

STANDARD TECHNICAL SPECIFICATION COVER SHEET

Specification No. : ENG-HV-2010

Specification Name : Specification for 11KV RMU Motorised Outdoor Type

Vijender Goyal	SHANTAPRIYA JENA	SATYA PRASAD NAYAK	JYOTIPRAKASH MOHANTY	Shailendra Kumar Jaiswal	SHIRISH SHARAD DIKAY
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPSODL	TPNODL	TPCODL	TPWODL	TPSODL	TPSODL
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1. SCOPE:

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading at site/store and performance of 11 KV motorized Ring Main Units with all accessories for trouble free & efficient performance.

2. APPLICABLE STANDARDS:

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured. and tested in accordance with latest editions of the following IEC/IS Standards and shall conform to the regulations of local statutory authorities.

IEC 62271-200	HV switchgear and control gear-AC Metal Enclosed switchgear and control gear for voltages above 1 kV and upto and including 52kV .
IEC 62271-1	Common specifications for high voltage switchgear and control gear standards
IEC 62271-102	HV switchgear and control gear-Alternating current disconnectors and earthing switches
IEC 62271-103	High voltage switches — Part 1: Switches for rated voltages above 1 kV and less than 52 kV
IEC 60529.	Degrees of protection provided by enclosures (1P Code)
IEC 62262	Degrees of protection provided by enclosures for electrical equipment against mechanical impacts (IK Code)
IEC 60060	High-voltage test techniques
IEC 60947 / IS 13947	Low voltage switchgear and control gear
IEC 60439-1	Low-voltage switchgear and control gear assemblies- Type tested and partially type tested assemblies
IEC 60255-151	Electrical relays - Part 3: Single input energizing quantity measuring relays with dependent or independent time.
IEC 60044-1 / IS 2705	Current Transformers
IEC 60044-2 / IS 3156	Voltage Transformers
IEC 60376	Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment
IEC 61958	High-voltage prefabricated switchgear and control gear assemblies - Voltage presence indicating system

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

1	Maximum ambient temperature	50 deg C
2	Max. Daily average ambient temp	35 deg C
3	Min Ambient Temperature	0 deg C
4	Maximum Humidity	100%
5	Average Annual Rainfall	150cm
6	Average No. of rainy days per annum	120
7	Altitude above MSL not exceeding	1000m

8	Wind Pressure	300 Km/hr
9	Earthquakes of an intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
10	Earthquakes of an intensity in vertical direction	equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)

TPCODL/TPNODL/TPSODL/TPWODL service area has **heavy saline conditions along the coast and High cyclonic Intensity winds with speed upto 300 Kmph**. The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months.

Note: Climatic Condition will be considered as per respective Discoms TPCODL/TPNODL/TPSODL/TPWODL.

4. GENERAL TECHNICAL REQUIREMENTS

Sl. No	Descriptions	As Specified By TPCODL/TPNODL/TPSODL/TPWODL
1	RMU Category	3Way Motorised (1CB + 2 LBS/ 2CB + 1LBS) 4Way Motorised (2CB + 2 LBS / 3CB + 1LBS) <i>(will be decided by user at the time of issuance of tender as per site requirement)</i>
2	RMU application	Outdoor.
3	Offered Model nos. and OEM type	a. 3 Way Non Extensible b. 4 Way Non Extensible
4	Dielectric medium	SF6
5	Interrupting medium	Vacuum- for CB SF6 for LBS and earth switch
6	System Frequency	50 Hz
7	Rated Voltage	12 KV
8	Service Voltage	11 KV
9	Rated current -Line Switches	630 A
10	Rated Current-CB and LBS	630 A for all type
11	Rated Short time current withstand (3 sec)	21 KA
12	Rated Short time Making capacity	50 KA
13	Rated cable charging interrupting current of incomer load break switch	10 A
14	Rated load interrupting line current	630 A
15	Rated cable charging breaking current of breaker	25 A
16	No. of operations at rated short circuit current on line switches, earthing switches should be E2	LBS- 5 close ES- 5 close The ES in line with CB

17	Opening time of breaker (max.) Without relay time	2.5 cycle
18	Closing time of breaker (max.)	3 cycle
19	Breaker Duty Cycle	O – 3min - CO - 3min – CO
20	i. Mechanical endurance for Isolator & Earth Switch	Min 1000 Operations
	ii. Mechanical endurance for Circuit Breaker	Min 2000 Operations
21	Electrical operations of at rated current a. LBS/Disconnecter b. Earth Switch	To be provided by bidder
22	Temp rise above ambient of 50 deg.	50 Deg C. (Type Tested as per IEC and complying to requirements)
23	Min Gas pressure in bar	To be provided by bidder based on type tested design
24	SF6 Gas pressure manometer with indicating bars/scale to measure the actual gas pressure (indirect method RFS etc. not accepted)	1. Dial type Manometer to be provided for gas pressure indication 2. Contacts to be provided and wires up on the TB for SCADA communication of gas status.
25	Enclosure	The RMU metal parts shall be 2mm thickness high tensile steel/CRCA. The overall paint thickness shall be 70 to 125 microns. (will be decided by user at the time of issuance of tender as per site requirement)
26	Guaranteed SF6 leakage per annum	Less than 0.1% from main tank
27	Degree of protection	a. IP 67 for the tank and b. IP2X for the front cover / mimic board and c. IP 54 (Main door closed) for Outdoor RMUs. d. IP 54 for cable compartment
28	Internal Arc rating	IAC AFL or better
29	Internal Arc test	20kA for 1 Sec.
30	Lightning Impulse withstand Voltage	75 kVp
31	Power Frequency withstand voltage	28 kVrms.
32	SF6 Tank design	Hermetically/robotically sealed unpainted stainless steel enclosure with SF6 Gas. Sealed pressure system by Laser welding / TIG & MIG welding so that no refilling of gas is required for 30 years. No gas work at site. Complete body shall be tamperproof to prevent access to live parts. No gaskets shall be used. No bolts shall be provided.

32.1	Tank material and grade of SS and welding	Should be of SS and non-corrosive, offered grade of SS to be mentioned. The welding shall be such that there shall be corrosion of welding for useful life of equipment.
33	Earth bus bars	In enclosure to prevent tampering.
34	Material & size of earth bus bar	To be provided by the bidder
35	Earthing of main CCT Cables shall be earthed with earth switch with S/C making capacity as per IEC 129. closing shall be possible only when Isolator is open	To be provided by the bidder
36	Incomer Load Break switch: Shall be SF6 insulated with least maintenance. Shall have at least 3 positions, Open, Close & earth with natural interlocks. Fitting of motor at site shall be possible & shall have mechanical interlock. The electrical interlock for preventing manual closing of earth switch under cable charged condition to be provided.	To be provided by the bidder
37	Circuit Breakers: a. With VCB interrupter and SF6 insulated bus with minimum maintenance and shall have at least 2 positions I.e. Open & Close, Manual operation & fitting of motor at site shall be possible if required. b. In view of safety each VCB shall be assisted with feeder side disconnect having 3 positions, open disconnected, closed, and earth (having fault making capacity) and shall be constructed in such a way that natural interlocking prevents unauthorized operations.	To be provided by bidder as per specs.
38	Protection Relay-Without auxiliary power & shall include , electronic relay, low energy release & fast on test receptacle for protection testing	To be provided by bidder as per specs.
39	Make of self-powered Relay & offered model	a. For TPCODL/TPNODL/TPSODL/TPWODL, ODISHA – ABB, Ashida, Schneider, Siemens
40	Flag indication for CB Trip on fault in relay/ mechanical or Electrical	To be provided by bidder
41	Testing of Cable- If doors are opened then earth switch shall be in closed position with necessary interlocks and cable test rod fixing provision in bolt head which can be fixed on terminations through boot cap/opening for testing purpose AND if doors are opened it shall not be possible to operate, Isolator, E/Switch or CB through interlocks	To be confirmed. If separate test bushing are provided, it shall be covered with suitable antitheft covers with anti vandal screws

42	Protection against theft	Design of RMU shall be tamper & arc proof. Anti vandal screws shall be provided. Cable covers shall be pad lockable. All live parts and internal parts etc. shall be covered with antitheft covers.
43	Doors	Outer enclosure should be hinged main door with padlock provision. Cable chamber door should not be hinged type. It should be arc proof with bolted arrangement.
44	Voltage indicator box shall be fixed type-This device shall be in compliance with IEC 62271-206:2011 standard only	Capacitive dividers type which will supply low voltage to power the lamps and 3 inlets can be used to check phase sequence or presence of voltage in cable
45	Cable cleats (full circle)	HDPE/Nylon (Fire Retardant)
46	Cable termination and bushing suitability	Heat/ Cold shrink terminations
46A	Cable Termination boot /Cable boot	Cable Termination Kit & Termination Boot in scope of Supplier.(Raychem/3M Make only) Cable Size in detailed Engineering Stage
46	Cable compartment suitability shall be	Suitable for cable sizes a. 11kV 3CX400 sq.mm having dia of 92mm in all compartment and b. For three way with two CB the LBS shall be suitable for 11kV 1CX630 sq.mm cable having diameter of 51mm in incomer LBS- the necessary cleat and nonmagnetic base plate cable entry arrangement and 15mm longer bolt than other compartment shall be provided.
47	The cable compartment	All cable compartment shall be bottom entry and front opening type only
48	Size of bimetallic washer in all compartments	Must be suitable for M16 for TPCODL/TPNODL/TPSODL/TPWODL, ODISHA) bolt and bushing sizes with min. 2mm thick.
49	Height of bushing terminal from base plate	Minimum 800mm for proper termination space.
50	Fault passage indicator	FPI on each LBS as a part of each RMU with specified default setting. FPI should be communicable type with remote resettable functionality.
51	Operating handle	To be provided by bidder as a part of RMU with each RMU and to be placed on front or on door

52	Non removable MIMIC Diagram on Front of panel	To be provided by bidder with detailed descriptions as mentioned in specs. And earth switch marking background shall be yellow for TPCODL/TPNODL/TPSODL/TPWODL-ODISHA As per annexure-2
53	Main Bus bar Material	Copper
53.1	Bus bar Cross Section	To be specified by bidder as per current density
54	Opening & Closing times with relay	125 ms maximum
55	Current Transformer for CB compartment	Shall be epoxy resin casted and mounted on cables. The CTs around the cables shall be supported on the sheet steel bracket and should be fixed with bolts. The mounting frame should be moveable up and down or to and fro but shall be fixed at coaxial position with base plat holes and bushing terminal bolts. a. For TPCODL/TPNODL/TPSODL/TPWODL, ODISHA The CT settings shall be adjustable & Primary & Secondary Current and range to be decided by user at the time of issuance of tender as per site requirement Burden is 2.5 VA, Class - 5P20.
56	Future motorization and SCADA Compatibility	To be provided
57	Guarantee	As per specification
58	Dimension (LxWxH) (mm x mm x mm)	To be provided by bidder
59	Total weight	To be provided by bidder
60	Paint	Light Gray shade RAL 7032
61	Type test of product	To be provided by bidder as per specification
62	Availability of spares	Assurance by bidder for 25 years,list of spares as mentioned in specification to be provide along with RMU lot
63	VPIS auxiliary contact	The VPIS shall have auxiliary contact such that it can be configured with SCADA for remote status indication of cable charged. The auxiliary contact to be wired up in TB.
64	VPIS	In all compartments
65	Breaker operation counter	To be provided by bidder
66	LBS operation counter	To be provided by bidder
67	Moisture absorption material in SF6 tank	Bidder should provide the detail of the moisture absorption material.

68	Making of earthing operations	a. For TPCODL/TPNODL/TPSODL/TPWODL, ODISHA All earth operation to be marked with Yellow back ground and permanent in nature.
69	Auxiliary contacts (and spare numbers to be provided)	LBS (4NO+4NC) Earth Switch (2NO+2NC) CB (4NO+4NC) CB Disconnecter (2NO+2NC) CB earth switch (2NO+2NC)
70	Control cable entry provision	To be provided
71	Shunt trip coil 24V DC	To be provided
72	MCB for LT AC incomer and TB connection of all CT, Aux switches and relay wiring	To be provided
73	RMU Cable Boot/ terminal protector	
a	Terminal protector	Insulating Boots
b	System voltage	12 kV
c	AC High voltage	28kV For 1 min
d	Impulse withstand voltage	75kV
e	Bushing Diameter	To be provided by bidder
f	Bushing Types	To be mentioned by bidder
g	Cable cross section suitability	Bidder to provide complying to specs.
h	Bushing Material & Class	Epoxy bushing-F class
h	Dimensions of cable protector	Suitable for cables & bushing in specs (offered size to be provided by bidder)
i	Material of the component	To be specified by bidder
j	Type test reports	Bidders to provide detailed list of tests conducted at lab name, conducted dates, report number along with full reports.
For motorized RMU		
1	SCADA Compatibility-Remote operation of RMU shall be possible by using motors fitted to operating mechanism of isolators & CB etc.	To be provided
2	Harting Plug arrangement for individual isolator as well as breaker motor connections, which will be fitted on RMU body itself	To be provided
3	Details of I/O	As per Annexure-IO list of this specs
4	System to prevent mal operation in case of latch command	Bidder to provide inbuilt system to prevent any mal operation in case of latch command at RMU in case of any fuse failure or DC fail situation

5	Technical Details of motors	
a	Operating Voltage	24 V DC
b	Max. power rating	240 Watts
c	Max current drawn	9 Amp ($\pm 10\%$)
d	Operating time	4-8 seconds
e	Power Supply	24VDC from Battery Charger and 230 VAC from Aux PT in scope of Supplier (Aux PT is optional and to be Quoted Separately)

Type of Ring Main Units shall be as under:

3 Way/4 Way Non Extensible Type (For Outdoor application):

3Way Motorised (1CB + 2 LBS/ 2CB + 1LBS) with Self powered O/C & E/F Relay and 1 FPI

4Way Motorised (2CB + 2 LBS / 3CB + 1LBS) with Self powered O/C & E/F Relay and 1 FPI

(will be decided by user at the time of issuance of tender as per site requirement)

5. GENERAL CONSTRUCTIONS

5 GENERAL CONSTRUCTION FOR RMU

5.1.1 The switchgear and bus bar shall be contained in a stainless steel tank filled with SF6 gas and the outer body shall be made of minimum CRCA of 2mm or GI high tensile steel 2mm thick with thick gland plates of 3mm. The sheet steel shall have surface treatment of 7 tank process With powder coating of minimum 70 microns. The tank shall have SS sheet of minimum 2mm thickness with internal Arc Type tested and meet the "sealed pressure system" criteria in accordance with the IEC 62271-200. This is a system for which no handling / refilling of gas shall be required throughout the expected operating life, i.e. 30 years. Sealed pressure systems are completely assembled, filled and tested in the factory. The maximum leakage rate of SF6 gas shall be lower than 0.1 % of the total initial mass of SF6 gas per annum. The filling pressure for the switchgear shall be just above the atmospheric pressure so as to reduce the tendency to leak. SF6 gas used for the filling of the RMU shall be in accordance with IEC 376. It is preferable to fit an absorption material in the tank to absorb the moisture from the SF6 gas and to regenerate the SF6 gas following arc interruption. The degree of protection for RMU tank (Indoor/Outdoor) shall be IP 67. The mimic board shall be provided with IP2X /IP3X degree of protection for Indoor RMUs and protection for Outdoor RMUs shall be minimum IP 54

The RMU shall be suitable for mounting on plinth with provision for cabling through gland plate in the base and trench below, The RMU shall be designed so that the position of the different devices is visible to the operator on the front and operations are also visible. The RMU shall be identified by an appropriately sized label which clearly indicates the functional units and their electrical characteristics. The RMU shall be designed to be tamper proof so as to prevent access to all live parts during operation without the use of tools.

5.1.2 The RMU shall be completed with all connection and electrolytic copper bus bar with continuous current carrying capacity of 630A at 50 Deg C ambient. The bus bar shall be fully encapsulated by SF6 gas inside the steel tank. There shall be continuity between the metallic

parts of the RMU and cables so that there is no electric field pattern in the surrounding air, thereby ensuring the safety of people. The earth bus bar shall be preferably enclosed in an enclosure to prevent theft/tampering.

5.1.3. All parts of main circuit to which access is required or provided shall be capable of being earthed prior to becoming accessible. This does not apply to removable parts which become accessible after being separated from the switchgear and control gear. The cables shall be earthed by an earth switch with short-circuit making capacity in compliance with IEC 62271-102. Circuit breaker shall not be closed in case Earth Switch is closed. The earth switch shall be fitted with its own operating mechanism and manual closing shall be driven, by a fast-acting mechanism, independent of operator action. Mechanical interlocking systems shall prevent access to the operating shaft to avoid all operator errors such as closing the earth switch when cable is charged.

5.1.4 Any accidental over pressure inside the sealed chamber shall be limited by the opening of a pressure limiting device provided in the rear part of the tank. Gas shall be released to the rear of the RMU away from the operator. Bidder shall provide type test report to prove compliance to the 'Internal fault IAC AFLR as per IEC 62271-200. An anti-reflex mechanism on the operating lever shall prevent any attempts to reopen immediately after closing of the switch-or earth switch. All manual operations shall be carried out on the front of the RMU. The instrument transformers (CT/PT) shall be required and to be incorporated in the drawing for discussion at the final stage.

5.1.5 Circuit Breaker for Transformer Local Feeder Control

The circuit breakers shall be of the maintenance free. The position of the power and earthing contacts shall be clearly visible on the front of the RMU. The circuit breakers shall have at least 2 positions: Open-disconnected and closed and shall be constructed in such a way that natural interlocks prevent all unauthorized operations. They shall be fully mounted and inspected in the factory. Breaker operation counter should be provided

An operating mechanism can be used to manually close the circuit breaker and charge the mechanism in a single movement. It shall be fitted with a local system for manual tripping by, an integrated push button. There will be no automatic re-closing. The operating mechanism shall be compatible for remote/SCADA operation. The circuit breaker shall be associated with an integrated protection unit that will operate without any auxiliary power supply and shall include three toroid transformers incorporated in the transformer tee-off bushings, an electronic self powered relay, a low energy release, and a "fast-on" test receptacle for protection testing (with or without CB tripping). The protection system shall ensure circuit breaker tripping as of a minimum operating. current which is the rated current of the underground network to be protected. The CT settings shall be adjustable & Primary & Secondary Current and range to be decided by user at the time of issuance of tender as per site requirement . Protection core CT complete details should be furnished (Burden, class, ALF).

The circuit breaker shall be provided with Phase protection of Definite time/ IDMT element for .overcurrent and earth fault with minimum PSM-0.05,Tsm-0.01 having standard characteristics of Standard Inverse, Very inverse, Extremely Inverse as per IEC 60255-3 standard. The Earth Fault Protection shall be provided of. Definite time/ IDMT element having standard characteristics of Standard Inverse, Very inverse, Extremely Inverse as per IEC 60255-3 standard. The "Time Multiplier" with minimum set point of 0.05 TMS shall be available. The breaker shall have the provision of flag Relay for indication of Trip on Fault. High set (DT) for overcurrent and earth fault-min .current setting-0.5 In, minimum Time Delay-20 millisecond. The relays shall be suitable numerical relay with necessary elements or any other relay as per the Purchaser's approval.

There' shall be provision for testing of cable without opening the front door by suitable arrangements. In case cables are to be tested with front door open, doors shall have interlocks such that doors can be opened only with earth switch in closed position. Termination boots as approved by the Purchaser's should have a proper opening to facilitate the testing. The opening shall be covered by means of removable protection cap

In case of front door opened, it shall not be possible to operate the breaker. All panel covers shall be provided with anti vandal screw bolts so that opening of panel covers is only possible with special tools, which shall be provided by the Bidder. This is required to prevent pilferage. The cable cover door shall be pad lockable and shall be Tamper and Arc proof. There shall be provision of hinged doors in the RMU. The circuit breaker and earth switch shall be lockable in the open or closed positions by 1 to 3 padlocks. Breaker shall have mechanical life of at least 2000 operations. The circuit breaker shall be compatible for remote operation and can close (ON) and open (OFF) by remote operation.

5.1.6 Incomer Load Break Switches :

The Load break switches shall have positions, open-disconnected closed, and earthed, and will be constructed in such a way that natural interlocking prevents unauthorized operations

The position indicator shall provide positive contact indication in accordance with IEC 265-1 standard. In addition, manufacturer shall prove reliability of indication in accordance with IEC 129.

The switches shall be fully mounted and inspected in the factory. Manual opening and closing will be driven by a fast-acting mechanism, independent of operator action.

Mechanical Interlock should be provided for Earth switch, If cable is back charged Earth switch should not be closed.

Each switch can be fitted with an electrical operating mechanism in a specially reserved location, without any modification of the operating mechanism and without de-energizing the RMU.

Load break Switch should be operated manually & motorized.

5.1.7 Bushings and Cable terminations:

Each cable compartment shall be provided with three bushings of adequate sizes to terminate the incoming and outgoing cables along with a terminal block (TB) located at convenient accessible location so as to wire all inputs & outputs (IOs) up to the terminal block (TB). The bushings shall be conveniently located for proper bend so as to allow easy working and termination of cables. The cable termination shall be done with Heat shrinkable /Push ON termination method so that adequate clearances are maintained between phases & cable shall be held by HDPE (fire retardant) cleat. 2 runs, of 3CX400 Sq mm, OR 1R of 3 NO. 1CX630 Sq mm shall be used for cable termination.(It shall be finalized during detailed engineering) All the cable secondary Wiring should be rooted through marshaling box separately for relay, CT etc.BA should provide bimetallic washer for tightening of cable.

5.1.8 Earthing:

The RMU outdoor metal clad, switchgear, Distribution Transformer, R.S. Joists, M.S Channels/M.S. angles etc, shall be equipped with an earth bus securely fixed along the base of the RMU. The size of earth busbar of GI Strip (75X12 mm) shall be as per IEC/IS. Provision shall be made on end of RMU for connecting the earth bus to the earth grid by erecting suitable 2 earth pipes of 50mm dia. M.S. rod of 3 meter in Pits. Both the earth pipes are also to be connected in a grid formation. Necessary terminal clamps and connectors shall be included in the scope of supply.

5.1.9 Voltage indicator lamps and phase comparators:

Each function shall be equipped with a fixed type voltage indicator box on the front 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. These devices shall be in compliance with IEC 61958 standard.

5.1.10 Front Cover

The front cover shall provide a clear mimic diagram that 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 bidder shall provide a marking plate showing RMU's main electrical characteristics.

5.1.11 Fault Passage Indicators

Fault Passage Indicators shall be installed on the Ring Main Unit. These devices shall be, electronic devices with their own energy source and connected to Single 3 phase Split Core CTs (CBCT) . These shall be provided with bright LED s / flag. Indicators, which shall be clearly visible in the day time. These shall have the following resetting facilities:

- Manual reset
- Resetting after a set time duration
- Electrically reset from remote with at least 2-spare potential free Contacts.

The unit shall have Short Circuit and Earth fault adjustable to different settings with separate Current transformer. They shall be fully field-programmable and shall have at least 16 settings for Earth Fault + 4 settings for Phase-Phase. It shall be possible to Test these indicators at site thru "Test" push button. The Fault Passage Indicators shall also be provided with a SCADA output contact. These shall confirm to the following standards:

IEC 60068-2-6, IEC 60068-2-9	: Environmental testing — For Vibration, solar radiations
IEC 60950	: Information Technology equipment - Safety
IEC 1000-2	: Electromagnetic compatibility for low-frequency conducted disturbances and signaling in public low power supply systems
IEC1000-4	: EMC - Testing & Measurement
IEC 1000-6	: EMC- Immunity for Residential, Commercial and light industrial environments

5.1.12 Remote Control of the RMU:

Remote operation of the RMU line switches shall be possible using pre- fitted motors to the operating mechanism for both line switch and circuit-breaker functions. All the necessary accessories shall be supplied separately, to stores.

Auxiliary contacts for remote indication of switch status are also required.

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 shall also be provided.

Preferred Communication protocol for FRTU shall IEC-60870-5-104

Signal requirement for field RTU (which shall be mounted near RMU) is attached (refer Annexure1). Bidder shall quote the cost of field RTU (FRTU) separately with all technical details for acquisition of the signal as described in Annexure-1.

5.1.13 Paint

All paint shall be applied on clean dry surfaces under suitable atmospheric conditions by seven tank process and powder coating. The overall paint thickness shall be 70 to 125 microns. (will be decided by user at the time of issuance of tender as per site requirement). The paint shall not scale off

or crinkle or be removed by abrasion during normal handling. The enclosure of the RMU shall be painted with shade Dark Gray, i.e., BS381C or RAL 7032. Sufficient quantity of touch-up paint shall be furnished for application at site.

6. MARKING

All the components and operating devices of the RMU shall be provided with durable and legible nameplates containing all technical parameters. Name plates shall be suitably embossed with " PO no. with date", "PROPERTY OF TPCODL/TPNODL/TPSODL/TPWODL & PO Number along with the following information. A Danger plate of appropriate size shall also be provided on the enclosure.

- a) Manufacturer's Name
- b) Month and year of supply
- c) PO Number
- d) Rated Voltage
- e) System Frequency
- f) Rated Short time withstand current for 1 sec
- g) Rated Impulse withstand Voltage
- h) Degree of Protection
- i) Type Designation or Serial no.
- j) Year of manufacture
- k) Applicable Rated values
- l) Mass of unit
- m) SF6 gas filling pressure

7. TESTS

7.0 TESTS FOR RMU

All the Routine and acceptance tests shall be carried out in accordance with the relevant IS/IEC standards. All routine/acceptance tests shall be witnessed by the purchaser/his authorized representative. All the components within the RMU enclosure shall have been tested for Routine/acceptance and Type tests as per the relevant standards. All Type tests as per latest IS / IEC shall have been carried out on the RMU as a whole as per relevant IS/IEC. Following tests shall be necessarily conducted on the equipment and its components in addition to others specified in the IS/IEC:

Type Test

- a) Power Frequency withstand test
- b) Mechanical operation test and checking of interlocks
- c) Dielectric test on main and control circuits.
- d) Temperature Rise test.
- e) Internal Arc withstand test,
- f) Degree of Protection test.
- g) Test to check the capability of main and earthing circuits subjected to rated peak and short time withstand current.
- h) Test to check the total time taken to clear the faults (relay pick up+ Trip coil pick up + breaker trip) for instantaneous & time delay modes.under various settings of relay and trip coil thru secondary current injection.
- i) Salt Spray Test

The above type test certificates must accompany drawing of type tested equipment, duly signed by type testing authority.

The above tests must not have been conducted on the equipment within time frame as per latest CEA Guidelines. In case of any change in design/type of Breaker already type tested and the one offered against this specification, the owner reserves the right to demand repetition of type tests, without any extra cost.

All Type tests must be conducted from CPRI/ERDA, Govt Laboratory or International Laboratory.

Routine test:

Following routine tests are to be done on 100% of the lot quantity

2. Dimensional & Visual Checks
3. Operational & Interlock Tests of breaker & isolator switches
4. Measurement of Circuit Resistance
5. Sf-6 chamber pressure withstands/leakage test.
6. HV withstand test across isolator distance.
7. HV withstand test of control and auxiliary circuits.
8. Voltage Indication Tests.
9. Breaker Contact Resistance Test
10. Total Trip Time Check Test through Current Injection in primary.
11. IR Value.

Below routine test has to be provided on cable Boot for cable termination:

- a) Visual inspection of the final finished product.
- b) Intactness with Bushing.
- c) Insulation Test.
- d) AC HV test.

Acceptance test:

All the tests specified under Routine Test Clause above shall be carried out as acceptance test on random samples as per sampling plan under IEC/IS for each lot.

Bidder should have all the requisite testing equipment's to carry out routine and acceptance test mentioned above including:

- a. Facility for primary current injection up to 1000amp.
- b. Facility to check total trip timing of breaker along with breaker main contacts through primary current injection

8.0 TYPE TEST CERTIFICATE

The Bidder shall furnish the type test certificates of the 11 KV RMU for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI/ERDA or any other International Laboratory as per the relevant standards. Type tests shall have been conducted in CPRI/ERDA or any other International laboratories during the period not exceeding time span as per CEA guidelines. In the event of any discrepancy in the test reports, i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to TPCODL/TPNODL/TPSODL/TPWODL.

9.0 PRE-DISPATCH INSPECTION

Equipment shall be subjected to inspection by a duly authorized representative of the TPCODL/TPNODL/TPSODL/TPWODL. Inspection may be made at any stage of manufacture at the option of the purchaser and the equipment if found unsatisfactory as to workmanship or material is liable to rejection. Supplier shall grant free access to the places of manufacture to TPCODL/TPNODL/TPSODL/TPWODL's representatives at all times when the work is in progress. Inspection by the TPCODL/TPNODL/TPSODL/TPWODL or its authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance

Certificate) is issued by TPCODL/TPNODL/TPSODL/TPWODL. Following documents shall be sent along with material

- a) Test reports
- b) MDCC issued by TPCODL/TPNODL/TPSODL/TPWODL
- c) Invoice in duplicate
- d) Packing list
- e) Drawings & catalogue
- f) Guarantee / Warrantee card
- g) Other Documents (as applicable)

10.0 INSPECTION AFTER RECEIPT AT STORE

The material received at TPCODL/TPNODL/TPSODL/TPWODL Store will be inspected for acceptance and shall be liable for rejection if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Project Engineering department.

11.0 GUARANTEE

Bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this contract for due and intended performance of the same, as an integrated product delivered under this contract. In the event any defect is found by the Purchaser up to a period of at least 48 months from the date of commissioning or 60 months from the date of last supplies made under the contract whichever is later, Bidder shall be liable to undertake to replace/rectify such defects at its own costs, within mutually agreed time frame, and to the entire satisfaction of the Purchaser, failing which the Purchaser will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the Purchaser's own charges (@ 20% of expenses incurred), from the Bidder or from the " Security cum Performance Deposit" as the case may be.

Bidder shall further be responsible for 'free replacement for another period of **THREE** years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by the Purchaser.

12.0 PACKING

Bidder shall ensure that all equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit

13.0 TENDER SAMPLE

Not applicable.

14.0 QUALITY CONTROL

The bidder shall submit with the offer, assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and after finishing, bought out items and fully assembled component and equipment including drives. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The Purchaser's or its nominated representative engineer shall have free access to the manufacturer/sub-supplier's works to carry out inspections.

15.0 TESTING FACILITIES

Bidder shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards.

16.0 MANUFACTURING ACTIVITIES

The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage with quantity. This bar chart shall be in line with the Quality Assurance Plan, submitted with the offer. This bar chart will have to be submitted within 15 days from the release of the order.

17.0 SPARES, ACCESSORIES & SPECIAL TOOLS/GAUGES

Bidder shall provide a list of recommended spares with quantity and unit prices for 5 years of operation after commissioning. The Purchaser may order all or any of the spare parts listed at the time of contract award and the spare parts so ordered shall be supplied as part of the definite works. The Purchaser may order additional spares at any time during the contract period at the rates stated in the Contract Document. Bidder shall give an assurance that spare parts and consumable items will continue to be available through the life of the equipment which shall be 25 years minimum. However, the Purchaser shall give a minimum of 12 months notice in the event that the Bidder or any sub-vendor plans to discontinue manufacture of any component used in this equipment.

Any spare apparatus, parts or tools shall be subject to the same specification, tests and conditions as similar material supplied under the Contract. They shall be strictly interchangeable and suitable for use in place of the corresponding parts supplied with the plant and must be suitably marked and numbered for identification.

18.0 DRAWINGS & DOCUMENTS

Following drawings and documents shall be prepared based on TPCODL/TPNODL/TPSODL/TPWODL specifications and statutory requirements and shall be submitted with the bid:

- a) Completely filled in Technical Particulars
- b) General description of the equipment and all components including brochures.
- c) General arrangement for RMU
- d) Power flow diagram
- e) Foundation plan
- f) Bill of material
- g) Experience List
- h) Type test certificates

Drawings / documents to be submitted after the award of the contract are as under:

Sl. No.	Description	For Approval	For Review/Information	Final Submission
1	General Technical Particulars	✓		✓
2	General Arrangement drawings	✓		✓
3	Schematic Diagram	✓		✓
4	Bill of materials	✓	✓	✓
5	Foundation Plan & loading details		✓	✓
6	Installation Instructions		✓	✓
7	Instruction for Use		✓	✓
8	Transport/ Shipping dimension drawing	✓	✓	✓
9	QA & QC Plan	✓	✓	✓
10	Test Certificates			

All the documents & drawings shall be in English language.

After the receipt of the order, the successful bidder will be required to furnish five copies of all relevant drawings for TPCODL/TPNODL/TPSODL/TPWODL approval.

Instruction Manuals: Bidder shall furnish two softcopies (CD) and four (4) hard copies of nicely bound manuals (In English language) covering erection and 'maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices.

19. GUARANTEED TECHNICAL PARTICULARS

Sl. No	Descriptions	As Specified By TPCODL/TPNODL/TPSODL/TPWODL
1	RMU Category	
2	RMU application	
3	Offered Model nos. and OEM type	
4	Dielectric medium	
5	Interrupting medium	
6	System Frequency	
7	Rated Voltage	
8	Service Voltage	
9	Rated current -Line Switches	
10	Rated Current-CB and LBS	
11	Rated Short time current withstand (3 sec)	
12	Rated Short time Making capacity	
13	Rated cable charging interrupting current of incomer load break switch	
14	Rated load interrupting line current	
15	Rated cable charging breaking current of breaker	
16	No. of operations at rated short circuit current on line switches, earthing switches should be E2	
17	Opening time of breaker (max.) Without relay time	
18	Closing time of breaker (max.)	
19	Breaker Duty Cycle	
20	i. Mechanical endurance for Isolator & Earth Switch	
	ii. Mechanical endurance for Circuit Breake	
21	Electrical operations of at rated current	
	a. LBS/Disconnecter b. Earth Switch	
22	Temp rise above ambient of 50 deg.	
23	Min Gas pressure in bar	
24	SF6 Gas pressure manometer with indicating bars/scale to measure the actual gas pressure (indirect method RFS etc. not accepted)	
25	Enclosure	
26	Guaranteed SF6 leakage per annum	

27	Degree of protection	
28	Internal Arc rating	
29	Internal Arc test	
30	Lightning Impulse withstand Voltage	
31	Power Frequency withstand voltage	
32	SF6 Tank design	
32.1	Tank material and grade of SS and welding	
33	Earth bus bars	
34	Material & size of earth bus bar	
35	Earthing of main CCT Cables shall be earthed with earth switch with S/C making capacity as per IEC 129. closing shall be possible only when Isolator is open	
36	Incomer Load Break switch: Shall be SF6 insulated with least maintenance. Shall have at least 3 positions, Open, Close & earth with natural interlocks. Fitting of motor at site shall be possible & shall have mechanical interlock. The electrical interlock of cable charge with earth switch is preferred.	
37	Circuit Breakers: a. With VCB interrupter and SF6 insulated bus with minimum maintenance and shall have at least 2 positions i.e. Open & Close, Manual operation & fitting of motor at site shall be possible if required. b. In view of safety each VCB shall be assisted with feeder side disconnect having 3 positions, open disconnected, closed, and earth (having fault making capacity) and shall be constructed in such a way that natural interlocking prevents unauthorized operations.	
38	Protection Relay-Without auxiliary power & shall include , electronic relay, low energy release & fast on test receptacle for protection testing	
39	Make of self-powered Relay & offered model	
40	Flag indication for CB Trip on fault in relay/ mechanical	

41	Testing of Cable- If doors are opened then earth switch shall be in closed position with necessary interlocks and cable test rod fixing provision in bolt head which can be fixed on terminations through boot cap/opening for testing purpose AND if doors are opened it shall not be possible to operate, Isolator, E/Switch or CB through interlocks	
42	Protection against theft	
43	Doors	
44	Voltage indicator box shall be fixed type-This device shall be in compliance with IEC 62271-206:2011 standard only	
45	Cable cleats (full circle)	
46	Cable termination and bushing suitability	
46A	Cable Termination boot /Cable boot	
46	Cable compartment suitability shall be	
47	The cable compartment	
48	Size of bimetallic washer in all compartments	
49	Height of bushing terminal from base plate	
50	Fault passage indicator	
51	Operating handle	
52	Non removable MIMIC Diagram on Front of panel	
53	Main Bus bar Material	
53.1	Bus bar Cross Section	
54	Opening & Closing times with relay	
55	Current Transformer for CB compartment	
56	Future motorization and SCADA Compatibility with FRTU	
57	Guarantee	
58	Dimension (LxWxH) (mm x mm x mm)	
59	Total weight	
60	Paint	
61	Type test of product	
62	Availability of spares	
63	VPIS auxiliary contact	
64	VPIS	
65	Breaker operation counter	
66	LBS operation counter	
67	Moisture absorption material in SF6 tank	
68	Bidder should provide the detail of the moisture absorption material.	
69	Making of earthing operations	
70	Auxiliary contacts (total numbers and spare numbers)	

71	Control cable entry provision	
72	Shunt trip coil 24V DC	
73	MCB for LT AC incomer and TB connection of all CT, Aux switches and relay wiring	
74	RMU Cable Boot/ terminal protector	
a	Terminal protector	
b	System voltage	
c	AC High voltage	
d	Impulse withstand voltage	
e	Bushing Diameter	
f	Bushing Types	
g	Cable cross section suitability	
h	Dimensions of cable protector	
i	Material of the component	
j	Type test reports	
For motorized RMU		
1	SCADA Compatibility-Remote operation of RMU shall be possible by using motors fitted to operating mechanism of isolators & CB etc.	
2	Harting Plug arrangement for individual isolator as well as breaker motor connections, which will be fitted on RMU body itself	
3	Details of I/O	
4	System to prevent mal operation in case of latch command	
5	Technical Details of motors	
a	Operating Voltage	
b	Max. power rating	
c	Max current drawn	
d	Operating time	
e	Power Supply	

20. SCHEDULE OF DEVIATIONS

(TO BE ENCLOSED WITH TECHNICAL BID)

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:

S. No	Clause No.	Details of deviation with justifications

TPC⚡**ODL**
TPW⚡**ODL**

TPN⚡**ODL**
TPS⚡**ODL**

Specification No: ENG-HV-2010

**Specification Name: Specification for
11KV RMU Motorised Outdoor Type**

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We confirm that there are no deviations apart from those detailed above

Seal of the Company:

Signature

Designation

ANNEXURE – 1
SIGNAL LIST FOR AUTOMATION

Description	Analog Inputs(AI)					Status(DI)		Reset Element
Type	Amp. Loading-R ph	Amp. Loading-Y ph	Amp. Loading-B ph	Phase Voltage	Power factor	Switch close	Switch Open	
RMU Switch *	0	0	0	0	0	1	1	
Breakers *	1	1	1	1	0	0	0	
FPI							1	1
Pressure Gauge (manometer)							1	

FRTU SIGNAL LIST

Description	Analog Inputs (AI)				
Type	Amp. Loading-R ph	Amp. Loading-Yph	Amp. Loading-B ph	Phase Voltage	Power factor
Switch *	0	0	0	0	0
Breakers *	1	1	1	1	1
Fault passage indicator *	0	0	0	0	0

Note: 0 indicate functionality not req. for that element, 1 indicate functionality required for that element

* Denotes the nos of switches/ Breaker s in RMU based on the type of RMU (3way, 4way, 5way & 7way).

Additional IOs

RMU switch Control Command
Earth Sw. 1 Status Input
Earth Sw. 2 Status Input
FPI Reset
FRTU Local/Remote Position
FRTU Door Open
FRTU Battery Charger Faulty
FRTU Battery Faulty
FRTU SwitchGear Supply Off
FRTU Aux Supply Off
FRTU Fault
Relay operation
CB OFF status
CB ON status
CB ON/OFF Command