meter shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially personal safety against electric shook, safety against effect of excessive temperature, protection against spread of fire, protection against penetration of solid objects, dust and water. The design of meter shall conform to IP51 class degree of protection against dust and moisture as per relevant standards.

5.5 Tropical treatment

All parts, which are subject to corrosion under normal working conditions, shall be protected effectively. Any protective coating shall not be liable to damage by ordinary handling or damage

due to exposure to air, under normal working conditions. Meters shall withstand solar radiation. The meters shall be suitably designed and treated for normal life & satisfactory operation under the hot and hazardous tropical climatic conditions as specified in clause no. 2. The meter shall work from -10°C to +55°C and RH 95% non-condensing type.

5.6 Meter case

The housing of the meter shall be safe high-grade Engineering plastic or any other high quality insulating material and shall be very compact in design. All the insulation materials used in the construction of meter shall be non-hygroscopic, non-ageing & of tested quality, capable of withstanding resistant to heat & fire. The construction of the meter offered shall be such that it can be sealed independently and the cover cannot be removed with the use of a tool, without breaking the seal. The case of offered meters shall be so constructed that any non-permanent deformation shall not prevent the satisfactory operation of the meter. The meter shall have a transparent cover and opaque base with seamless ultrasonic welding.

5.7 Terminals -terminal block

The base of the meter shall have a terminal block at the bottom made out of high grade engineering plastic so as to facilitate bottom connection and houses solid nickel plated brass terminals having capability to carry maximum value of current.

The material of the terminal block shall be capable of passing the tests given in IS 14697: 1999.

The terminal holes in the insulating material shall be of sufficient size to accommodate the insulation of the conductors. The diameter of the terminal hole for current terminals shall not be less than 5.0 mm & shall be of adequate length in order to have proper grip of conductors / crimping pins with the help of two screws.

The terminal block shall satisfy all the conditions such as clearance & creepage distance between terminals & surrounding part of the meter as specified in relevant clause of IS 14697: 1999.

The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there shall have no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixing which may be loosened and tightened several times during the life of the meter shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Electrical connections shall be so designed that contact pressure shall not be transmitted through insulating material.

5.8 Terminal block cover

The terminals block cover for the energy meters shall be extended transparent type, which can be sealed independently of the meter cover. The ETBC shall have a clear space of min 40$\pm$5mm, thus

allowing sufficient clearance space for inserting cables. ETBC shall have a top side hinge arrangement for easy access of terminal for wire termination. The terminals, their fixing screws and the insulated compartment housing them shall be enclosed by extended terminal cover in such a way that no part of meter or accessories at terminal block shall be accessible from the front of the meter. There shall be provision of fixing of seals so that screws cannot be loosened without breaking the seals.

The terminals shall not be accessible without removing the seal(s) of terminal cover when energy meter is mounted on the meter board.

5.9 Window

The energy meter cover shall be made of high-grade engineering plastic with one window. The window shall be of transparent material ultrasonically welded with the meter cover such that it cannot be removed undamaged without breaking the meter cover seals.

5.10 Quality

Overall the quality of the meter should be good and the service life of the meter shall be more than the guarantee period. The material, components used for manufacturing the meter shall be of premium quality. The LCD display shall not fade with time and the display annunciators should be visible. Functionality of the meter shall not be affected by the harsh environmental conditions. Quality meters shall be given preference and the performance of previous installed meters shall be analyzed before awarding the tender. Aesthetically, the meter shall be of premium quality.

5.11 Communication port

5.11.1 Local communication port

The energy meter shall have a galvanically isolated IEC 1107 optical communication port located in front of the meter for data transfer to or from a hand held Data Collection Device. The sealing provision should be available for optical port.

5.11.2 Remote communication port

Meter shall have an additional communication port (RS 232) in the form of RJ11 port to interface external modem for remote data collection. RS 232 (RJ11) port shall be located under the terminal cover.

Both the ports will support communication on DLMS and should be accessible through a DLMS compliant HHU

5.12 Data downloading capability

Meter shall support a minimum baud rate of 9600 on optical port as well as RS 232 remote communication port. It shall be possible to read selective data from the meter as specified in the companion standard.

5.13 Display of measured value

The measured value(s) shall be displayed on seven segments, seven digit Liquid Crystal Display (LCD) display unit/register, having minimum character height of 10 mm.

The data should be stored in non-volatile memory. The non-volatile memory should retain data for a period of not less than 10 years under unpowered condition. Battery back-up memory will not be considered as NVM.

It should be possible to easily identify the single or multiple displayed parameters through symbols/legend on the meter display itself or through display annunciators.

Meter shall have Scroll Lock facility to display any one desired parameter continuously from display parameters.

The register shall be able to record and display starting from zero, for a minimum of 1500 hours, the energy corresponding to rated maximum current at reference voltage and unity power factor. The register should not roll over in between this duration.

The meter should display the required parameters in two different modes as follows:

(Display sequence for both auto and Push button must be maintained, no interchange in sequence or display parameter will be accepted. All the display should have proper legend to identify the same.)

5.13.1 Auto Display Mode

The following parameters should be displayed in auto cycle mode, in the following sequence. Each parameter should be on meter display for 10 seconds and the time between two auto cycles should be at 60 seconds gap.

1. LCD test
2. Total Cumulative Active Forwarded Energy in kWh(up to date)
3. Meter serial number
4. Real Date (dd mm yy)
5. Real Time (hh mm ss)
6. Present Month MD in KW and KVA since last MD reset with date and time.

Each parameter should be on meter display for 10 seconds and the time between two auto cycles should be at 60 seconds gap.

5.13.2 Push Button mode

The following parameters should be displayed on pressing the push button

1. LCD test
2. Total Cumulative Active Forwarded Energy in kWh (up to date)
3. Meter serial number
4. Real Date (dd mm yy)
5. Real Time (hh mm ss)
6. Present Month MD in KW and KVA since last MD reset with date and time.
7. Previous 3 months (at least) cumulative KWh, KVAh and Maximum Demand in KVA at 24.00 hrs. of last date of the month.
8. Instantaneous Phase Voltages
9. Instantaneous Phase Currents
10. Instantaneous Neutral Current* i.e. Actual Current flowing through the Neutral
11. Instantaneous Power Factor
12. Inst. Power Factor – Phase Wise
13. Average Power Factor (Previous Month)
14. Instantaneous Active Power
15. Instantaneous Apparent Power
16. Instantaneous Frequency
17. High resolution display for KWh, KVARH and KVAH (minimum 2+4 i.e. 4 digit after decimal
18. Phase Sequence
19. Connection check (For CT Reversal Connection Not OK)
20. Self-Diagnosis

Display for Auto and manual mode must be listed by two headers

A) Auto Display Mode and

B) Push Button Mode (Parameters should be pasted in front of the PP Box

Each parameter should be on meter display for 10 seconds and the time between two auto cycles should be at least 60 seconds gap).

5.14 Electromagnetic compatibility

The static energy meters shall conform to requirements listed in relevant standards and shall also be protected against radiated interference from either magnetic or radio-frequency source.

5.15 Immunity to electromagnetic disturbance

The meter shall be designed in such a way that conducted or radiated electromagnetic disturbance as well as electrostatic discharge do not damage or substantially influence the meter and meter shall work satisfactorily under these conditions as per relevant standards

NOTE: the disturbances to be considered are:

(a) Harmonics
(b) Voltage dips and short interruptions
(c) Conducted transients
(d) D.C. and A.C. magnetic fields
(e) Electromagnetic fields
(f) Electrostatic discharges

5.16 Radio interference suppressions

The meter shall not generate noise, which could interfere with other equipment, and meter shall work satisfactorily as per relevant standards

5.17 Influence of high magnetic field

The meters shall be provided appropriate magnetic shielding so that any external magnetic field (AC/DC electromagnet) as per CBIP Technical Report no. 304 applied on meter would not affect the proper functioning of the meter and meter shall work satisfactorily as per relevant standards.

5.18 Starting current

The meter shall start and continue to register at the current 0.1% of Ib.

5.19 Running with no load

When the 115% of rated voltage is applied with no current flowing in the current circuit, the meters shall not register any energy and test output of the meter shall not be more than one pulse/count on "no load".

5.20 Power consumption

The active and apparent power consumption in each voltage circuit of the CT Operated meters at reference voltage; temperature and frequency shall not exceed 1.0 W and 4 VA per phase respectively.

The apparent power consumption in each current circuit for the CT Operated meters at basic current, reference frequency and reference temperature shall not exceed 1.0 VA per phase.

5.21 Calibration & test output

All the meters shall be tested, calibrated and sealed at works before dispatch. Further, no modification of calibration shall be possible at site by any means.

However, it shall be possible to check the accuracy of energy measurement of the meter in the field by means of LED output on meter. Meter should have two calibration LEDs for accuracy measurement for different energies. Out of these, one should be kept fixed on kWh and other one shall be configurable for rest two (kVArh, kVAh). Resolution of the test output shall be sufficient to enable the starting current test in less than 10 minutes.

5.22 Connection diagram

The connection diagram of the meter shall be clearly shown for 3 phase 4 wire system, on the terminal cover. The meter terminals shall also be marked and this marking should appear in the above diagram.

5.23 Quantities to be measured

The meter shall be able to provide the following data in line with Category 'C' type as per IS 15959 - Indian Companion Specification.

a) Instantaneous Parameters
b) Block Profile / Load Survey data
c) Abstract quantities
   - Name Plate Details
   - Programmable parameters
d) Event Conditions
e) Billing profile parameters.
f) Time of day registers.

The meter shall be able to measure and provide the parameters listed in the guideline document. The OBIS code for each parameter shall be as identified as per DLMS /COSEM protocol in line with Indian companion standard.

5.24 Abnormality events detection

The meter should have features to detect the occurrence and restoration of, at least, the following common abnormal events:

a) **Missing Potential:** The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of Potential failure (one phase or two phases). All potential missing cases shall be considered as power failure.

b) **Current imbalance**: The meter shall be capable of detecting and recording occurrence and restoration with date and time of Current unbalance (for more than a defined persistence time).

c) **Current Reversal:** The meter shall be capable of detecting and recording occurrence and restoration with date and time if the current is flowing in reverse direction in one or more phases. The meter shall continue to record in forwarded direction even in case of CT reversal.

d) **Power on/off**: The meter shall be capable to record power on /off events in the meter memory. All potential failure should record as power off event.

e) **Magnetic Influence** - The Meter shall be capable of detecting and recording of presence of abnormal magnetic influence near the meter, if the magnetic influence affects the meter functionality. The meter should record at Imax on account of magnetic influence. Separate

legend for magnet event shall be made available on LCD. This legend shall remain in on state till meter reading so that it will come in to notice of meter reader.

f) **Voltage unbalance** – Meter shall detect voltage unbalance if there is unbalance in voltages.

g) **Over Current** – When load condition at any phase i.e. Line current at any phase goes more than defined limit , this will be detected as Over current condition.

h) **CT Open** – The meter should detect phase wise current circuit open when the circuit is opened from meter side.

i) **CT Bypass** – The condition should be detected whenever the current terminal is bypassed in the meter

j) **Neutral Disturbance** – The meter should detect neutral disturbance if any spurious signal is applied at the meters neutral.

k) **High and Low Voltage**: The meter should detect under and over voltage events respectively if voltage falls / rise from defined limits.

l) **Cover Open**: The meter shall be able to detect cover open occurrence event if cover is opened in mains on or off condition. Separate legend for cover open event shall be made available on LCD. This legend shall remain in on state till meter reading so that it will come in to notice of meter reader

The above shall be selectable and will be in line with IS 15959: Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification

The meter shall keep records for the minimum last 300 events (occurrence + restoration) for above abnormal conditions. Each event shall be logged with date and time of occurrence/restoration with snapshot of voltage, current power factor and active energy (except cover open, power on-off). It shall be possible to retrieve the abnormal event data locally using a hand held unit (HHU) through the meter's optical port & same can be viewed / analysed at base computer end in simple and easily understandable format.

5.25 Abnormal voltage/frequency device test

The accuracy of the meter would not be affected with the application of abnormal voltage/ frequency generating device having spark discharge of approximately 35KV. The meter will be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

i) On any of the phase or neutral terminals.
ii) On any connecting wires of the meter.
iii) Voltage discharge with 0-10 mm spark gap.
iv) Spark on meter body.
v) Spark on the optical and RS 232 port.

vi) At any place in load circuit.

The accuracy of the meter will be checked before and after the application of above device.

5.26 Load survey

Meter should support parameters as mentioned IS-15959 for Category "C" .

Following parameters shall be made available for last 60 days with integration period of 15 min. Out of which the utility should be able to select any five parameters

- Real time clock, date and time.
- Current, Ir
- Current, Iy
- Current, Ib
- Voltage ,V Rn
- Voltage ,V Yn
- Voltage ,V Bn
- Active forwarded Energy
- Reactive lag forwarded energy
- Reactive lead forwarded energy
- Apparent Energy

These load survey can be retrieved with the help of Meter Reading Instrument on local interrogation or remotely using the remote communication interface.

5.27 Maximum demand

The meter should be capable of recording the Apparent/Active MD in kVA/kW with integration period of 15 minutes. Itcommence at the fixed time intervals of the real time mustbe provided. 12 (twelve) months back up data for KWH, KVARH (lag and lead), KVAH and MD in KVA with date and time should be available in BCS.

5.28 MD reset option

1. Billing Date at 12:30 Hrs (Bhutan Standard Time) (Programmable) first day of the month.
2. Push button
3. By Authenticated Command from BCS through HHU or directly from PC/REMOTE
4. MD reset button should have proper sealing arrangement. Specific Operation should be available in downloaded data.

5.29 Time of day registers

The meter shall have support of eight TOD registers and rate registers for demand and energy monitoring in peak and off peak time zones. TOD rate and MD registers are required for active and apparent energy channels.

5.30 Billing Parameters

The meter shall generate these parameter for each billing cycle and should store in the memory. The set of data for last 12 cycles shall be stored in the memory. And the parameter should be as per table 29 of IS-15959.

5.31 Self-diagnostic feature

The meter shall be capable of performing complete self-diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data memory location at all time. The meter shall have indication for unsatisfactory/non-functioning/malfunctioning of the following:

a) Time and date on meter display
b) All display segments on meter display
c) Self-diagnostic (RTC, NVM information) on display

5.32 Other salient features of meters

- It should be possible to check the healthiness of phase voltages by phase indicator available on meter display.
- The meter shall have provision of reading in the absence of power through an internal battery. It shall be possible to access the display in power off condition. It shall also be possible to do meter data download through MRI under power off condition.
- The meter should work accurately irrespective of phase sequence of the supply.

5.33 Test and test conditions

- Acceptance test: All acceptance tests as per relevant standards shall be carried out in the presence of utility representatives.
- Routine Test: All the routine tests as per – IS 14697 shall be carried out and routine tests certificates shall be submitted for approval of purchaser.

6 PACKING – TRANSPORT AND INSTALLATION

The Package Substation shall be delivered in a protective cover made of polythene or similar product. Lifting facilities for transportation of the complete unit shall be provided. Commissioning and operating instructions shall be provided with each substation.

7 TESTS

The type test report should have been carried out within 5 years from the date of opening of the tender. Following type tests shall be submitted:

1. Insulation level of the prefabrication substation.
2. Temperature rise test of the main components contained in a prefabricated substation.

3. Rated peak and the rated short time withstand current of earthing circuits.
4. Degree of protection for each compartment.
5. Mechanical withstand test of the enclosure.
6. Internal arc fault test of the USS with main component fitted inside enclosure.
7. Test to verify the sound level of the prefabricated substation

Summary

SH. No.	Particulars	Cost (Nu.)
1	Supply & delivery of materials	-
2	Erection, Testing and Commissioning	-
3	Civil works	-
	Total	**-**

A. SUPPLY AND DELIVERY OF MATERIALS

Sl.#.	Particulars	Unit	Provisional Qty.	Unit price			Total FAS excluding BST/CD	Provisional for BST/CD			Total FAS including BST/CD
				Ex-work	FAS excluding BST/CD	FAS including BST/CD		BST %	CD %	Value (BST+CD)	
A	**Medium Voltage**		**1**	**2**	**3**	**4**	**5=1x3**	**6**	**7**	**8=(6+7) x1x2**	**9=1x4**
1	33kV, 6-Ways RMU (2-Isolator and 4-VCB) with PT in two incomer, rated 630 Amps and with O/C and E/F protection, short time current - 20kA for 3 sec, Outdoor Type	No	6								
2	Compact Secondary Substation, 750kVA, 33/0.415kV, Outdoor type, 3-Ways RMU (2-isolators and 1-VCB), rated 630 Amps and with O/C and E/F protection, short time current - 20kA for 3 sec, with 1 Nos ACB - 1250 amps and 1 no. 630 Amps & 5 nos. of 200 Amps MCCB outgoing feeders with adjustable setting, Non - Walk in type	No	2								
3	33 kV, 3C x 400 sq.mm, XLPE grade cable.	Mtr	3,500								
4	33kV Indoor ternimation kit including acessories for RMU	Set	40								
5	33 kV, Outdoor termination kit with accessories	sets	2								
6	33 kV, Straight through termination kit with accessories	sets	14								
7	GEE slab including nuts and bolts	No	175								
8	Earthing conductor - GI Strip 25 x 6 mm	Mtr	280								
B	**Low Voltage**										
1	Supply of 1.1 kV XLPE insulated, PVC sheathed, steel armoured underground cable with aluminium conductor of 1C x 630 sq.mm with lugs & double Compression glands, GI nuts & bolts to terminate the cables in Distribution pillar.	Mtr	5,200								
2	1.1 kV, straight through jointing kit including all accessories.	No	21								
3	Distribution pillar as per the specification	No	2								
4	Spike earthing rod, 40 mm dia x 2500 mm long with GI earthing flats (25 x 6mm)	Set	8								
	Total Amount									-	-

B. Erection, Testing and Commissioning

Sl. No.	Description	Unit	Quantity	Rate (Nu.)	Total Amount (Nu.)
A	**33kV UG**				
1	33kV, 6-Ways RMU (2-Isolator and 4-VCB) with PT in two incomer, rated 630 Amps and with O/C and E/F protection, short time current - 20kA for 3 sec, Outdoor Type	No	6		
2	Compact Secondary Substation, 750kVA, 33/0.415kV, Outdoor type, 3-Ways RMU (2-isolators and 1-VCB), rated 630 Amps and with O/C and E/F protection, short time current - 20kA for 3 sec, with 1 Nos ACB - 1250 amps and 1 no. 630 Amps & 5 nos. of 200 Amps MCCB outgoing feeders with adjustable setting, Non - Walk in type	No	2		
3	33 kV, 3C x 400 sq.mm, XLPE grade cable.	Mtr	3,500		
4	33kV Indoor ternimation kit including acessories for RMU	Set	40		
5	33 kV, Outdoor termination kit with accessories	sets	2		
6	33 kV, Straight through termination kit with accessories	sets	14		
7	Laying of GEE slab including nuts and bolts as per the drawing	No	175		
8	Earthing conductor - GI Strip 25 x 6 mm	Mtr	280		
B	**LV UG**				
1	Laying of 1.1 kV XLPE insulated, PVC sheathed, steel armoured underground cable with aluminium conductor of 1C x 630 sq.mm in trenches, with lugs & double Compression glands, GI nuts & bolts to terminate the cables in Distribution pillar.	Mtr	5,200		
2	Digging of cable trench, with supply and laying of bricks 250 mm long, sand bedding and LT route marker & joint marker every after 15 m to complete the work in full as per the specification and approved drawings.	Mtr	200		
3	1.1 kV, straight through jointing kit including all accessories.	No	21		
4	Distribution pillar as per the specification	No	2		
5	Spike earthing rod, 40 mm dia x 2500 mm long with GI earthing flats (25 x 6mm)	Set	8		
TOTAL LABOUR COST (Nu.)					

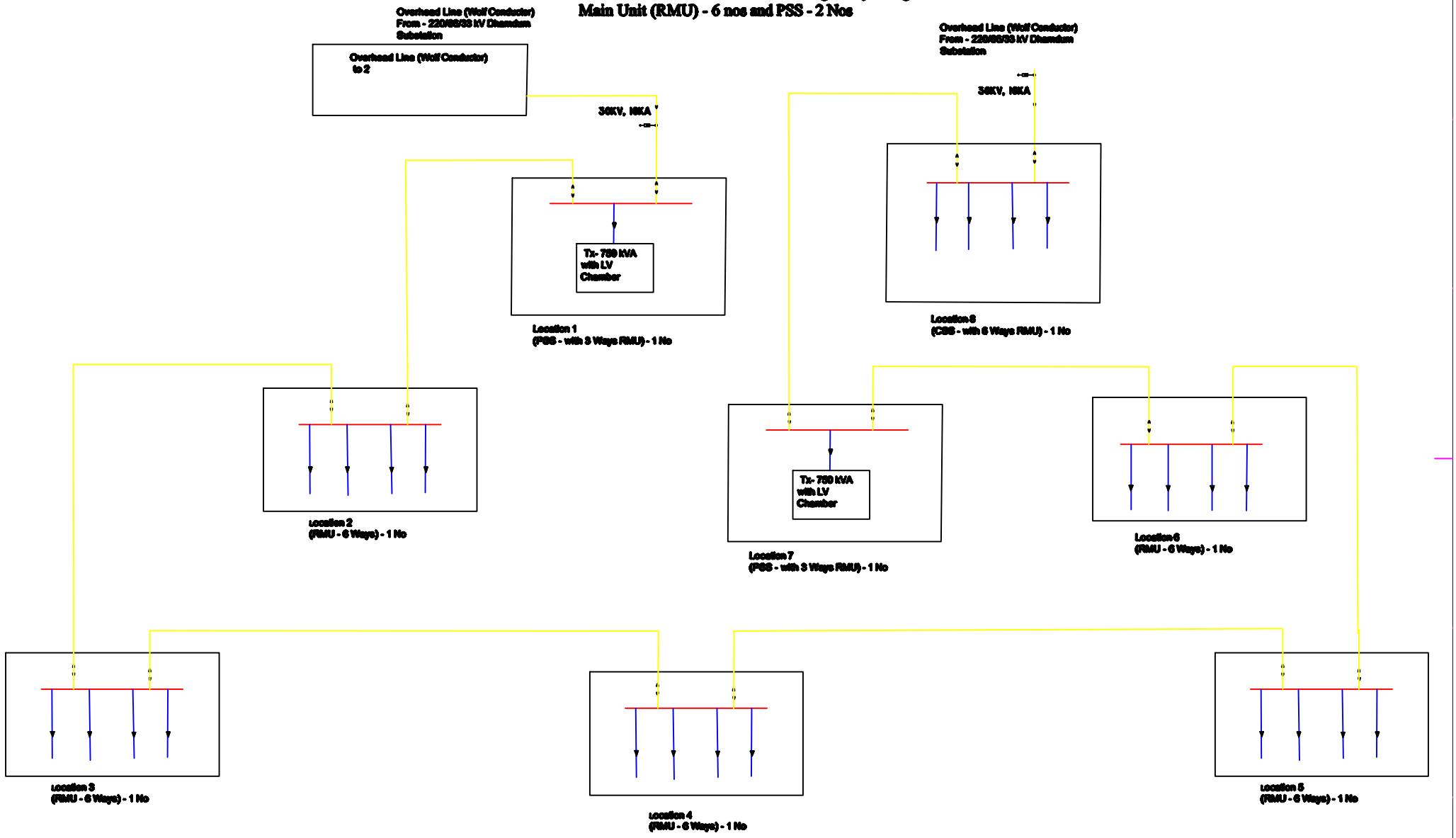
C CIVIL WORKS

Price schedule for Construction of foundation for Package substations/Ring main Unit

Sl.#.	Particulars	Unit	Provisional Qty.	Unit rate	Total Price
1	Earthwork in foundation trenches or drains not exceeding 1.5m in width or 10sq.m in area on plan including dressing & ramming, disposal of surplus soil within all lead and lifts All kinds of soil as per the drawing and directed by engineer in charge.	cu.m	30.00		-
2	Filling of trenches, sides of foundation etc. in layers<200mm using selected excavated earth, ramming etc. within lead 50m & lift 1.5m as directed by engineer in charge.	cu.m	18.00		-
3	Providing &laying cement concrete excluding the cost of centering and shuttering - 1:2:4, 20mm aggregates excluding the cost of centering & shuttering - in foundation & plinth as per drawings.	cu.m	0.48		-
4	Providing & laying Cement concrete 1:3:6, 40 mm agg., excluding p&f the cost of centering & shuttering-in foundation and plinth as per drawings.	cu.m	0.84		-
5	Providing & laying R.C.C 1:1.5:3, 20mm agg. excluding p&f the cost of formwork & reinforcement cost, below & incl. floor 2 level - Foundation, footings, bases of columns etc complete as shown in the drawings. (USS foundation)	cu.m	7.20		-
6	Providing & fixing cold twisted deformed bar (Fe500) for R.C.C work incl. cutting, bending, binding & placing in position complete.	kg	1,800.00		-
7	Providing & fixing centering and shuttering (formwork), including strutting, propping etc. and removal of formwork as directed by engineer in charge.	sq.m	42.00		-
8	Providing & laying 2nd class bricks work in foundation and plinth - CM 1:4 as per the requirement and drawings.	cu.m	0.84		-
9	Providing & laying 50mm thick Plinth Protection & grouted with fine sand mix including well rammed, finishing the top smooth - With cement CC 1:3:6, 20mm agg., laid over 75mm thick layer of compacted gravel (40mm) as directed by engineer in charge.	sq.m	9.84		-
10	Constructing second class brick masonry open surface drian in CM 1:4 incl. earth work in excavation, 100mm thk Cement Concrete bed 1:5:10, 40mm agg. 25mm thick CC 1:2:4, 12mm agg. for filling haunches, incl. 12mm cement plastering with a floating coat of neat cement (150 x 200 mm) as directed by engineer in charge.	m	20.40		-
11	Providing and laying hand packed stone soling or filling with stones - 400mm thick as per the drawing and directed by engineer in charge.	cu.m	1.80		-
12	Providing & laying 12mm cement plaster in CM 1:4	sq.m	35.93		-
13	Construction of earth pit chamber with supply and installation of earthing by 40 mm dia. x 3000 mm long GI pipe earth electrode with 40 x 8 mm GI plates. 3000 mm earth electrode including all civil works in complete as per the approved drawings.	Nos	4		-
	Amount for 1 foundation Nu.				**-**
	Amount for 8 Foundations Nu.				**-**

RevNo	Revision note	Date	Signature	Checked

Dhamdum UG Distribution Network Plan using 6 ways Ring Main Unit (RMU) - 6 nos and PSS - 2 Nos

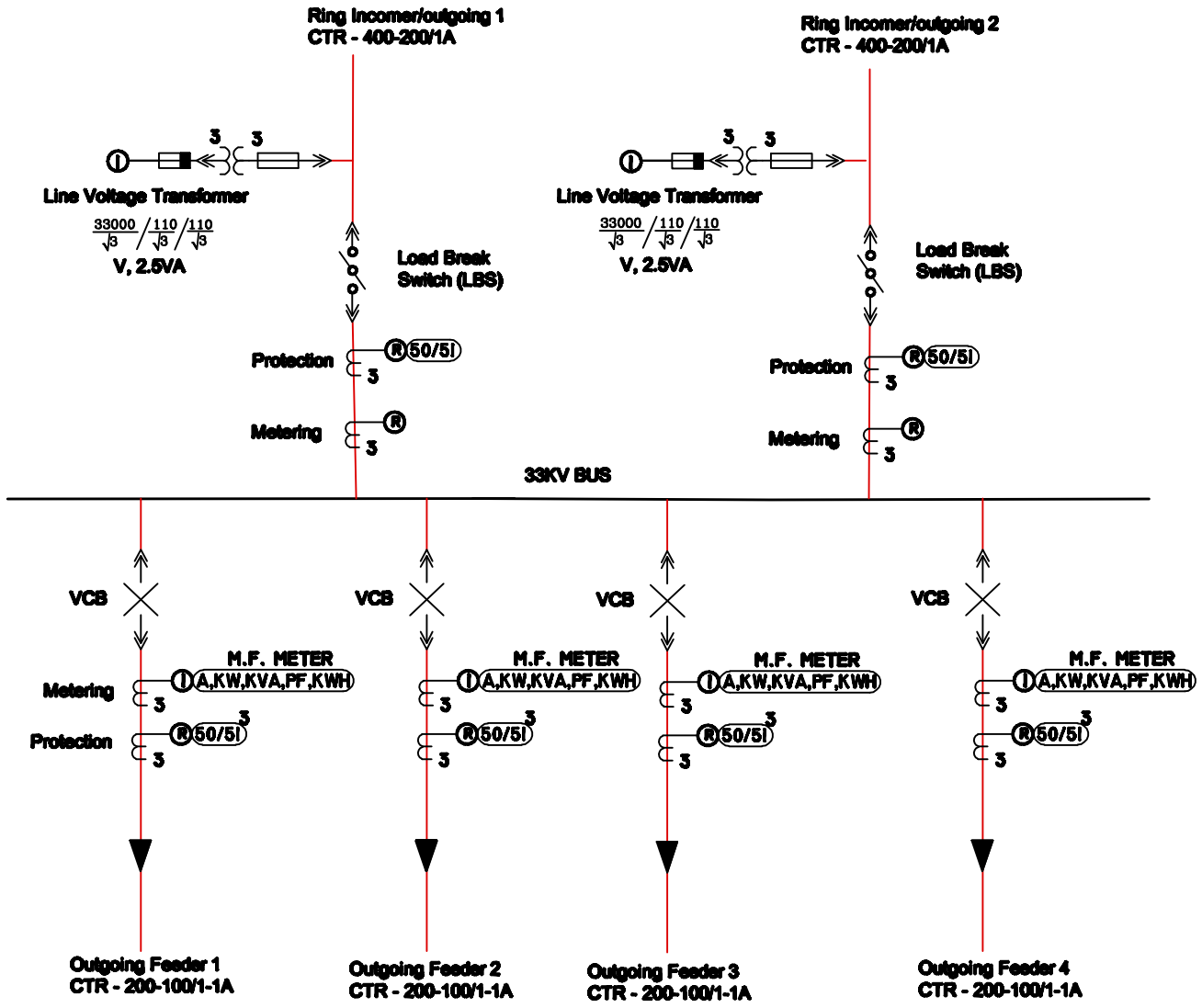


NOTE:

DHAMDUM INDUSTRIAL PARK

Title: 750 kVA, Package Substation and Ring main unit (6 Ways) for MV distribution network		File Name:	Date: *November 2020*	Scale: *NTS*
Division: Electricity Services Division Samtse	Bhutan Power Corporation Limited	Project: *Electrification Division, Distribution Construction Department, Distribution Services, Bhutan Power Corporation Limited.*		Code:

RevNo	Revision note	Date	Signature	Checked



LEGEND

SYMBOLS

- VOLTAGE TRANSFORMER
- CURRENT TRANSFORMER
  - FIG. INDICATES NO. OF CTs/VTs
  - R-RELAYING
  - I-INSTRUMENTATION
- CIRCUIT BREAKER
- INSULATOR/LBS
- LIGHTNING ARRESTER
- FUSE (THICK LINE INDICATES SUPPLY SIDE)
- HT HRC FUSE
- TWO WINDING TRANSFORMER

RELAYING

- REF RESTRICTED EARTH FAULT RELAY

INSTRUMENTATION

- A AMMETER
- V VOLT METER
- W WATT METER
- VAR VAR METER
- VS VOLT METER SELESTOR SWITCH
- F FREQUENCY METER
- PF POWER FACTOR METER
- MWh ENERGY METER
- MFM MULTI FUNCTION METER

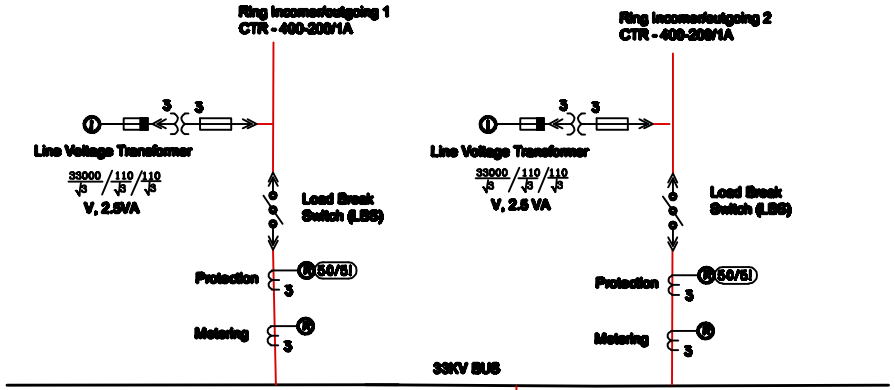
Note:
THIS SCHEMATIC IS NOT MEANT TO BE A DETAILED SPECIFICATION OF THE TENDER. IT IS FOR ILLUSTRATION PURPOSE ONLY.

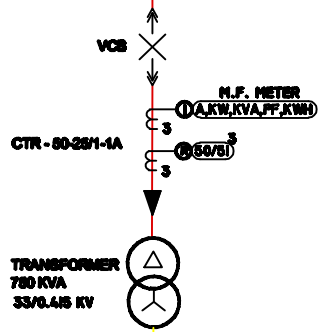
NOTE:

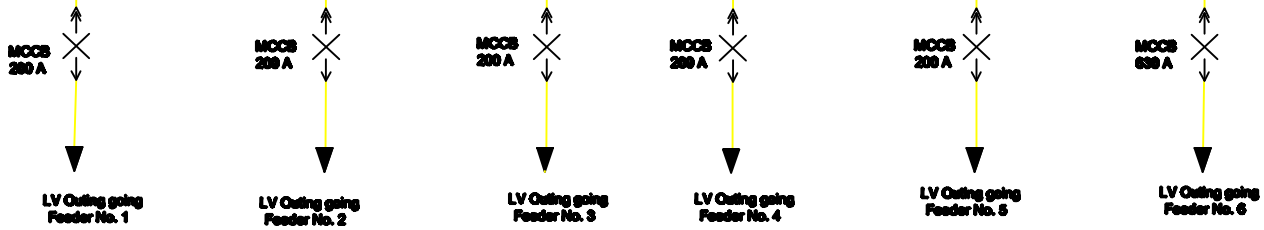
DHAMDUM INDUSTRIAL PARK

Title: Ring main unit (6 Ways) for MV distribution network		File Name:	Date: November 2020 / Scale: NTS
Division: Electricity Services Division, Samtse	Bhutan Power Corporation Limited	Project: Electrification Division, Distribution Construction Department, Distribution Services, Bhutan Power Corporation Limited.	Code:

RevNo	Revision note	Date	Signature	Checked







LEGEND

SYMBOLS

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- CURRENT TRANSFORMER
  - FIG. INDICATES NO. OF CTs/VTs
  - R-RELAYING
  - I-INSTRUMENTATION
- CIRCUIT BREAKER
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- LIGHTNING ARRESTER
- FUSE (THICK LINE INDICATES SUPPLY SIDE)
- HT HRC FUSE
- TWO WINDING TRANSFORMER

RELAYING

- REF RESTRICTED EARTH FAULT RELAY

INSTRUMENTATION

A	AMMETER
V	VOLT METER
W	WATT METER
VAR	VAR METER
VS	VOLT METER SELECTOR SWITCH
F	FREQUENCY METER
PF	POWER FACTOR METER
kWh	ENERGY METER
MFM	MULTI FUNCTION METER

Note:
THIS SCHEMATIC IS NOT MEANT TO BE A DETAILED SPECIFICATION OF THE TENDER. IT IS FOR ILLUSTRATION PURPOSE ONLY.

NOTE:

DHAMDUM INDUSTRIAL PARK

Title: 750 kVA, Package Substation with ring main unit (3 Ways) for MV distribution network		File Name:	Date: November 2020
Division: Electricity Services Division Samtse	Bhutan Power Corporation Limited	Project: Electrification Division, Distribution Construction Department, Distribution Services, Bhutan Power Corporation Limited.	Code:

Scale: NTS

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Bhutan Power Corporation Limited

(An ISO 9001:2015, ISO 14001:2015 & OHSAS 18001:2007 Certified Company)

Registered Office, Thimphu

Electrification Division

Distribution Construction Department

Distribution Services

Thimphu : Bhutan

Tender due date Extension.

Due date for submission of bids is extended as given below:

1. D – Submission of bids, Clause 20.3 (b) – should be read as "bear the following identification: Bids for the "Supply & Construction of UG Distribution Network for Dhamdum Industrial Park, Samtse"

   Bid Reference Number:
   BPC/DS/DCD/ED/C-03
   DO NOT OPEN BEFORE:
   29.12.2020, 14:15 hours

2. Clause 21.1 – should be read as "Bids must be received by the Employer at the address specified above no later than **13:00 hours on 29.12.2020."**

3. E – Bid Opening and Evaluation, Clause 24.1 – should be read as "The Employer will open the bids, including modifications made pursuant to Clause 23, in the presence of bidders' representatives who choose to attend, at **14:15 hours on 29.12.2020** at the Conference Hall of BPC, Thimphu."

(Pushpa Lal Acharya)
Sr. Manager

Tele # 02-321846, Fax # 02-321847 ; Email : ued@bpc.bt